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# THE

# FAR EASTERN REVIEW

## Volume

## XIX.

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*NOTE:—Illustrated articles are marked with an asterisk (*). Look for general subject rather than the specific titles of the articles. Thus: "Automotive," "Bridges," "Railways," etc., will give related articles much more quickly than reference to the titles.*


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## FINANCE ENGINEERING COMMERCE

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遠東時報

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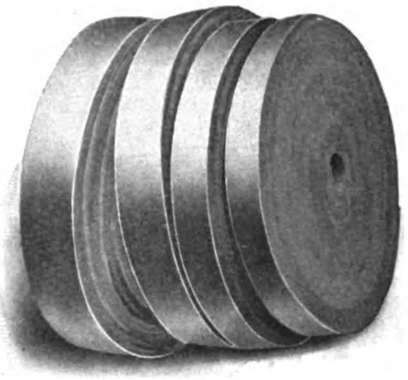

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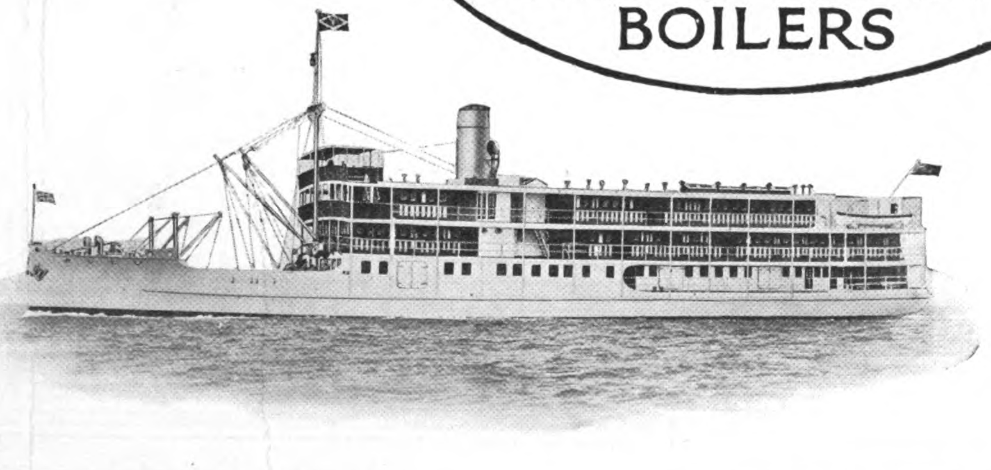

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, JANUARY, 1923 No. 1

# Anglo-Japanese Pact Survives

IT begins to look as though the high advisory staff to the Peking government overlooked a bet in their campaign to destroy the Anglo-Japanese alliance. They failed to reckon with France, who, up to date has not ratified the four-power treaty. As a consequence, the Anglo-Japanese alliance was automatically renewed on November 23 for another year.

Now THE FAR EASTERN REVIEW has never agreed with those who professed to see in this instrument a menace to the peace of America maintaining that its simple modification in 1911 eliminated any possibility of its binding Great Britain as an ally of Japan in the event of a war between that country and the United States. It may not be good policy to disagree with the majority opinion, but nevertheless we hold firmly to the conviction that American sentiment has been influenced by a calculated misrepresentation of the facts, in order to further the schemes of war-makers who hoped by isolating Japan to facilitate her downfall. With the alliance in full operation there was little hope of precipitating a situation in the Far East that would bring America into the conflict. With Japan discredited and world opinion turned against her by the most audacious campaign of falsehoods the world has ever witnessed, bereft of the material support of Great Britain, and held up to world contempt as morally impossible, the " show down " would have been forced on some pretext that would have saddled America with the task of " putting Japan in her place."

If France persists in her present attitude and declines to ratify the four-power pact, what then ? The American senate rejected the Versailles treaty which guaranteed France against future attack ; why should France now become a party to a pact designed to guarantee American insular possessions in the Pacific against attack ? It may not be a wise move for France, as it can only result in bringing America, Great Britain and Japan into closer harmony for the solution of Pacific and Far Eastern problems, and may in the end lead to the creation of a new balance of power in order to offset the present tendency of France to resume her traditional relations with Russia. The isolation of France under prevailing international political conditions will automatically compel the perpetuation of the Anglo-Japanese alliance as the one practical safeguard for their mutual interests in Asia, with a possible three-power pact for the preservation of peace in the Pacific. Once the Anglo-Japanese alliance is shorn of its menace to the United States, Americans have no reasonable right to challenge its usefulness.

The flirtation with Russia added to a growing French irritation against their former allies for failing to live up to the provisions of the Versailles treaty, may well result in overthrowing the league of nations and other pacts and force a return to alliances as the only safe way to preserve the balance of power. In this case, whether we like it or not, Americans will be compelled in self-defense to cast aside our traditional aloofness, and in the Pacific at least, resort to age old practices and line-up with powers whose interests are identical. This means, if it means anything at all, that the United States, Great Britain and Japan would form a *bloc* that would counterbalance any Russo-Germanic-Turco or Franco-Russo combination. If we swing back to pre-war days with France and Russia in full accord on Asiatic policies, and with Germany and Russia working in close harmony, the impotence of China to fulfill her most elementary international obligations, must of a necessity restore the Anglo-Japanese alliance to its full vigor. And, as we have repeatedly pointed out, as long as that instrument carries no menace to the United States, its operation is absolutely none of our concern. If we wish to make it our business, we must either share its obligations ; or play the game with Russia and China.

# The U.S.-Russo-Chinese Combination

THE interview with Mr. Roy C. Anderson printed in the *New York World* of November 7, in which he declared that the United States will have to go to war with Japan over China, once more indicates that most of the high advisers to the Chinese government are monomaniacs on this subject, furnishing further evidence, if such evidence be necessary, of the existence of a common understanding between these highly paid employees of Peking. Mr. Anderson is introduced to his American audience as "adviser to Chinese presidents, counsel to provincial governments and representative of great American corporations in China," harvesting the usufruct coming and going.

It was not our intention to refer to Mr. Anderson's activities after the rebuke administered by the *North-China Daily News* and the *Japan Advertiser*, but the last mail from America tells us he is still working to poison the minds of Americans against Japan. He now alleges that the failure of France to ratify the four-power pact arises from a secret understanding entered into at Tokyo when Marshal Joffre passed through Japan last March.

" *That mission* " High Adviser Anderson assures the American public through the Hearst publications of December 7, "*undoubtedly dealt with the position of France in the Pacific and it was taken for granted in China, by foreigners and Chinese alike, that an understanding had been reached in Tokyo between the gallant marshal and the Japanese government. The proof would appear to be the lack of interest in Paris concerning the four-power pact.*"

If such a conclusion was reached by foreigners and Chinese alike, it only goes to illustrate how tortuous are the workings of the minds who advise the Chinese government ; how little they are informed as to the larger phases of world politics. Marshal Joffre

also spent some time in Peking. Applying the logic of Mr. Anderson to present world tendencies, it might be taken for granted that Joffre also concocted some scheme with Wu Pei-fu or Chang Tso-lin to co-operate with Russia, and, indirectly, by reason of the present trend of French diplomacy, with France. Once we follow the devious workings of the Peking advisory mind, taking for granted that which appeals most to our ideas, there is no end to plausible conclusions.

To arrive, however, at any correct estimate, it would first be essential to ascertain just what position Mr. Roy C. Anderson actually holds in the Chinese *tuchun* oligarchy. Is he really the adviser to the president of China, to Wu Pei-fu, to Chang Tso-lin; the representative of great American corporations in China? What are the names of these great corporations? If true, what was Mr. Anderson doing in Mukden and then in Moscow hobnobbing with Soviet officials? When Mr. Anderson tells the people of the United States that China, Russia and America must stand together and that America must intervene in Manchuria to save China from Japan, there is a good sized nigger concealed in-the-wood-pile somewhere. It would be interesting, most interesting, in view of present intrigues in the north, to know the names of these great American corporations represented by the adviser to Chinese presidents and *tuchuns*. The story smells fishy, and looks as though Mr. Anderson is mixed up in some political intrigue which carried him to Moscow and from there to Washington. The same logic which enables Mr. Anderson to take for granted that Japan and France have entered into a secret understanding to destroy the four-power pact as a result of Joffre's visit to Tokyo last March is applicable to his own visits to Chang Tso-lin and Lenin, and by the same process of reasoning the proof of this would appear to be sufficient by his advocacy of a Sino-Russo-American understanding. It's a poor rule that don't work both ways.

If the good faith of Japan and France is to be openly impugned by a high Chinese official accusing them of double dealing, entering into treaties they have no intention of carrying out, the Chinese government should publicly repudiate his activities and utterances or accept the responsibility for spreading propaganda and misleading reports calculated to impair world peace. The fact that Japan has religiously lived up to all her committments at Washington, that her foreign minister has declared if France fails to ratify the treaties, Japan will work in harmony with the United States and Great Britain for the solution of Far Eastern problems, means nothing to the unsound reasoning powers of these mischief-makers.

If we employ Mr. Anderson's methods in arriving at deductions, we might take for granted that he is engaged in some intrigue as the outcome of his visit to Moscow, by his advocacy of a partnership between America, Russia and China to fight Japan, in which, of course, the poor fish that will do all the fighting and supply all the financing will be, as usual, America.

In conclusion, we will permit the *North-China Daily News* and the *Japan Advertiser* to express their opinion on his present activities. On learning through Reuter's of the substance of his interview in the *New York World*, our Shanghai contemporary expressed entire disagreement with and reprobation of the interview given out in the United States, characterizing his "attempt to revivify the ancient bogey of Japan's hostile designs against the United States as deplorable and unjustifiable. At such a time as this in Japan when the new ideals are steadily gaining ascendency over the old, nothing could be more mischievous than to make trouble between China and Japan except to try to involve America in the quarrel."

The *Japan Advertiser*, after shooting his arguments full of holes and utterly discrediting the high adviser to Chinese presidents, ends by saying:

"Mr. Anderson's statements are the most glaring recent example of a wholly mistaken—or if not mistaken, utterly vicious—campaign of misinformation about the Far Eastern relations of Japan and the United States. China will have little reason to be thankful to him and his fellow 'advisers.'"

If Mr. Roy C. Anderson, is, in effect, what he advertises himself to be, it would seem by so openly impugning the good faith of Japan and France, he has placed the Chinese government in a most delicate position. The tragedy of Europe was precipitated by Austria's ultimatum to Servia, and one of Austria's principal grievances against her neighbor was the incessant propaganda carried on by the Serbs to undermine her prestige with other powers and instigate uprisings against her authority. We do not believe that Japan would follow the example of Austria by presenting a similar ultimatum to China, but she would be amply justified before the world in calling upon the Chinese government to repudiate the activities of its high advisers and demand their dismissal.

The American-Russo-Chinese coalition advocated by the high adviser to the Chinese government is, however, worthy of further investigation. Let us pass on.

# Baiting the Trap for America

JUST before the Far Eastern republic threw off its mask and went back into the fold of the Soviet, it gave to the Sinclair Oil Company, an American organization, the exclusive right to bore for oil in the northern half of the island of Saghalien. Interviewed on November 20, on the significance of this concession, Mr. B. Svirsky, the English speaking chief of the Far Eastern republic's delegation in Washington, said that although the Japanese were then holding the territory as security for reparations growing out of the Nikolaievsk massacre, "*they would have to get out.*" "*The United States has announced it will defend the rights of American citizens in all parts of the world,*" he added as justification for granting the concession in disputed territory. Fine! Great Stuff!

The International News Service sends out from its Peking bureau under date of November 18, the story that Mongolia's "Living Buddha" has gone into partnership with a firm of American engineers for the development of mineral resources. Concessions have been granted including approximately one-third of Mongolia and total 250,000 square miles of territory, the possibilities of which geologists declare most unlimited.

"Preliminary surveys show that stores of gold amounting to many millions of dollars lie within easy access. The area was originally ceded to Russians, who, in co-operation with Mongolian princes and the Chinese government, secured the concession. Various political intrigues and internal disturbances made mining difficult, and in 1900 the working groups were reorganized into the now famous 'Mongolyor' Company, the stock of which was sold in nearly every country in the world. One of the large subscribers was the late King Leopold of Belgium.

"Bolshevik successes in 1920 made further operations impossible. By a series of dramatic episodes the leases and concessions fell to two American engineers, Edwin W. Mills and J. F. Manning, who have now the control of the company, which they have reincorporated as an American concern. The future seems unusually bright since the Mongolian government has shown its willingness to recognize all titles in return for a portion of the profits. Similar arrangements are under negotiation with Russia and China. The shareholders are sufficiently international to prevent aggression from other countries who might claim a violation of the 'open door.'

"A report made for the United States department of commerce calls attention to the fact that thus far the several millions of dollars worth of ore already marketed were taken from placers in a comparatively restricted territory thirty miles wide by fifty miles long. The rest of the 250,000 square miles have hardly been prospected, although there are known to be other gold placers here and there which have been worked in a small way by primitive methods."

Here we have the Hutuktu of Mongolia granting a concession covering the rather insignificant area of 250,000 square miles, to a company whose shareholders are sufficiently international to prevent aggression from other nationals who might be tempted to jump a claim or so in this *eldorado*. It would seem that this enterprise has been incorporated under American laws. Now the American government was very emphatic in its stand during the consortium negotiations that Mongolia was a *most important province of China* and could not be considered apart. It would seem, therefore, that for such a concession to have proper legal standing, its charter should be derived from the Chinese government and not from his serene highness, the Hutuktu. But neither China or the Hutuktu at present seem to have any great say about things in Mongolia, for we find the Soviet holding down the capital at Urga and wielding a good sized club, over those unfortunate Chinese foolish enough to believe they have any rights in that territory. If reports from Urga are to be relied upon, the majority of the Chinese are now "riding the dragon" and the Mongolians are burrowing into holes in the Gobi desert. The reds reign supreme. From the Peking story it would seem that the international Mongolyor company is taking no chances and will forego a good slice of its profit to grease the Chinese and Russian governments, in order to obtain their sanction to the concession. However, the dictum of the state department still holds good: "*Mongolia is a most important province of China*," hence any document worth the paper it is written upon, must bear the great seal of the Chinese government, and any concession in Mongolia that has to pay tribute to the Mongolian and Soviet governments is contrary to the fundamental principle involved in the sovereignty over this territory. If such a concession signed by the Hutuktu holds good, then the Cassel concession covering the coal mines of Kwangtung is also legitimate.

The Mongolyor and Sinclair concessions are not all. The Vanderlip concession is stiil very much in evidence in any discussion of American "rights" in these territories, and we find Mr. Vanderlip hard on the job, working hand in glove with Mr. Svirsky and High Adviser Anderson. In a recent interview, also published in the Hearst newspapers, Mr. Vanderlip reminds us that:

> "Both Russian and Chinese statesmen have agreed that the designs of Japan in the Asiatic continent (Siberia and China) must be blocked. Japan, by repeated acts of aggression in Vladivostok, is solidifying Russia against the Japanese and is drawing Russia and China together into a union that one day will drive the Japanese from the eastern coast of Asia. While none will predict when it will come, nevertheless there is a feeling that war is brewing. The time will come when Russia will have completely recovered and will be able to supply China with all the ammunition she needs to make war with. Russia and China together could sweep Japan from the Asiatic coast."

If Mr. Svirsky's logic is sound, the United States must protect the rights of its citizens in *all* parts of the world, so if we are to drive the Japanese out of northern Saghalien to enable the Sinclair Oil Company to work the concessions granted by the Soviet, by the same logic the United States must defend the Mongolyor Company and drive the Soviet out of Mongolia, and when some adventurous American digs a hole in the Pienmah district, strikes oil or finds the mother lode west of Tachienlu or out on the southern borders of Sinkiang, and obtains a concession to work his claim, the American army will have to be mobilized, the fleet ordered to the English channel, while the Yangtze patrol will steam up to Suifu and beyond in order to induce our festive cousin, Johnny Bull, to pull in his horns in Tibet.

Congress should keep this in mind when voting on the next army and navy appropriation bills. We never can tell when the high board of strategy sitting secretly in Peking will create a situation that will compel us to fight for our rights at places in central Asia which will call for a minute inspection of all the maps in the world to properly locate the seat of trouble.

Of course, Mr. Roy Anderson's appeal for an American-Russo-Chinese coalition can have nothing in common with a mining company operating under a Sino-Russo-Mongol charter. The reference to other countries who might claim a violation of the open door, in conjunction with Mr. Anderson's solicitude about the necessity of American intervention in case Japan blocks the red program in Manchuria, is suspicious at any rate. By the way what are the names of those great American corporations operating in China represented by Mr. Anderson?

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# That Secret "Alliance"

APROPOS of that secret alliance and plan of campaign concocted so quietly in Peking that Americans knew nothing about it, let us follow some of its possible ramifications. The Chinese publicity system in the United States has annexed Cornelius Vanderbilt, Jr., and we find him "spilling the beans" in a long syndicated article appearing in the Hearst newspapers of November 12. Vanderbilt leaves nothing to the imagination; he jumps right into the fray from the beginning. Listen:

**"JAPAN dreads an awakened China!**

**"The sleeping giant of Asia is rubbing the slumberdust from its eyes; it will shortly stretch its arms and yawn a bit. With an almost vicious suddenness, China may be expected to leap from her couch of the ages as one stung by the biting flames of oppression and demand, at the point of the bayonet, the return of stolen properties and compensation for the outrages committed upon her.**

**"It will be a hard day for the little imperial island empire of Japan when young, strong and revenge-driven China finds herself ready to call upon Japan for an accounting of the Nipponese stewardship of the Orient."**

Vanderbilt then goes on to eulogize Dr. Wellington Koo, incidentally sheds light on why China will become so extraordinarily active and makes clear just how the American government is to be brought into this great war when revenge-driven China demands of Japan the return of stolen properties that is, the Kwantung leased territory. First in the new order of remarkable Chinese leaders is Dr. Wellington Koo, says Mr. Vanderbilt. "One of Koo's first acts after his return to China was to brazenly announce that China would seek the return of the Kwantung peninsula next year.

"The Liaotung lease was secured by Russia for a period of 25 years, was wrested from Russia by Japan in the Russo-Japanese war, after the historic siege of Port Arthur, and in 1915 was taken from China again for 99 years by the Japanese, through the operation of the infamous 21 demands.

"The United States stands morally opposed to the 21 demands, which may cause Dr. Koo's administration to call upon this government next year for support in his claim against the island empire. The claim is held by Dr. Koo that the original Russian lease expires in 1923 and that the Japanese rights were secured under duress.

"Naturally, Japan will never consent to the loss of this peninsula, which since 1905 she has nursed into one of the most rapidly growing sections of the Asiatic mainland.

"Dr. Koo's startling statement failrly caused the Tokio foreign office to rock in dizziness.

"Ably abetting the new Chinese foreign minister is Dr. Sao-Ke Alfred Sze, the Chinese minister to the United States. Dr. Sze, who is considered the most highly trained diplomat of the Chinese diplomatic corps, is counted upon to swing the United States into line to support Dr. Koo's claims.

"The United States will probably refuse to take sides, although public opinion in America may force this government to openly declare itself."

Here we have one working of the secret plan of campaign that was to make the United States the ally of China in a war with Japan. Dr. Koo was to call upon Japan to get out of Kwantung, and when Japan declined to get while the getting was good, the sleeping giant would rub his eyes, yawn loudly, stretch his arms, jump from his couch, grab his trusty bayonet and jab Japan a few times to facilitate her movements. In preparation for this sudden awakening of China and to be sure that her leap with the bayonet would be effective, public opinion in America was to be worked upon in order to force our government to openly declare itself, which means, to line up on the side of China in ejecting Japan from Kwantung. As an insight into the manner in which the United States might be railroaded into war, the story has its moral.

# Why Not?

**It surprises most Americans, says the "Brooklyn Eagle," to read that the United States army has established a "separate command" for "the American forces in China." What are we doing there? What are we doing in Nicaragua? There is commonly war-provocation in peaceful invasion by uniformed rifle-carriers."**

DON'T you know Brother Howe that we are going to drive the Japanese out of Northern Saghalien, then prod the Bolsheviki out of Mongolia, ally ourselves with China and send Japan packing out of Kwantung, call the British bluff in Pienma and in Tibet, and then if we have any regiments left over and a few loose dollars in the treasury we are going to police China, take over her foreign obligations and defy the world to pry us loose from the new *eldorado* ?

Great Britain is preparing to convert her share of the Boxer indemnity into an educational fund. Japan is only waiting for the organization of a stable government to do the same, in fact, the powers are literally falling over themselves in their haste to join the procession and forgive and forget the lesson of the Boxer year, but—this forgetfulness does not extend to the withdrawal of our troops from Peking and Tientsin. The road from Peking to the sea simply must be maintained open.

No sensible American would for a minute believe any of the stories set in circulation by Sun Yat-sen's publicity bureau. But one never can tell. The stories from Canton state that shipments of German arms for the southern government which were refused permission to land by the commissioner of customs when Dr. Sun was at the head of affairs in Canton, have found an easy entrance under the new *régime.* Many millions of British money were to have poured into the treasury of the Canton satrap, and altogether, according to the Sun publicity bureau, the situation in the south is very similar to that which we have been led to believe exists in Manchuria, with the difference that instead of Japan supplying funds and arms to Chang Tso-lin, here it is the British who are behind Chen Chiung-ming.

It is hardly two years since an active American concern slipped past the vigilant eye of Hongkong and the British commissioner of customs at Canton a complete up-to-date arsenal for Sun Yat-sen. We were solemnly assured by one of the highest officials of the southern government in Canton last year that a British steamer was at that moment unloading arms and ammunition at Kowloon for the northern forces. We are now told that the British authorities in Hongkong are moving heaven and earth to discover contraband arms, turning over all the coal in the bunkers of an American steamship to uncover fifty odd Winchesters and a store of cartridges. Another enterprising American has been arrested at Hankow for diverting the destination of some aeroplanes originally intended for peaceful flying in Fukien. We learn that an American missionary society operating in Szechuan has voted to purchase a number of planes to facilitate the work of spreading the gospel in that interesting and thickly populated province, and incidentally, the scene of the next spring drive on the part of Wu Pei-fu and his cohorts.

There is really no telling what the future holds for us. The time may arrive when the American army may disembark somewhere in South China and our fleet blockade Hongkong in order to persuade our British cousins to quit monkeying with that ponderous old door to Kwantung province. Or, the British may become exasperated over Americans beating them at the game, and we may be haled before the tribunal of the league of nations and soaked for an indemnity that would automatically reduce some of the allied indebtedness, for permitting Americans to supply arms to Sun Yat-sen and his valient armies.

Then again, we must keep a weather eye on Japan. Notwithstanding the fact that her government is determined to keep its "Hands Off" in China, that under no conditions will it send further troops to this country or act as the policeman for other powers; that its cardinal policy at this time is to re-establish cordial and intimate relations with China, she may have something concealed up those baggy sleeves of her *kimona.* To forstall any contingency, we must reinforce the American garrisons in North China and keep a separate military establishment on the ground to see that Japan puts nothing over.

The air is filled with wars and rumors of wars, with America and Britain alleged to be backing Wu Pei-fu and Japan accused of supporting Chang Tso-lin. There may be another spring drive in the north, and the armies of the overlord of Manchuria seek to carry the fight into Chihli, which means using the Peking-Mukden Railway, thus obstructing the free exit from Peking to the sea. That possible menace to the lives of Americans in Peking and Tientsin could not be passed by lightly, and the American command in North China would have to carry out its treaty obligations by taking over control of the line and telling the sportive Chang where he got off. Or, the contrary may happen. The playful Wu may determine to take the offensive, and then, of course, there would be little opposition to his using the Peking-Mukden Railway for military purposes. A troop movement from Peking northwards carries no menace to the lives of Americans or foreigners in Peking. But on the other hand, as soon as the valiant Wu and his legions cross the rubicon, that is, the Great Wall, and begins to harass the equally valiant Chang in districts where the operations might interfere with the traffic of the South Manchuria Railway and endanger Japanese vested interests in Manchuria, the Japanese army would appear on the scene and advise the festive Wu to

betake himself and his armies back into strategic positions behind the wall. In which case, that separate American command in North China might well be cajoled into a position that would start off the fireworks.

It is a wonderful situation, fraught with wonderful possibilities. At all costs we must protect our " allies." They have drawn up a secret plan of campaign that will bring us in with both feet when the time is ripe. We should not disappoint them. The Chinese are most fortunate. They not only have the Boxer indemnities turned to their own account, but the good-natured American people who hav'nt the slightest idea of what is going on, are called upon to maintain a considerable military establishment in North China to protect them against any sudden change of heart on the part of " Brother Banzai." So there are any number of excellent reasons why we should have a " separate command " for the American forces in China. There are just about a hundred possibilities that the presence of our armed forces in that part of the world will be urgently needed at almost any old time during the next year or so. There is only one other place where we could have got mixed up in a first-class fight with quicker dispatch. We just missed our chance by declining a mandate for Armenia and Syria. But we are going to make up for this lost opportunity. We will muddle our way into it yet, if our Celestial " allies " and their " Advisers " have their way. So there is no reason for the *Brooklyn Eagle* or other suspicious Americans to wonder what we are doing in China. We are simply on the job, and as we have apparently made up our minds to be the policeman of Asia and the " protector of China " the sooner the whole general staff is transferred to Peking the better will be our chances for victory. Let's make a workmanlike job of it. Why not ?

# Saving the Nation

CHINA is bankrupt financially, politically and morally, betrayed by her military overlords and sunk in a morass of helpless dependence upon the foreigner. The temporary hope of China may lie in the rise of a strong man, the discovery of a financial genius or some coalition of parties, but in the long run the salvation of the country must rest upon an elightened public opinion. Pending reorganization, the establishment of schools and raising the intellectual standard of the people, the essential element to the well-being of the nation must be supplied by the student and merchant classes. " The enlightened public opinion China," which gave birth to the boycott against Japanese goods was engineered by the student federations, the guilds, the street unions and other bodies. This movement developed into a nation-wide secret organization called " The Save-the-Nation-and-Weep Society." Whenever a Chinese shop-keeper persisted in selling Japanese wares, a mob of the secret society gathered at the shop door, fell on its knees and began wailing and moaning. After a few hours of this musical persuasion the shop-keeper became intensely patriotic and burnt his Japanese goods, or, the " saviors " sacked the premises and made their own bon-fire of the boycotted wares. It was very effective.

This society is now being disbanded since Japan's policy has changed into one of sincere friendship towards China. With it will go public opinion, such as it is. We suggest to its leaders that its work has only just commenced.

If a list were compiled of all official millionaires who have robbed the nation for the past twenty years and the full facts of how they accumulated their pile published in the Chinese newspapers and public opinion appealed to in order to come to the rescue of the nation in the same manner as the Japanese boycott was engineered, it is quite possible that remarkable results would be obtained. At least, we would have a real test of the force of Chinese public opinion.

We suggest, therefore, that the patriotic labors of " The Save-the-Nation-and-Weep-Society," go on. Its organizers should spread the story of China's present plight and persuade the masses to work in harmony with them. If the Chinese are ever to help themselves, now is the time. Japanese goods were boycotted amongst other things, because of Japanese loans to the Anfu clique, but we have never heard of any movement to boycott the Anfuites or bring pressure to bear upon defeated *tuchuns* and retired boodlers to compel them to make restitution of their ill-gotten hoards. Now if great mobs would surround the houses of grafting officials and begin wailing and moaning, to the tune of " Where Did You Get It " (in Chinese music) and manhandle a few of the real culprits instead of Peking officials who are not to blame for an empty treasury, a proper respect for public opinion might percolate into the heads of other grafters and pave the way towards future official honesty in the handling of public funds. If the laws of China cannot protect the people from these rascals the last and only remedy is the force of public opinion expressed through personal visitations to the homes of the robbers.

The names of high officials charged with selling their country to various foreign powers or syndicates in the past twenty years and looting the provincial treasuries are no secret. Their huge personal fortunes are still intact. In any other country the question, " Where Did You Get It " ? would be asked in a manner that would elicit a quick response and quicker restitution.

This may sound like cynical advice. However, we recall not many years ago, when the countrymen of Chihli province desired to register an emphatic protest against the Peking-Mukden Railway for raising dykes which diverted the flood waters to their lands, they swarmed on the railway track, laid down on the rails and challenged the engineer of the train to run over them. They remained encamped on the road bed until their protests were heeded. We do not believe that any serious force would be applied against any similar mob in China standing up for the rights of the people. We have seen how easy it has been to organize strikes that worked great injury to foreign vested interests in China. It proves that the latent power to achieve their purposes rests in the hands of the people. If they would divert these energies to their own officials instead of venting displeasure on the foreigner, the world would loudly applaud this exhibition of sane public sentiment.

If such methods could succeed in the matter of the Japanese boycott, in the various strikes and in the campaign to destroy the Anglo-Japanese alliance, why should they not prove equally effective when applied to domestic problems ? For just so sure as China drifts into bankruptcy and foreign governments take measures to safeguard their loans, an anti-foreign campaign and boycott will be engineered in order to divert attention from the real culprits. All this can be averted by a save-the-nation campaign launched at this time.

Such an exhibition of Chinese public opinion would make a great hit and fill the front pages of every newspaper in the world. It would do more to restore confidence in China's future and credit than the allocation of the land-tax as security for further loans.

* * *

Since writing the above, the Chinese general chamber of commerce of Shanghai has taken the initial step towards exposing the treasury looters by drafting a telegram to the parliament at Peking demanding the publication of a report of all loans contracted by the government since the establishment of the republic in 1912. The chamber demands the full details of how the loans were secured,

the amounts and for what purposes, so the entire nation may scrutinize the manner of their distribution and bring the grafters to justice. It is the plan of the chamber to organize a national committee for the purpose of investigating the distribution of the funds and ascertain the cases of bribery and corruption that has taken place since the establishment of the republic. In the case of all loans whose character and uses are justified the people will agree to become liable for the repayment, but in cases where the loans have been concluded for the sake of filling private purses or where the proceeds of the loans have been embezzled the chamber demands that the offenders, without discrimination, should be prosecuted by the law, severe punishment meted out and their private property confiscated by the government.

This is a step in the right direction, and if supported by all the elements which at present go to make up Chinese public opinion, and parliament forced to take such action, it will help towards restoring faith in China's promises to pay. However, this is only one phase of the situation, and simply goes to support our statement that attention will be diverted from the real culprits and the blame attached to the foreigner. Undoubtedly, foreign loans to the Peking and provincial administrations have materially contributed to bring China to her present deplorable financial condition, but the real root of her troubles springs from and derives nourishment from the traditional corruption of the Chinese scheme of government. More millions have been stolen and appropriated into the pockets of the *tuchuns* from the proceeds of internal taxation and extortion than have been misappropriated from foreign loans. We see in this attitude of the Chinese general chamber of commerce exactly what we feared; when China is actually faced with bankruptcy and foreign control over the customs and salt surplus, an attempt will be made to lay at the door of the foreigner all the woes that have befallen the country in order to deflect attention from a system so ingrained in the Chinese character and methods of government that it cannot be uprooted.

It is eminently just that officials who have embezzled the proceeds of foreign loans be brought to justice and their private properties confiscated by the state, but for this campaign to meet with the full sympathy of the foreigner and pave the way for the rehabilitation of China's credit abroad, it must cover the wholesale misappropriation of provincial and central government revenues by the *tuchuns* and their satallites. The loan mongers of Peking have been forced to the extremity of raising foreign loans to make ends meet, by the refusal of the provinces to remit funds to carry on the government. The dishonesty of the *tuchuns* and their henchmen are responsible for the breakdown of the central administration at Peking forcing it to resort to sharp practices to keep alive a semblance of government and maintain the status of China in the comity of nations. Our advice holds good. Prosecute the dishonest loan mongers and grafters, but make the *tuchuns*, the provincial treasurers and other freebooters disgorge. To concentrate a campaign of official purity solely upon officials responsible for raising foreign loans can only result in obscuring the main issue, working up an anti-foreign sentiment throughout the country, and covering up the real evil. Let the weeping and wailing, the gnashing of teeth, and other persuasive demonstrations outside the yamêns and palaces of retired *tuchuns* and boodlers proceed.

# Undermining the Consortium

## U. S. HOLDS UP CONSORTIUM

**SAN FRANCISCO, November 23—Operation of the international consortium, intended to stabilize China's trade and finance, is being held up through the apathy of American bankers and their desire for better security than now is apparent, Julean Arnold, commercial attache of the American legation at Peking, told a gathering here.** *(Press Dispatch.)*

HERE we have an illustration of the difficulties surrounding the working out of any intelligent American policy in China. The state department fought a determined diplomatic battle to establish the consortium and abolish the spheres of special interest in order that American capital might participate in the development of China. The consortium is headed by the most experienced bankers of America, the best judges of the value of a foreign security on the American market. Yet its policy is openly condemned as too harsh, while Mr. Arnold goes so far as to make the absurd statement that the present instability of China arises from the failure of the consortium to depart from basic banking principles in lending money to a government whose credit is ruined and whose revenues are mortgaged to the hilt for previous loans. It is no secret that an underhand campaign to discredit the consortium has been in operation for over a year, the criticisms being directed not against the consortium as a whole, but against the very able representative of the American group who refuses to be budged from his common sense point of view by appeals to sentiment.

The remarks of Mr. Arnold before a gathering in San Francisco appear to be the first public utterance on the part of an American government official criticizing the consortium, that is, the American group representative in Peking. The attitude of the American commercial attaché will provide ammunition to others interested in breaking the influence of the consortium, and give official sanction of the department of commerce to a campaign that would throw open the Chinese field to a flood of disastrous loans. Once the safeguards surrounding loans to China are dispensed with, the road will be cleared for unscrupulous financial agents and loan brokers to deluge the markets of the United States with securities upon which the investor could never hope to realize.

It would be difficult to reconcile Mr. Arnold's implied recommendations with actual facts. The Pacific Development loan to the Peking government was advanced without security; the Chicago loan had ample security but no means of safeguarding the investor: several American firms have sold many millions of dollars worth of materials to the Chinese government without security. The consequences are seen in the appointment of a special committee of American business men to unify Chinese financial obligations to American bankers and manufacturers and in the financial embarrassment of the most important American trading concern in China.

An elementary knowledge of the actual conditions in China and of the trust character in which a bank's resources are held, together with the impossibility at any time in the last two years of selling Chinese government bonds in the American market, should be sufficient to fully justify the clear-visioned view-point of the American group representative in Peking and disprove the statement of the American commercial attaché.

The real danger attached to such statements on the part of American government officials lies in the possibility that the other partners in the consortium may arrive at the conclusion that American diplomacy forced through a combination for its own political ends, and when it failed to function according to expectations Americans were the first to advocate measures tending to destroy

its usefulness. When Dr. Paul S. Reinsch, the acknowledged "father" of the new combine, tells an audience in Peking that unless the consortium lends funds to the present government, China will have to seek accommodation from independent bankers, and the American commercial attaché criticises its usefulness in the above terms, the other powers who accepted the American invitation to pool their interests, have a reasonable justification to doubt our good faith in forcing their positions. The same conditions have existed in China since 1918, when the new consortium was proposed by Americans. What was wise then, is ten times wiser at this time.

* * *

## A Disaster Averted

THE disastrous effect upon American interests in China arising from undue confidence in the ability of the Chinese government to meet its obligations is emphasized by the present activities in New York to find a practical plan to enable the Pacific Development Corporation to carry on. The plight of this corporation is occupying considerable space in American financial papers. The details of the much discussed reorganization plan were made public on December 14 and at the same time a special meeting of the stockholders was called for December 20 to vote on the proposals formulated after five months work to evolve the best method of continuing the Oriental trading business of the corporation and obtain a substantial extension of its obligations and those of its subsidiary companies.

According to notices appearing in the New York newspapers on December 13th, a special meeting of the stockholders of the Pacific Development Corporation was called for December 20th for the purpose of considering plans for reorganization. The Pacific Development Corporation is the holding company for Andersen, Meyer & Company of Shanghai, the Pacific Commercial Company of Manila, and a number of other concerns. Although nothing definite has been heard to date in Shanghai regarding the results of the meeting of stockholders on December 20th, local officials of Andersen, Meyer & Company stated that they are in receipt of cable advices that reorganization is proceeding satisfactorily.

The main feature of the reorganization plan originally announced included the separation of the three companies and the opening of separate offices in New York by Andersen, Meyer & Company and the Pacific Commercial Company of Manila. The plan also included refinancing for both the Shanghai and Manila companies and possibly the liquidation of the holding company. The Pacific Development Corporation, according to report, has been seriously embarrassed in its recent operations owing to the default of the Chinese government upon a loan of G$5,500,000 extended in 1919, upon which neither interest nor principal has been paid for approximately one year.

In view of this embarrassment caused to the Pacific Development Corporation by reason of the default of the Chinese government, it has been considered to the best interests of the Oriental Trading Companies—Andersen, Meyer & Company and the Pacific Commercial Company—to segregate their respective interests from the holding company.

The future of Andersen, Meyer & Co., Ltd. is exceptionally bright as the company undoubtedly has an excellent good will in China in the ability to sell machinery and engineering supplies. Need for a large amount of equipment exists but the ability of the Chinese to secure this equipment on terms satisfactory to the supplier depends on when and how soon the existing condition in Chinese government finance and the disorder incident to the revolution now going on are worked out.

We had this situation in mind when we wrote the editorial appearing in the September (1922) number of THE FAR EASTERN REVIEW entitled "Facing the Facts." "If American firms are forced into bankruptcy by reason of the failure of the Chinese government to pay its debts for merchandise and materials, or because of its unwillingness to issue notes in order to enable its creditors to seek relief from the carrying banks, the effect upon China will be disastrous. Unless these unsecured debts are paid within a reasonable time, foreign firms in China can prepare for another catastrophe before which the crash of 1920 will appear insignificant."

In the face of a situation which has only narrowly averted disaster to the largest American trading firm in China, it seems stupid in the extreme to invite another flood of griffins to enter the field until conditions improve.

# The Japanese Decision

DENIED the right of emigration to and citizenship in the United States, barred from Canada, Australia, New Zealand and British South Africa, treated as undesirables in Asiatic Russia, prohibited from owning land and settling outside the treaty ports of China and confronted on all sides with suspicion and a campaign launched to deprive them of the fruits of past sacrifices, with a population increasing at the rate of 700,000 a year, the *Chicago Tribune* commenting on the reception in Japan of the recent United States supreme court decision, says that the Japanese are peevish, seeking a cause of irritation and strife. It would seem that any other self-respecting nation laboring under such handicaps would be peeved also, especially when, in addition to the above impediments to their struggle for existence, Japan is made the target for all the abuse arising from China's unfortunate condition, and foreign diplomacy, publicity and propaganda is directed towards obstructing her peaceful penetration into the only logical place in the world remaining open to her activities. The Japanese may accept the decision of the U.S. supreme court with equanimity, there may be no disposition on the part of any class to display an ugly spirit, but altogether aside from the intrinsic merits of the decision, it must bring considerable dissatisfaction and chagrin coupled with regret that they should be so consistently maligned and attacked at a time when they are earnestly striving to fall into line with the more liberal spirit of the advanced western nations.

Although there are distinct differences of opinion editorially expressed in the American newspapers concerning the merits of the decision, it is generally agreed that that the right of congress to

determine who shall and shall not enjoy the privilege of naturalization and citizenship is most important and must be upheld. While perhaps the Japanese have no cause to feel aggrieved because of the fact that this decision is no reflection on their culture or standing, it must necessarily tend to influence them to seek closer relations with other Asiatics.

If Japan has a real grievance it is not so much because of the decision of the supreme court as it is the fact that Caucasian opposition is carried to the extreme of circumventing their legitimate activities on the mainland of Asia, amongst peoples who come under the same ban. The decision, if not modified by congress, means that Japan must seek a future home for her surplus millions in Asia. And here the fight against them is waged with no less severity than in the United States, with the difference that at home it is racial while in Asia it is commercial and political.

The *New York Evening Post* says the decision does not mean that there can be no such person as an American citizen of Japanese blood. Japanese who are born in the United States and subject to its jurisdiction are American citizens by the fourteenth amendment like all other persons so born and governed. Even a Chinese who is in that category is an American citizen. The fact that his parents cannot become citizens has no effect upon his status whatever. Nor can any state change this fact. The fourteenth amendment was adopted for the very purpose of preventing states from excluding anybody from citizenship, and while it was aimed primarily at discrimination against the negro, it includes discrimination against any other race as well.

Whether or not we should alter our attitude and admit to the privilege of naturalization those Japanese whom we permit to enter our country is another question, says the *Post* which continues :

"Mr. Roosevelt believed that we should. In his annual message to congress in 1906—the year in which we passed the law which figures in Justice Sutherland's opinion—Mr. Roosevelt recommended that 'an act be passed specially providing for the naturalization of Japanese who come here intending to become American citizens.' The recommendation was not heeded. But Mr. Roosevelt was right. To refuse naturalization to Japanese whom we allow to settle here is not only an illiberal policy ; it is also inconsistent with our general principle that permanent residents of this country should be an integral part of our citizenship."

The *New York Times* in discussing the decision emphasizes the fact that Justice Sutherland took pains to avoid saying anything to wound Japanese pride. After explaining that the sole duty of the court was to ascertain and apply the meaning of the act of congress, he was careful to acquiesce in what had been said by counsel in praise of Japanese culture and prestige, maintaining that there was no intent to assert any offensive racial distinction.

"This," says *The Times*, "may seem a little forced to the Japanese themselves, but to Americans, at any rate, it ought to deepen the sense of obligation to bear themselves toward the Japanese in this country and elsewhere with all fairness and courtesy, and to respect all the rights which they have under international law and special treaties. Particularly to those Japanese who were born in this country and hence are, under our constitution, citizens of the United States, unless they choose to expatriate themselves, should every consideration be shown."

Inasmuch as it is the function of the supreme court to interpret the laws and not to justify them, the decision, the *Chicago Tribune* points out, has no bearing on the policy of exclusion. As Justice Sutherland wisely pointed out, there is no implication of inferiority in either the decision or the law. Our policy of exclusion is not based on any assumption as to relative levels of culture or of race quality or character. It is based, and based solely, upon difference —difference of race, culture, and economic standard. This difference is so great as to make fusion and inclusion impracticable. Intermarriage, it is American conviction, is not good for either race or for the individuals of either race, though in exceptional cases intermarriage may be successful. This does not imply that the Japanese are inferior to the Americans in race or culture, and there is no occasion for offense to Japanese pride. Another basis of exclusion is economic. The difference in standard of living gives the Japanese an advantage over the American from which the latter has a right to defend himself."

*The Baltimore American* in reviewing the decision emphasizes the fact that no slight is intended toward the Japanese as a race, and it hopes that progressive and powerful nation will soon accept unanimously the decision in good part, with an understanding of our own viewpoint of the fundamentals involved. There is no occasion, the American insists, for sensitiveness, and if the situation were reversed it thinks Americans would accept a similar decision by the Japanese courts with unmoved emotions.

*The Buffalo Express* characterizes the decision as a law of narrow vision, unjust and the principle embodied unsound. Americans, it adds, should be ashamed to discriminate against intelligent, law-abiding Japanese when they admit almost everybody to citizenship. "It is not likely" concludes the *Express*, "that the Japanese government will make any diplomatic protest, but if Japan counters with some retaliatory discrimination against Americans, we should hardly be in a position to say much about it."

*The New York World* sees nothing startling or sensational in the decision as it follows the beaten path adhering to the rule that the privilege of naturalization be accorded only to white persons and those of African nativity and descent. "It lies within the discretion of congress to raise the bars against all but Caucasians and Africans, for reasons good or bad, but expressed in the form of law. It is thus entirely a matter of policy."

# When the World was Young

WE learn from the *Editor & Publisher* that "Hank" Cary is dead. "His passing will be mourned in hundreds of newspaper offices and in the out-of-the-way places of the world where correspondents of another day-seekers of adventure who won fame in the latter days of the last century-foregather to spin yarns."

This item of news means nothing to our Far Eastern readers. Outside of a few army officers in the Philippines not a dozen men in Asia ever heard of Henry N. Cary. It means much, however, to American journalists and their British comrades of "98" who learned to love the man who has passed on. He was a real newspaperman thoroughly trained from the ground up according to the rules of a rapidly passing school, the outstanding characteristics of which were an intense Americanism, news-getting under the most hazardous circumstances, combined with a spirit of comradeship and loyalty to colleagues which bound together in one great

brotherhood the correspondents of the Cuban revolution and the Spanish-American war. During the Santiago campaign Cary went to Cuba to take charge of *The New York World* field staff, and as a war correspondent won fame and the esteem of all his colleagues. *The New York World* field staff of "98" was not large, but it made up in efficiency what it lacked in numbers. They were all willing to take desperate chances, and, if necessary, to pay the price, the highest price of all, so that their paper got the news first. They held no monopoly of this spirit, however; there were others, daring resourceful spirits of the opposition whose names are now famous in the annals of American journalism. Many of them have passed on leaving the record of their exploits in the musty old files of forgotten newspapers and their memories enshrined in the hearts of surviving comrades. Of the field staff of *The New York World*, two survive.

### "The Red Badge of Courage"

At the head of the little group stood a famous young author, one of the rising stars of emotional literature, frail in appearance, as full of whims as a *prima-donna* and as difficult to manage, with a heart soft and tender as a woman's, full of sympathy for life's unfortunates, yet every inch a man, eager to experience the first thrills of being under fire. Such was "Stevie" Crane, the genius who penned the realistic "Red Badge of Courage" before he ever heard the whizz of bullets or watched a man slowly pouring out his life blood on the field of battle. He plunged into the thick of the fighting, was here, there, everywhere; with the marines on the beach at Playa del Este, with Wood at Guasimas and with Chaffee at El Caney. His delicate constitution gave way under the strain: sick with fever and dizzy with delirium he staggered through the campaign and featured its thrills until he broke down and could go no further. He was shipped home on a transport cursing his luck, raving at his comrades and crying loudly for . . . . "Pickles." The exposure hastened his end. He died within the year at his manorhouse in the south of England. "Stevie" won the badge and paid the price.

### Francis H. Nichols

Francis H. Nichols, "Nick," they called him, the jaunty, debonnaire, matter of fact, but deadly efficient New York reporter also received his baptism of fire at Santiago. "Nick" didn't know the meaning of the word "fear." Smoking his old briar pipe, he strolled as unconcernedly up San Juan Hill with the Rough Riders, with men falling all around him, as though he was covering a parade maching up Fifth Avenue. Not until it was all over could he be made to realize that he had been in the middle of it, that he was the hero of the day, the only one who had the real story of the battle. "You fellows quit joshing me," he said, "it was nothing."

In the same happy-go-lucky spirit he came to China during the Boxer troubles, journeyed through the interior on a special mission for the red cross and wrote the classic, "Through Hidden Shensi." He returned to China the following year with the set purpose of hiking through Szechuan and the "Forbidden Land" to Lhassa, and spent several months at Chungking learning the language before venturing into the unknown. While climbing up the "Roof of the World" from the east, Younghusband with an army behind him was marching up the Chumbi valley from the south to force an entrance into the capital of the Dalai Lama. "Nick" tackled the job single-handed. His bones lie rotting in a cairn somewhere along the grim, frozen borderland of Tibet. He died, the dirty lamas said, from exposure, from pneumonia. They lied. He was alone, unarmed, and they poisoned him. "Nick" paid the price.

### Sylvester Scovel

Towering high above his companions in efficiency and dash stood Sylvester Scovel ("Harry" to his intimates) a strikingly handsome, lovable dare-devil whose exploits filled the front pages of *The New York World* for over three years. War journalism may produce another "Bull Run" Russell, another Archibald Forbes or Frederick Villiers, but there will never be another Sylvester Scovel. He also worked alone in a war where no quarter was given, against an entire army sworn to kill him if captured. He was the first and last of his kind. Journalism don't produce many like him and if it did, they would never have another opportunity of displaying their talents. Scovel developed a new type and wound up his career in a manner that closed the door for anyone to follow him. He was always ready to stake his life to obtain a real piece of war news or score a beat for his paper. He also knew not the meaning of the word "fear." Standing on top of his horse like a circus rider with field glasses glued to his eyes to better view the fights between Cubans and Spaniards, he became the idol of the Cuban army; he rode by the side of Maceo and Gomez in over a hundred battles; at Maltiempo, at Cacarajicara, at the Rubi Hills and other bloody fields he was in the thick of the slaughter; he crossed the "uncrossable" trocha in Pinar del Rio with an escort of only eighteen men: passing in and out of the Spanish lines like a phantom with the entire secret service organization of Spain at his heels hungry to earn the reward for his capture, dead or alive; the hero of many hair-breadth escapes from capture and death which modesty forbade relating, he finally slipped in a rash effort to "scoop" his chum, and the Spaniards got him. Quick work on the part of *The World* and the entire weight of the American government obtained his release from the prison whose other exit led to a blank wall and a firing squad. He forced the Chilkoot Pass during the Klondyke gold rush, was ubiquitous during the Santiago campaign and rounded out a meteoric career resenting an insult from "Pecos Bill," the commander-in-chief of the American army, by punching the latter on the jaw before all his staff at the surrender of Santiago. This finished Scovel as a war correspondent. He narrowly escaped being shot down in his tracks by the provost-marshal, and only the fear of public opinion and kicking up a rumpus in the United States saved him from a drumhead court martial the next day. His companions had a hard time convincing the irascible and rotund old Indian fighter that deportation would be much better than a firing squad. "Harry" Scovel rests in a cemetery in Havana. He failed to pull through an operation for an ailment contracted while campaigning in the swamps and forests of Cuba. He lies amongst the palms in the land he helped to liberate. Scovel paid the price.

### Louis Seibold

There was also Louie Seibold, who is still in harness, standing at the head of his calling and sharing with "Sam" Blythe the distinction of being the highest authority on American politics and public men. Seibold's arrival at Santiago during the campaign brought a reinforcement to *The World* staff that doubled its news efficiency. A wonderful comrade.

### The Cub

There was also a cub, "Brian Boru," Scovel nicknamed him (not much of a newspaperman in that constellation of stars), whose main occupation seem to consist in restraining his chum from sacrificing his life every time he came within gunshot of a Spanish fort or flying column. Scovel was chuck full of curiosity. His thirst for first hand knowledge was insatiable. He refused to take the Spaniards seriously until he had a regiment or a block house vigorously expressing disapproval of his presence in their vicinity or a band of *guerrilleros* hot on his trail.

The cub was different. The Spaniards potted him once from an armored car, they tracked him for days with blood hounds and pressed him so hard at another time, that they captured his assistant and cut his head off, thinking they had killed the cub. After that, the cub developed an unreasonable appreciation for rear-guard scenery. He was at all times opposed to his side-partner's propen-

sities for exploring the interior of outwardly peaceful looking villages and haciendas scattered around the Cuban landscape, in fact he acquired a most retiring disposition. There were times when he instinctively sought the lee side of a boulder, the shelter of a fat tree, a hole in the ground or a gully, or if these safety-first requisities to a war-correspondent's usefulness and longevity were not always properly scattered around the vicinity of trouble, he quickened the innate sagacity of his Cuban steed and headed a formidable rear-guard movement of the escort to more distant and tranquil surroundings. All to the intense irritation of Scovel, who on more than one such occasion threatened to spoil the countenance of the more cautious cub for foiling his attempts to break into the obituary column. The cub also broke down under the strain after the surrender of Santiago. Like Crane, they put him on a transport hollow-eyed, and emaciated with fever and carried him ashore at New York as they thought, to die. For four months his life was despaired of, but he came through it and lived. He almost paid the price. The Dons subsequently captured him. He is now serving a life sentence in a castle in Spain.

### "Hank" Cary

The genius, the star reporter, the spectacular war-correspondent, the political authority and the cub leader of rear-guard movements, all had to toe the mark and for once in their young lives recognize a boss, taking their orders meekly from the quiet, genial comrade whose common sense and knowledge of what the office wanted brought greater efficiency into an organization that had to hump itself to maintain the prestige of its paper with only one snorting old filibustering tug-boat (the historical "Three Friends") to buck the fleet of palatial steam-yachts and swift dispatch boats working for the opposition. They did just that, and scored many scoops, thanks to the direction of "Hank" Cary.

His companions and colleagues of those days when *The World* was young will echo the words of the *Editor & Publisher*, "he knew how to make friends and keep them."

* * *

## New Map of China

(PHILIPS' COMMERCIAL MAP OF CHINA, edited by Sir Alexander Hosie, published by George Philips & Son, Limited, 32 Fleet Street, London, E.C.4. Mounted on cloth and varnished with rolls, 50s. net: mounted on cloth and folded in French case, 55s. net).

Undoubtedly the best commercial map of China yet published. It has been carefully edited by the late Sir Alexander Hosie, the foremost British authority on commercial and industrial China. In the map folder, is a comprehensive handbook giving the essential data on area and population, inhabitants and customs, currencies, weights and measures, foreign relations, communications, import and export trade and trade conditions, modern industrial development, old and new names of cities and a complete map index.

The map itself is in five colours, 45-in. by 62-in., scale, 48 miles to 1-in. The scale is also given in kilometres and Chinese *li*. It shows the railways in operation and under construction and the districts where various staples and commodities are found. Amongst these are the animal and vegetable products, minerals and manufactures, each product being indicated on the map by a separate symbol of which there are 98. These symbols, being printed in red and royal blue, are easily distinguishable. Wherever space permits, the names of the animal and vegatable products are given in full.

This is the first map to be published with the new "Hsien" nomenclature (the new republican form) and for reference the older and more familiar forms are also inserted. The spellings throughout are those officially adopted by the Chinese Post Office.

The map also shows canals, steamer routes (with distances between ports), submarine cables, passes, caravan routes, telegraphs and wireless stations. Heights of land are indicated in feet at intervals.

Altogether it is a most valuable work, thoroughly in keeping with the reputation established by Sir Alexander Hosie, and that of the map-makers.

* * *

## Famine Prevention in China

PLANS for the prevention of famine in China have been made by the executive committee of the China famine fund, of which Thomas W. Lamont is chairman. Two Chinese colleges have been endowed with funds to provide for scientific study and education in agriculture and forestry. The money for this work will be forthcoming from the balance left from the $7,750,000 donated by the American people for the relief of millions of starving Chinese in the winter and spring of 1921. All demands on the committee from the Chinese have been met and the cash surplus amounts to approximately $900,000.

Thomas W. Lamont made the following statement in New York on the aims of the famine fund trust:—

"After the committee had met all demands for famine relief in China, including those caused by the recurrence of want in the first half of 1922, there remained of the generous offering of the American people to the provinces of China stricken by starvation in 1920-21 a balance of approximately $900,000. The executive committee has determined to devote this surplus to the prevention of famine in China, by scientific study and by education in agriculture and foresty.

"After consulting with the American advisory committee, organized at Peking under the leadership of the American minister, the plan to undertake famine prevention has been based upon the creation of a conditional trust, which is to last for ten years. Nanking University and Peking University have been selected as the educational centres of the work, and there will be placed in the hands of a trustee $675,000 for the first named college, and $225,000 for the second, as the trust funds to be used for the study and investigation of famine causes, prevention and relief and as a means there to for the education of the Chinese in agriculture and forestry.

"Expenditures from the principal of either sum can be made only with the approval of the China famine fund committee, which is to be composed of five American residents of China, serving without pay. Two of these committeemen are to be selected by the American minister to China, and two by the committee on reference and counsel, foreign missions conference of North America. These four are to select the fifth.

"The universities are required to inform the committee of all proposed expenditures and the committee has authority to revise them. Compensation from the fund is limited to those actually engaged in carrying out the purposes of the trust.

"There has been reserved from the two grants for five years an emergency fund of $100,000 for use as a nucleus to start a campaign for famine relief in China should such an operation be necessary.

"At the end of ten years the China famine fund committee, created by the trust, may direct the trustee finally to surrender control of the funds to the two universities, in sums apportioned by the committee or if the administration by the universities has not been satisfactory it may withdraw them entirely and direct the trustee to apply them to other uses within the purpose of the plan."

The members of the executive committee of the China famine fund are Union N. Bethell, Graham Patterson, Dr. Robert E. Speer, Dr. Frank Mason North, Raymond B. Fosdick, John Price Jones, H. T. S. Greene, William H. Taft, Dr. Livingston Farrand, George Horace Lorimer, Galen L. Stone, John Jay Abbott, Festus J. Wade, Robert Dollar, Mortimer L. Schiff and Arthur B. Parker.

# A Pioneer for Pacific Peace

## Alexander Hume Ford

### The Founder of the Pan-Pacific Union

DESTINED in the course of years to outrival in usefulness the Pan-American union as an instrument of international good-will and understanding, the organization that has grown and gathered strength at the "Cross Roads of the Pacific" is rapidly assuming an importance which bids fair to become one of the world's greatest institutions. The Pan-Pacific union embracing in its membership the great empires whose shores are washed by the waters of the Pacific, has a peculiar and far-reaching mission, thrashing out vital problems in an informal way at its annual conferences and other meetings which enable the governments concerned to formulate and apply policies assured of a hearty welcome by the other interested Pacific peoples.

In Washington and other seats of democratic governments, the officials in power adhere scrupulously to the basic law of popular government, keeping their ears glued close to the ground at all times to catch the first far-away murmur of public opinion. It may well be as the years roll by that this fundamental political rule will be modified in form to meet the requirements of international Pacific politics by listening in and paying attention to what Honolulu has to say. In this free forum for ventilating ideas and ideals, the voices of America, of China, of Japan, of Canada, Australia and the other free peoples of the Pacific are heard through their unofficial spokesmen relieved of all diplomatic restraint. If listened to by the governments concerned with as much interest as they display in catching the first rumble of home opinion, the way will be cleared for mutual understandings that will lighten the load of active diplomacy and make possible a thorough understanding between the peoples of the Pacific Ocean.

Alexander Hume Ford

To mention the Pan-Pacific union, the name of Alexander Hume Ford comes automatically to the fore. Listening in on Honolulu, also means "keep your eye on Ford." Who is Ford? To begin with he is a bundle of energy, one of those hundred per cent. Americans whose forebears from England carried their full share of the load in transforming a wilderness into the great nation of to-day.

Born in Charleston, South Carolina, in 1868, on his father's side Mr. Ford was descended from Peter Ford, who arrived in Charleston harbor about 1668 with three ships and a grant and a royal patent of land for quite a portion of South Carolina. On his mother's side he is descended from the Humes, Earls of Marchmont, Scotland, and from many distinguished pre-revolutionary leaders, one of whom, General Christopher Gadstone, was a signer of the Declaration of Independence and a warm personal friend of George Washington. He was the first governor of South Carolina and it was through his efforts that the colony of South Carolina broke away from the British empire. One of the first flags of the United States was the Gadstone flag, a rattle snake on a yellow field and the motto "Tread on me and die."

Mr. Ford was educated at Charleston in Porter Academy, in a class with General Charles Summerall and others who have since become distinguished. He began life on the *Charleston News and Courier* and after the earthquake moved to New York City, where he was associated with the two grandsons of his father's lifelong friend, Senator John C. Calhoun. Later he went into newspaper work in New York and playwriting. Early in life he became a traveler, visiting most of the countries of the world. For a period of time after the Chicago Exposition he was on the staff of the *Chicago Daily News* with such men as Ray Stannard Baker, Peter Finley Dunn ("Mr. Dooley"), Trumball White, George Ade and others who have become distinguished.

The basis of Mr. Ford's life work in the Pacific may be said to have begun in Chicago. He undertook the task of supporting a congregational minister, who he believed had been treated unjustly by his congregation because of his views, and Mr. Ford organized the the militant church of Chicago. On the board of directors were Protestant clergymen, a Jewish Rabbi, a Catholic priest, and an Episcopalian bishop, and the agnostics represented by Robert Ingersoll. The Columbia theatre, the largest in Chicago, was used for the church services, and here Robert Ingersoll preached his only sermon, "How to Reform Mankind." In this church no one was compelled to give any donation. Its motto was "Deed not Creeds, act in this World, theorize in the next." Every member had to give two hours of his time at the call of the pastor, Rev. John Rusk, for the good of humanity. A hundred women pledged themselves to visit daily the police stations and rescue any women who expressed a desire to reform. As many physicians gave free treatment and in the police stations there was a physician who took hold of the dipsomaniacs for there was a hospital organized by this church for the caring of alcohol and morphine fiends. It killed some and cured others, but there was never a complaint. Rusk was pastor of the church until he died. There was a chorus of 200 voices and an orchestra of fifty in connection with the church. Everyone gave his services free.

When Mr. Ford came to Hawaii to live in about 1907 it began to impress itself upon him that if Chicago men of all creeds and no creeds could get together to run an institutional church why could not men of all races and religions be brought together to bring the nations of the Pacific into real co-operative effort for the advancement of the interest of all. He spent a year in Honolulu studying the subject and the races. In the meantime he organized the Outrigger Canoe Club and revived the sport of surf-board riding. Starting with membership of less than a hundred and the ridicule of the old-timers who were certain that no white man could learn to ride the surf-board, the club has grown until it now has a membership of 2,000 men, women and children and half-a-dozen of the world's champion swimmers. The following year he organized the

Trail and Mountain Club for the trampers and this now has a membership of several hundred. These two successes gave him confidence and brought him into contact with the men of all Pacific races. It was at the Outrigger Club that he gave a series of dinners to the leading men of each Pacific race to meet Jack London and discuss with him the great international problems of the Pacific. This led to the idea of the Hands-Around-the-Pacific Club and the movement was the beginning of the Pan-Pacific union.

About 1908 Mr. Ford made a trip around the Pacific with a commission from then Governor Walter F. Frear to begin the organizing of the Pan-Pacific union. T. E. Dunne of New Zealand and Percy Hunter of Australia took the leadership in their countries and branches of the Union were established with government backing. A conference was held in Honolulu and the governments of the Pacific selected that place as the conference centre of the Pacific because of its convenient location as a cross roads station, so Mr. Ford decided to make his home there. In 1914 he again made a trip around the Pacific organizing branches of the union in the Orient, and in 1920 he persuaded a party of congressmen to visit the Orient and establish points of contact with the leading men in the Philippines, China and Japan and here was established a series of branch organizations of the Pan-Pacific union with the heads of these governments as honorary presidents. In fact, to-day the head of every Pacific government is honorary president of the Pan-Pacific union and they are all personal friends of Alexander Hume Ford, the director of the Pan-Pacific union.

The first conference after the war was the Pan-Pacific scientific conference in 1920, when about a hundred scientists from Pacific lands met and organized to discuss the scientific problems of the Pacific. In 1921 Mr. Ford had the union call the first Pan-Pacific educational conference, which has been such a splendid success under the chairmanship of David Starr Jordan. He is at work with the new executive secretary of the Pan-Pacific union, Dr. Frank F. Bunker, in organizing a permanent Pan-Pacific press conference to meet every three years, the object of which will be to disseminate truthful knowledge to the world about Pacific lands. This year the Pan-Pacific commercial conference will be held in Honolulu under the auspices of the Pan-Pacific union and it is hoped that President Harding and the presidents and premiers of Pacific lands will be able to be present as guests of the Pan-Pacific union to establish points of contact among themselves that will be useful for all time to the people of the Pacific. A number of other Pan-Pacific conferences are scheduled to meet in Hawaii to establish points of contact between the leaders of thought and action in Pacific lands and there is a plan afoot to charter a steamer and take on a tour around the Pacific a hundred of the leading statesmen and others of Pacific lands, that they may grow to know each other and become acquainted with each other's countries. This has the backing of the leading statesmen of Japan and America and it is expected that conclusive arrangements will soon be made.

Alexander Hume Ford has been the leading worker in the Pan-Pacific union for more than a decade. He states that in organizing the work he believes that the Pan-Pacific league of nations might be brought about after thrity years of labor. Twelve years have already passed and such men as Woodrow Wilson, Warren G. Harding, Franklin K. Lane and Henry Cabot Lodge have expressed their belief that a world league of nations should have its beginning in the Pacific Ocean where the traditions are traditions of peace, and these men have given Ford their consideration and support. Franklin K. Lane was about to take the position of director-general of the Pan-Pacific union when he was called by death. Ford is now gathering about him the biggest men of the Pacific and the Pan-Pacific union is well established with financial support from the United States government, that of Hawaii, the Australasian countries, China and the Orient. In fact, all of the countries of the Pacific are members of the Pan-Pacific union, which is still an informal organization that thrashes out the problems of the Pacific in an informal manner and does not commit the governments in any way, so that the governments are glad and willing to finance the Pan-Pacific union and send delegates to feel the way toward movements that the governments may later take up and perfect in an official manner. Mr. Ford has been a pioneer, but the pioneer days of the Pan-Pacific union are over and it is to-day one of the great organized bodies that is working for peace by understanding and an organized league of nations. Ford perhaps has not put Honolulu on the map, but he has made the " Cross Roads of the Pacific " the meeting place and forum of the peoples who must work out their destinies within its influence, and laid down for the governments of these peoples that basic political law that in time cannot be disregarded : " listen to Honolulu." Ford will pass on, but his work will live.

# Lead and Zinc Mining in China

Lead and zinc are still mined by native methods in the province of Hunan, with the exception of the Shui Kou Shan Mine, which has been equipped with modern machinery under the supervision of the Hunan mining board. For the present native methods of mining suffice, as there are not enough smelters in the province to take care of the output of the mines.

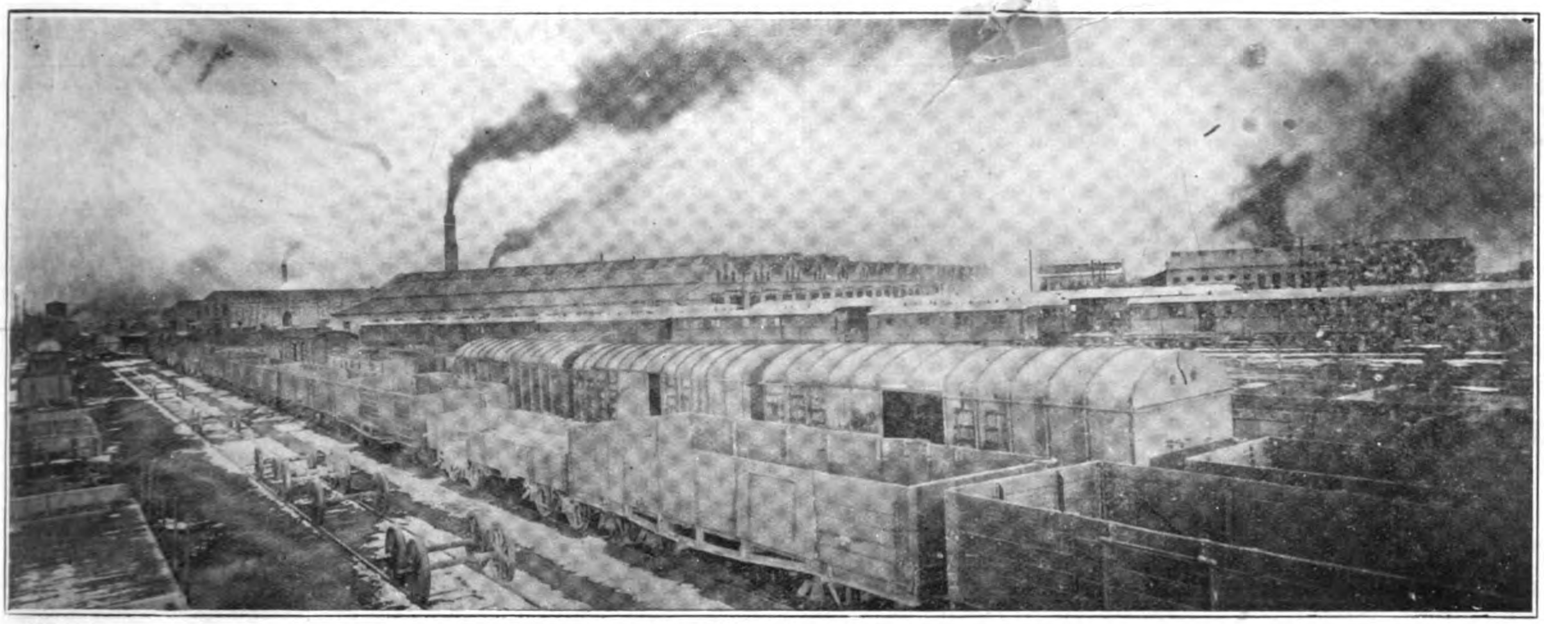
Production since 1896 has been 88,753 tons of lead ore and 236,571 tons of zinc ore, aggregating in value about $7,000,000. Although labor is extremely cheap costs are excessive, chiefly on account of many unnecessary officials, administration comprising 36 per cent. of the total cost.

About 50 tons a day of sorted ore is the maximum future production unless development is carried ahead of stopes. With intelligent development this capacity can be doubled and the ton cost reduced. The character and size of past ore bodies leads to the belief that much additional ore exists and justifies development.

There are only two smelters in operation at this time—the Hunan Lead Smelting Works at Changsha and the Sumpeh Zinc Smelting Works at Sumpeh, which is about three miles from the Shui Kou Shan lead and zinc mines. Both plants are under the con rol of the Hunan board of mines, which is a government institution.

The Hunan Lead Smelting Works is a modern plant, consisting of two reverberatory roasting furnaces, one blast furnace, one refining plant, and one retorting and cupelling plant. The Parks process is used for de-silverization. On account of the high cost of fuel and repairs, the reverberatory furnaces for roasting were abandoned in 1920 and pot roasting was adopted. In the same year the blast furnace plant was enlarged by the addition of one more blast furnace. The Sumpeh Zinc Smelting Works is an old native type smelting plant. The Hunan board of mines intends to build a modern zinc-smelting plant, if the necessary funds can be secured.

About 500 tons of lead ore, composed of both lump ore and concentrates, are smelted in the Hunan Lead Smelting Works every month, producing approximately 250 tons of refined lead about 99.90 per cent. pure and 10,000 ounces of silver of 99 per cent. fineness. The refined lead is sold to the native shops and foreign firms. It is shipped to Shanghai and Hankow and occasionally exported to Japan.



View of Tangshan Works

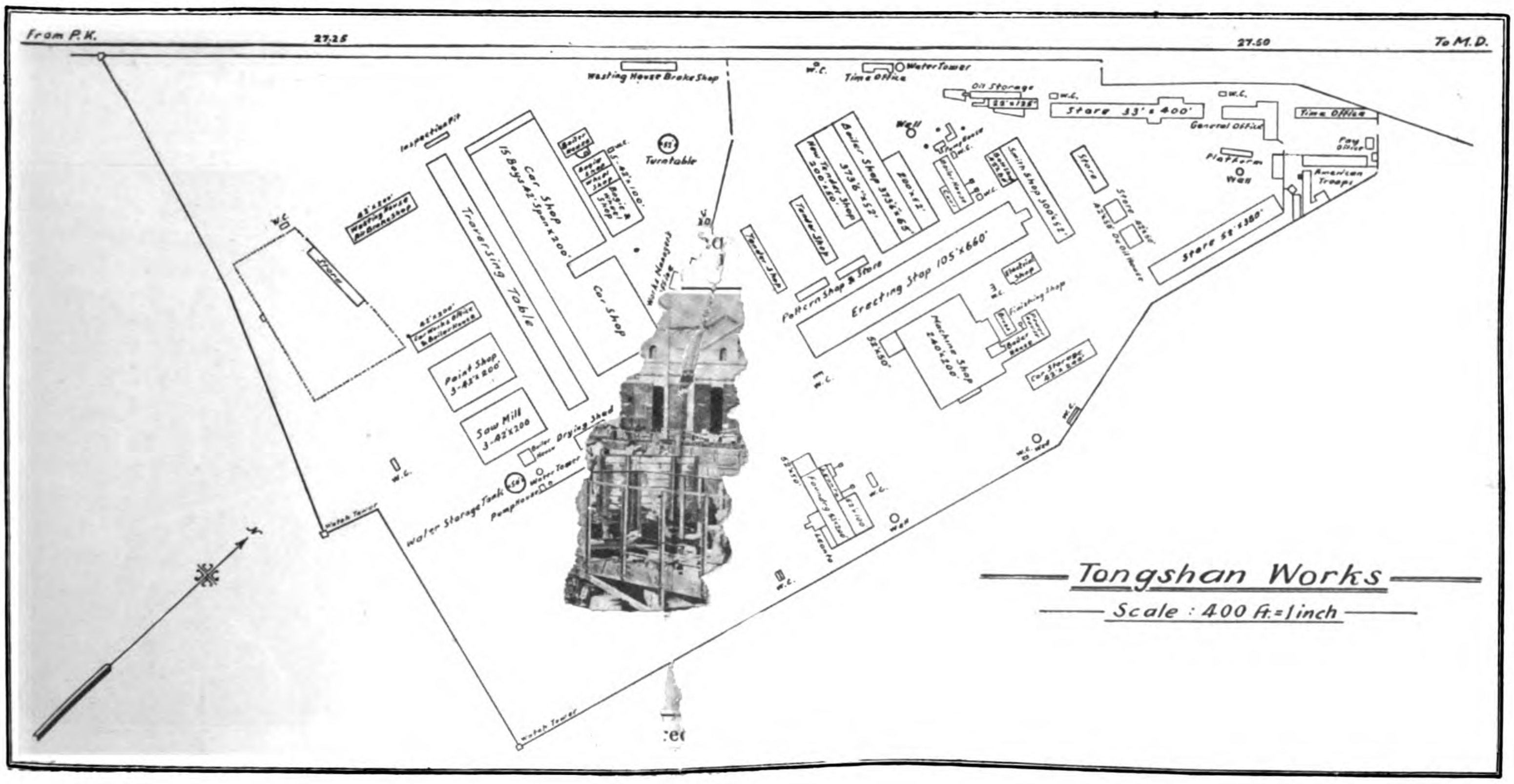
# THE TANGSHAN WORKS

## *H. STRINGER, B.A., A.M.I.C.E.*

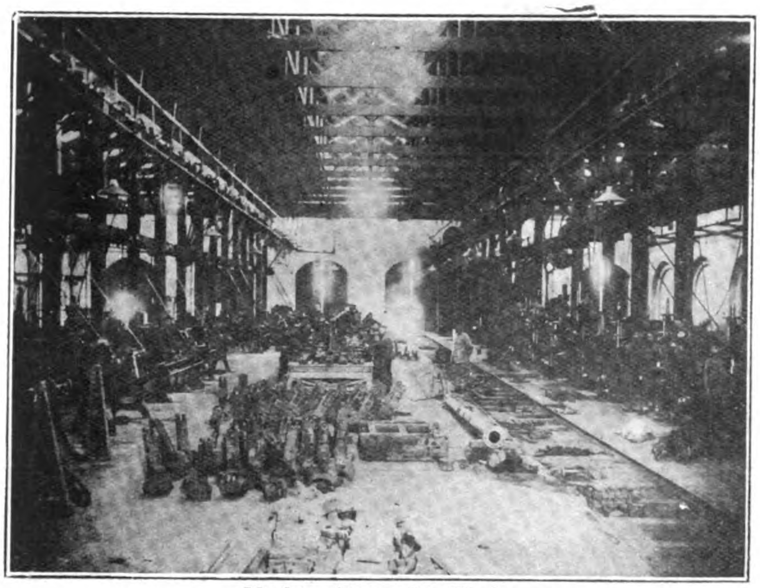
THIS is the locomotive carriage and wagon works of the Peking-Mukden Railway. The present works replaced one on a much smaller scale now utilized as repair shops by the Kailan Mining Administration.

Building on the present site began in 1899 the first structures to be put in hand being the erecting, boiler and machine shops, smith's shop, stores and time office. These were completed in 1900 and by 1903 the whole works had been removed. Considerable extensions were made in 1907 more particularly to the car works and since 1915 there has been considerable building activity in all departments.

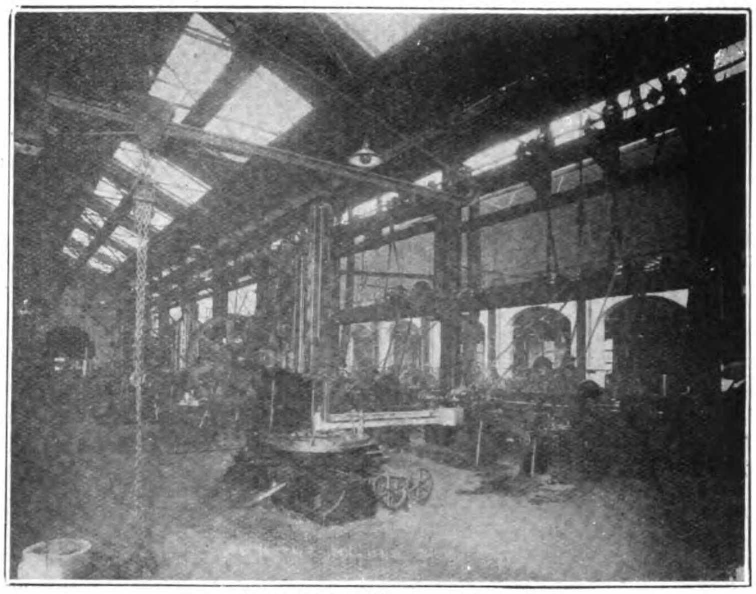
Power is derived from three main boiler houses for the locomotive and car works, and the electric power-house. The first boiler house is equipped with two Babcock and Wilcox, five Cornish and two Lancashire boilers, the second with four Babcock boilers and the last, with eight Babcock boilers. There is also an auxiliary boiler house equipped with three Cornish boilers which supplies power to the log frame, steam-driven saw, in the saw mill, and heating to the paint shop and car works offices. The Westinghouse air-brake shop also has its own boiler power supplied from one loco. boiler at 180-lbs. per sq. inch. Steam pressures are 160-lbs. per sq. inch in the electric power-house and 100-lbs. elsewhere; all boilers are hand fired. The annual-coal consumption is some 14,800 tons about 55 per cent. of which is consumed in the five winter months from November to March when the demands for heating are heaviest. The prices paid for coal are $3.50 for lump and $2.50 for slack.



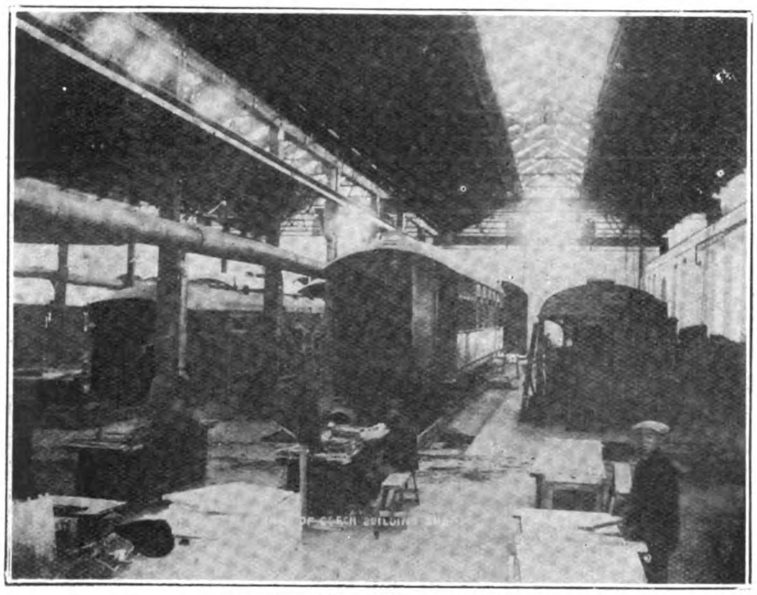
# THE TANGSHAN WORKS



Machine Shop—Car Works

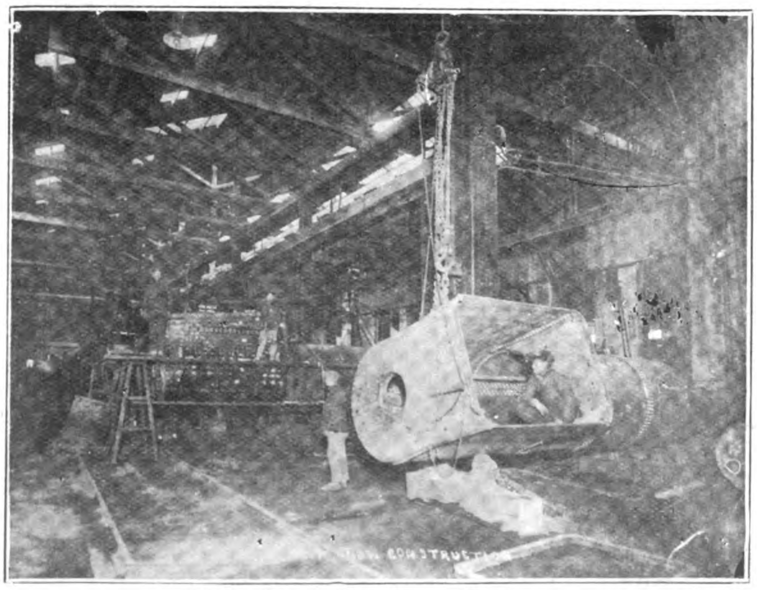


Locomotive Machine Shop

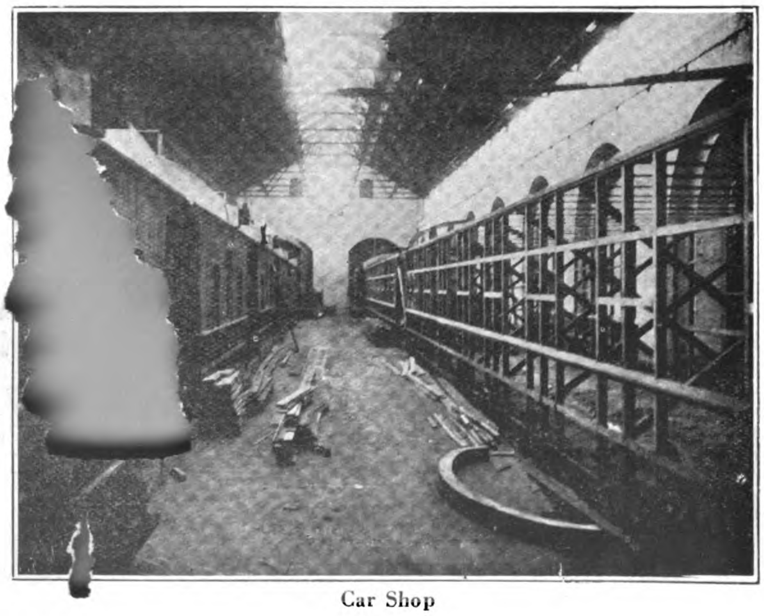


Corner of Coach Building Shop

Locomotive Erecting Shed

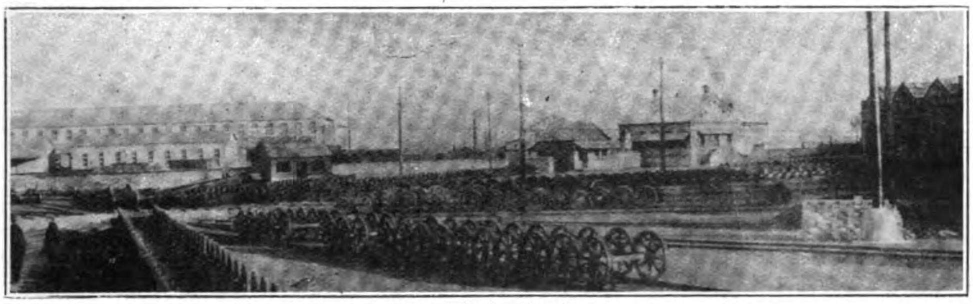


Boiler Shop—New Contruction



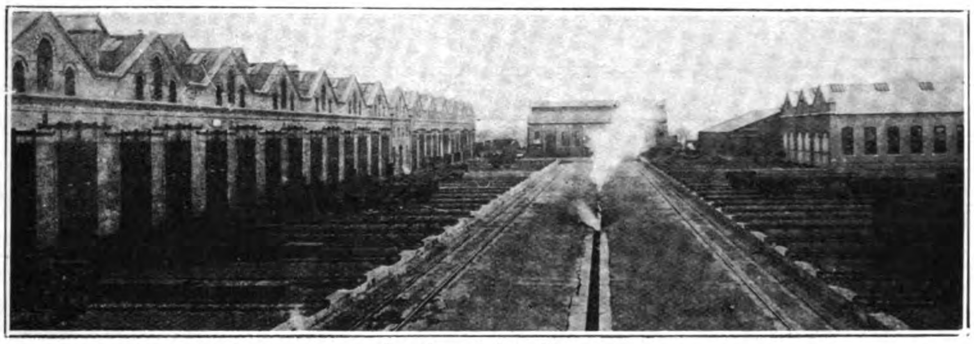
Car Shop

As everywhere electricity is largely replacing steam for motive purposes. Power is supplied at present from two 110 kilowatt direct current Crompton generators, and one of 225 kilowatts of the same make, all driven by Belliss & Morcom compound high-speed vertical engines. The pressure is 220 volts. Motors are now installed with a nominal total capacity of 1,000 B.H.P. rated continuously, and the average daily power-house output is 3,000 kilowatt hours. Power is distributed from a 22 panel switchboard also by Cromptons. To cope with recent developments a new 500 kilowatt generator of the same make is now being installed which will give a total brake horse-power capacity in the power-house of 1,455 or 940 kilowatts. In connection with the power-house there is also a battery 118 cells with a capacity of 420 ampere-hours.



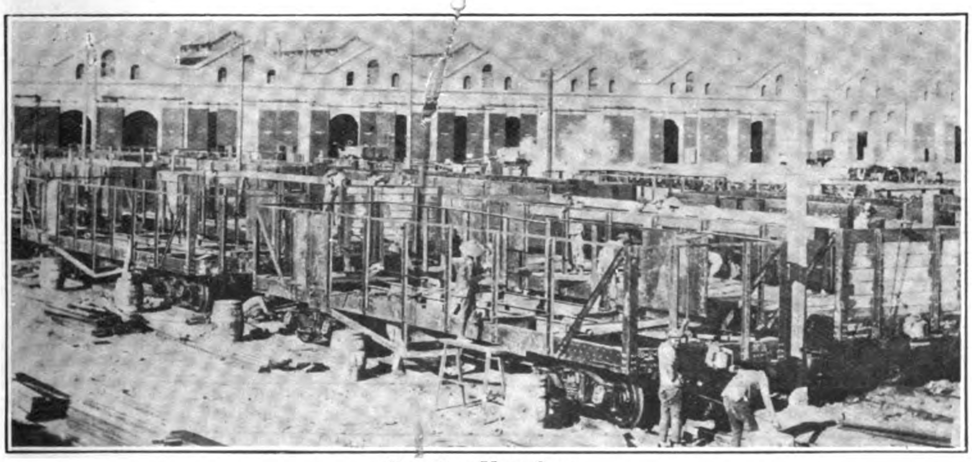
Car Works Yard

Hydraulic power at a pressure of 1,500 pounds is supplied to hydraulic rivetters and presses from an accumulator worked by three pumps. Air pressure is in universal use all over the works for drills and hammers, air at 100 pounds per sq. inch being supplied from three compressors in the car works and four in the locomotive works. Generally speaking all the heavier machines have their own electric drive, and shafting is electrically driven in all machine shops and the saw mill. Steam is confined to the smith's shops for steam hammers, and for heating. The shop cranes of heavier capacity are all electric driven.



Coach and Car Shops

The water supply of the works is obtained chiefly from one 8-in. borehole of a depth of 90-ft. approximately. There are also seven surface wells from which water is pumped by steam or electrically and by compressed air wherever depth permits. The bore hole output of 8,000 gallons an hour together with that of two surface wells (operated by compressed air and giving 4,000 gallons an hour) gravitates to a reinforced concrete reservoir of 250,000 gallons capacity, whence it is electrically pumped in to a water tower of 35,000 gallons which is connected with a second tower of 35,000 gallons capacity (the water being under a mean head of 40-ft.). The average daily consumption is 160,000 gallons (winter months 200,000 gallons) of which the works itself consumes an average of 80,000 gallons the balance being used for locomotive supply, the shed tank in the station drawing from the same source.



Erecting New Cars

With regard to the shops in detail, the boiler shops are in process of re-organization. Very shortly they will be capable of dealing with 28 boilers under repair, eight boilers under construction and twelve under test and mounting. These shops are served by one 30-ton electric crane, one 15-ton electric crane and another 30-ton electric crane is to be shortly installed. The equipment is remarkable for an Armstrong Whitworth boiler shell boring machine which will drill a fire box—900 holes in one working day against eight days required by older methods. There is also a rotary splitting shears by Ryersons of Chicago which will shear plate up to $1\frac{1}{4}$-in. thick on a 10-ft. gap. There is also a large vertical gap hydraulic rivetter for boiler rivetting fixed in a pit and served by a 20-ton crane (hand) which is also utilized for the shell boring machine previously mentioned. A hot flanging press (Twedell system) capable of flanging plate up to $\frac{3}{4}$-in. is in use for boiler shops and car requirements.

Boiler plates are shaped by a Smith vertical plate bending rolls capable of taking inch plate 12 feet long, while there is also a large Bennie plate punching machine with a capacity for $1\frac{1}{4}$-in. holes in $1\frac{1}{4}$-in. plate. There are two Alfred Herbert automatic stay-making machines. Boiler tubes are scaled on withdrawal by a machine on the friction roller principle designed in the works. Ends are also cropped and safe ended by machine; and afterwards tested hydraulically up to 250-lbs. per sq. inch. A scaling machine which scales tubes by stretching by hydraulic power is also giving good results. At present 30 new boilers are under construction.

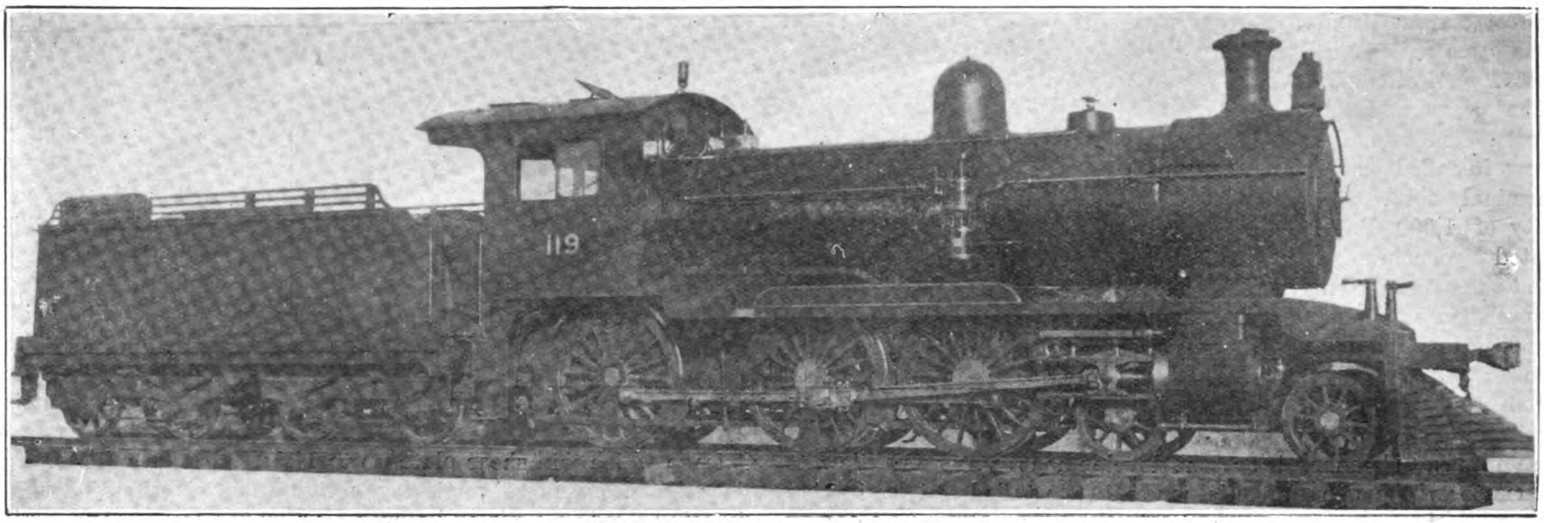
The tender shop which adjoins these buildings is provided with eleven pits each of which will accommodate two tenders. It is served by a 30-ton electric crane and the building is of sufficient height to admit of tenders being lifted over each other to the two tracks which serve the shop.

The erecting shop is furnished with longitudinal pits and is equipped with two 45-ton electric cranes together capable of handling the heaviest engine now in use.

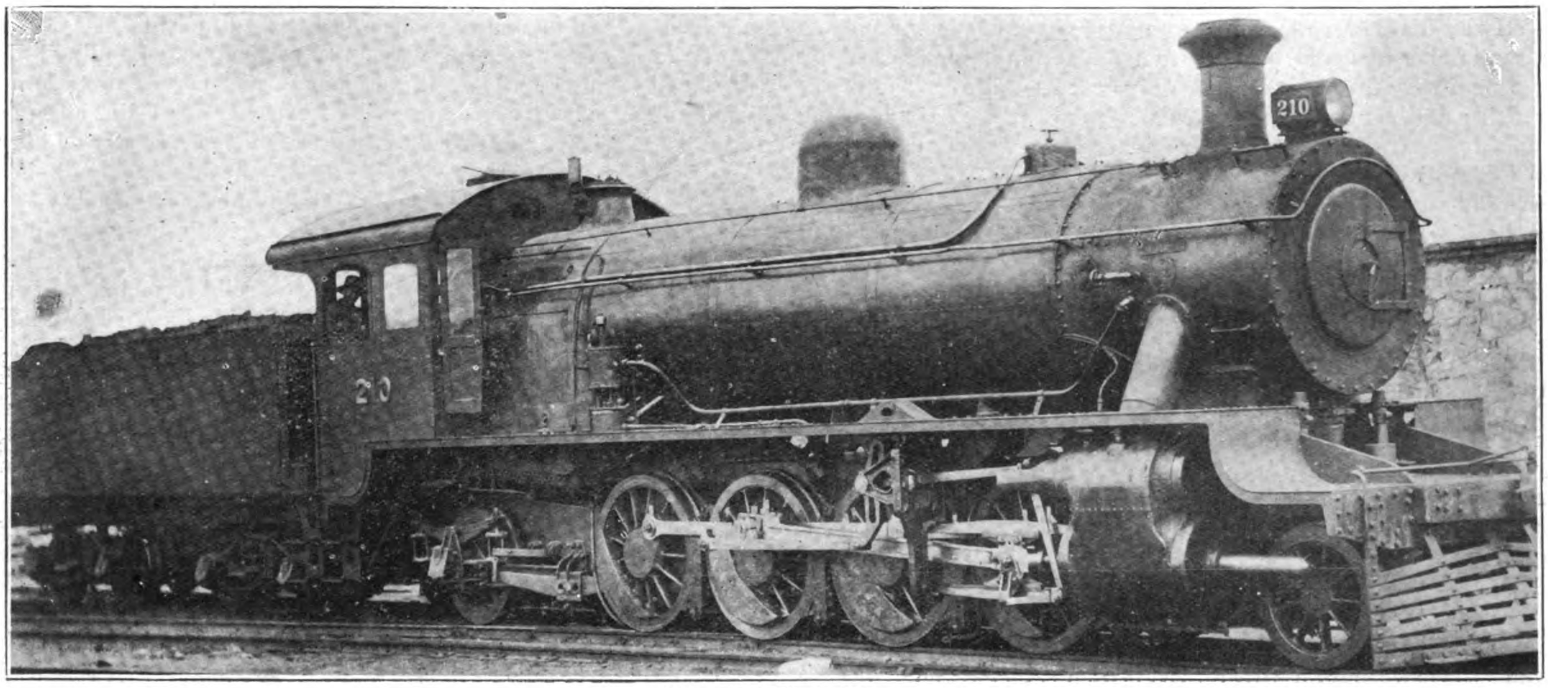
The shop has portable self-driven machines for machining horn blocks and for reboring cylinder barrels in position. About fifteen locomotives pass through the shop each month of which five are general overhauls.

In a lean-to to this shop is the engine painting department shortly to be moved to the main paint shop the traverser for which having been recently converted to electric drive and strengthened for loads of 80 tons.

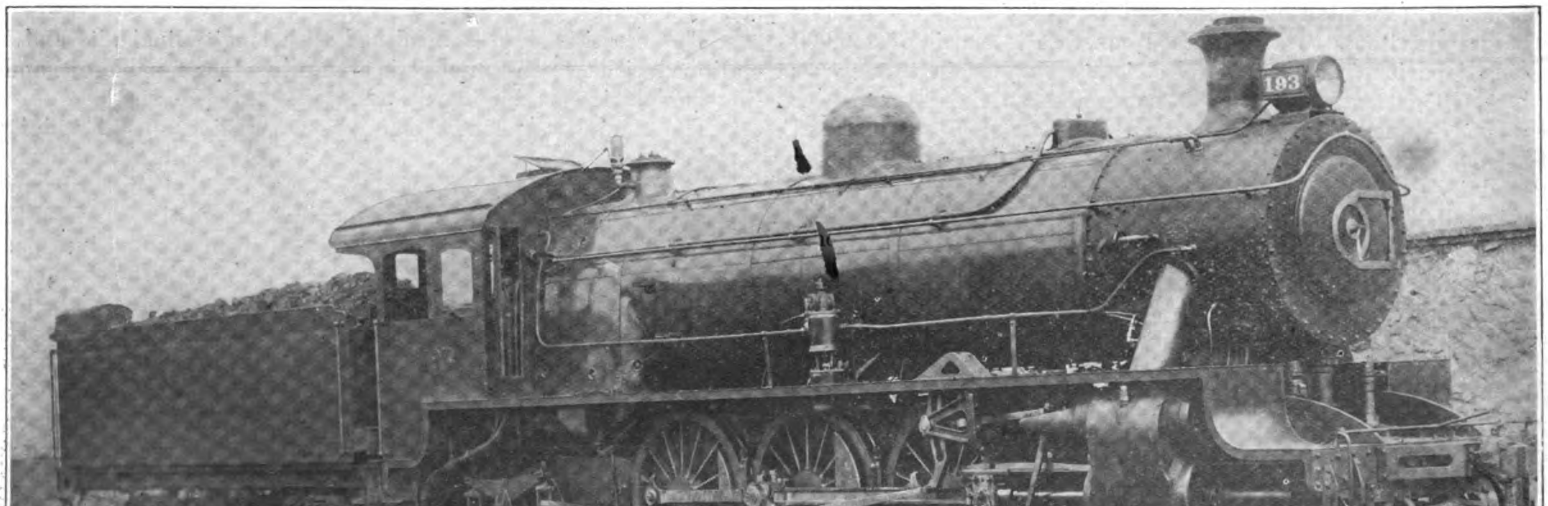
# TYPES OF LOCOMOTIVES BUILT AT THE TANGSHAN SHOPS




Ten Wheeler Passenger Locomotive

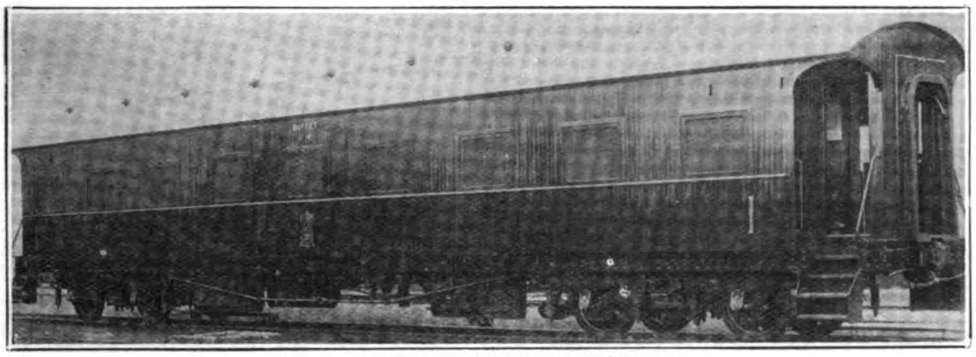



**Baldwin Mikado Type**




**Latest Pacific Type Locomotive**

The machine shop equipment is mainly remarkable for a 7-foot boring mill by Cravens, a 42 inch duplex boring mill by Webster and Bennett and a London wheel lathe which will deal with 5-ft. 6-in. diameter wheels. It has the latest hydraulic equipment for removing and fixing wheels and axles, is furnished with a case hardening plant, and has oxy-acetylene and electric welding plants sufficiently portable to work in other shops if needed. The bay dealing with wheels and axles is served by a 10-ton electric crane.

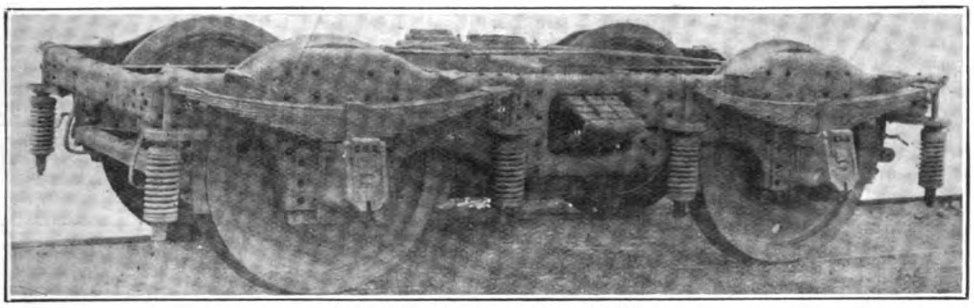


Buffet Car Built at the Tangshan Shops

Eight new locomotives are under construction the only finished material imported being wheels and axles, springs and brake equipment.

The foundry is served by a 10-ton electric crane. It is equipped with pneumatic moulding machines for repetition work and has two Morgan tilting crucibles in the brass foundry. The output is about 90 tons of iron and 16 tons of brass castings per month. This cannot keep pace with growing requirements and the foundry is in process of enlargement.

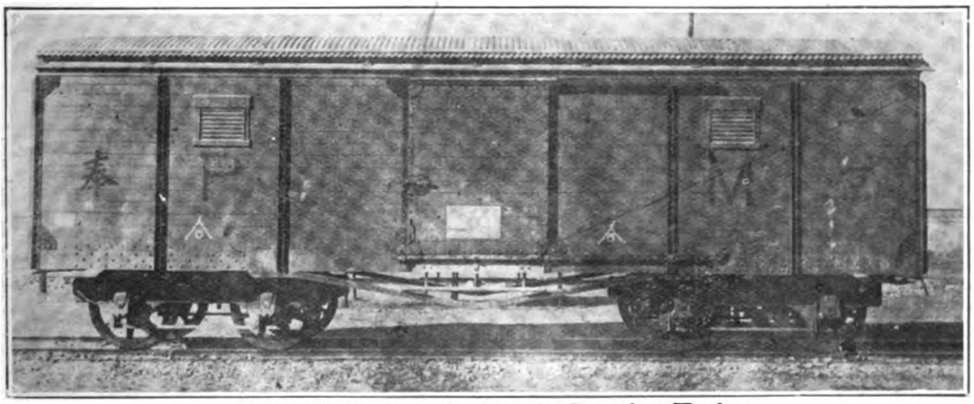
The car works has its own smithy, frame, and machine shops. and a separate department for dealing with wagon wheels and axles. The smithy, which has 92 fires, five steam hammers and two hot saws, is mainly remarkable for a Brett three stage drop hammer battery for stampings and general smith work. The machine shop has the usual equipment including a Putnam wheel lathe which turns down seven pairs of car wheels per day at a cost of 36 cents each. The saw mill serving these shops is the most recent addition to the works. With the exception of a 60 h.p. vertical steam log saw the motive power is electric to the extent of 130 h.p. The shafting with the exception of saw sharpening tools is in pits. The machines are all of English manufacture. Timber is mainly imported in log, but two inch planks for car bottoms are also stocked. With this exception the saw mill meets all requirements as regards scantlings, mouldings, flooring, also mortising and planing, for carriage and wagon work. A drying shed with steam-drying chamber is provided for seasoning timber.



Standard Passenger Car Truck

The paint shop which is steam heated and has six pits is of sufficient size to accommodate sixteen passenger cars. Repairs and painting of wagon stock are at present carried out in the open. Bogies and underframes are painted with a tar paint neutralised with cement.

The Westinghouse air-brake shop is used for the repair and testing of this brake which is standard on the railway. In the same building is housed the electrical department which in addition to maintaining the electrical equipment of the works is responsible for the lighting of eight stations, the maintenance of train lighting sets of which there are 141 on the Stone system, and the care of fan equipment, and of those staff quarters electrically lit.



30-Ton Covered Car built at the Tangshan Works

The car works is served by an electrically driven traverser taking loads up to 80 tons.

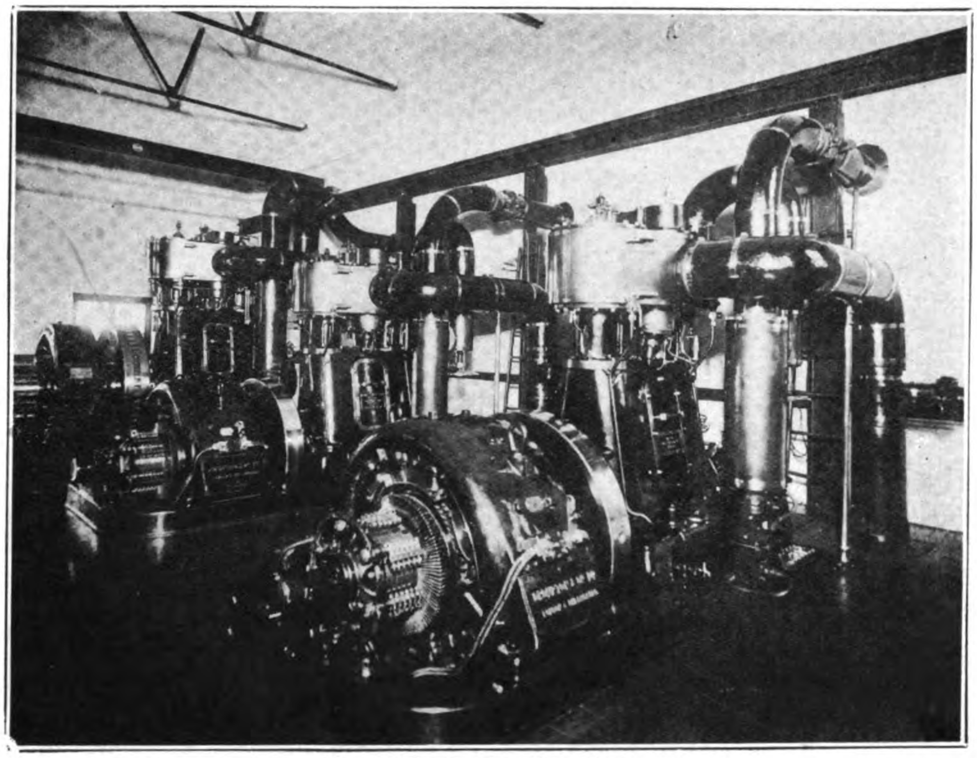
Wagon stock repairs are carried out entirely in the open, the sidings being able to deal with 300 cars per month. Sixteen passenger cars and sixteen brake vans are at present under construction. As regards passenger car construction the only finished materials imported are springs, wheels and axles, brake and electrical gear. Everything else even to nickel plating tailoring and upholstering is carried out locally. Recent additions to wagon stock include 300, 40-ton all steel coal cars and 200, 30-ton covered cars by the Metropolitan Carriage and Wagon Co. The cars are sent out knocked down and are rivetted up at the rate of sixteen a week. The works is equipped with an up-to-date tailor's shop, has three bolt and rivet making machines with a capacity of 60,000 per month, and all cotton waste from shops and car axle boxes is passed through a Tern De-Oiling plant which extracts and purifies the oil, and renders the waste fit again for shop and locomotive shed use.

This completes very summarily the detail notes of the various shops. To again generalise, the heating of the shops is either hot air on the Sturtevant principle or steam through radiators manufactured from old boiler tube.

Until within a year ago the pail system was in use for dealing with sanitation, but incinerators after a design used by the British armies in France have recently been installed for dealing with solids. These have so far worked very successfuly but of course the system earns no revenue as the old one did.

Structurally great attention has been paid of late years to the elimination of fire risk. On this account second floors where provided are in re-inforced concrete, windows are in cast iron or of angle iron construction, doors of steel and lintels for the same also of concrete. Buildings are carried out in the native blue brick on a rubble base wherever circumstance admit, but where work of any strength is required a hand-made fire-clay brick is used which

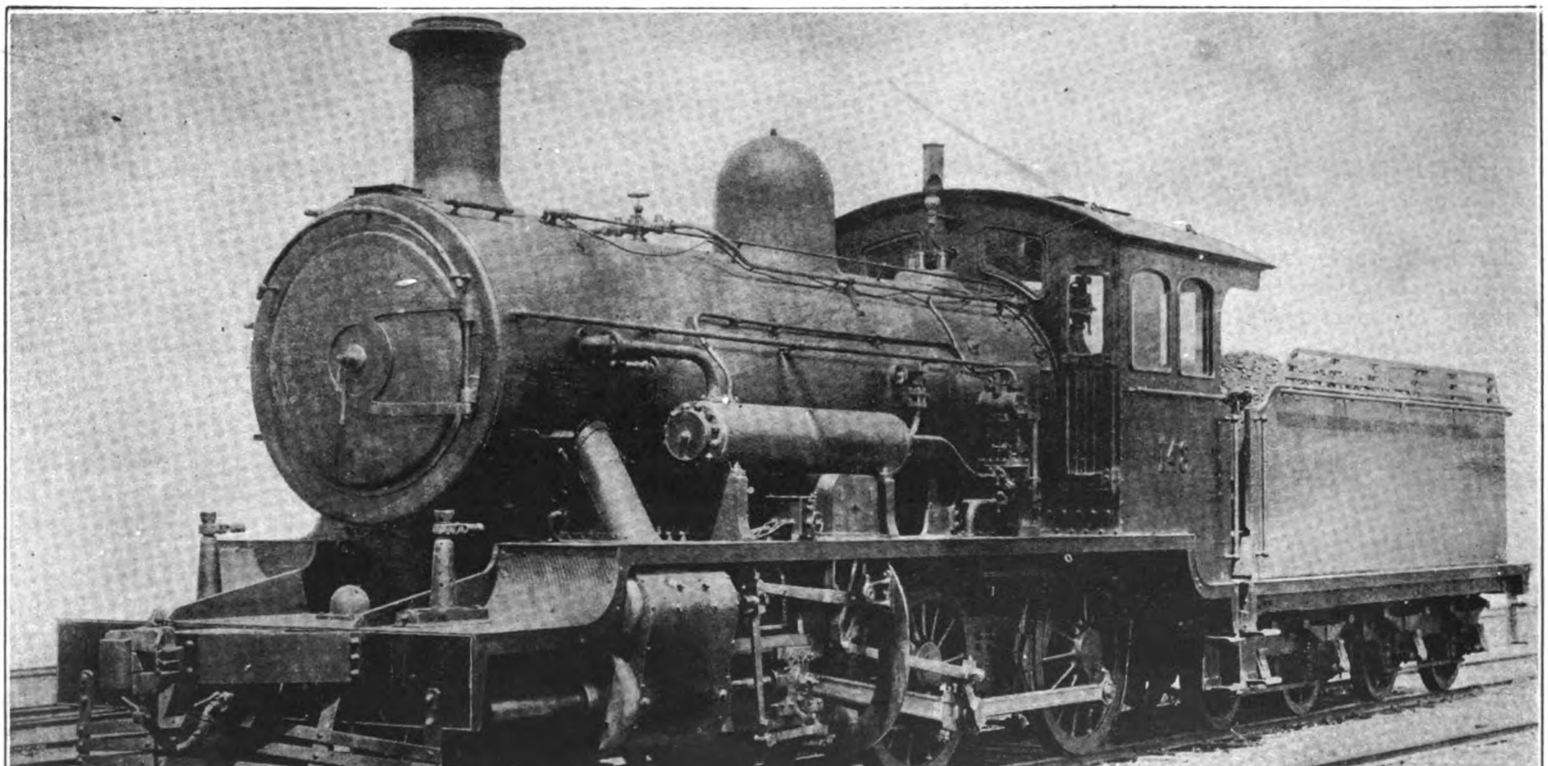
crushes at about 1,200-lbs. per sq. inch. Floors are in concrete; wood blocks cut from old sleepers and soaked in tar have been tried for this purpose, but they are not an unqualified success being far too sensitive initially to temperature change. Roofing during the war was carried out in waterproofed felt laid in pitch on boards, and this policy may be continued in Smithies and engine sheds but even in such unsuitable localities galvanized iron has recently been removed after being in service 17 years. There is thus little question that this material will again come into favor for general roofing purposes in a climate with the extremes of North China. Roofs are all of the ordinary ridge type with about a quarter rise. Skylights on all new work are in wired glass and roof lighting is proportioned at the rate of 25 per cent. of roof area. Store racks are either in steel or in reinforced concrete on fire-brick pillars in the case of new work. Craneways are carried on arches wherever height permits.



Power Plant—Tangshan Shops

The works has a 12-foot macadamised road running through it and the various shops are served by 13.5 miles of sidings. Main roads are all under a 60-pound rail, car repair and shop sidings have either a 45 or 50-pound rail. Where loads are light and in sidings under cover a re-inforced concrete sleeper, re-inforced with old boiler tube, is in use.

As regars labor, at the present time some 3,000 men are employed. These men wherever feasible work under the Halsey bonus system based on estimates, as introduced in the Sakako Works of the South Manchuria Railway. Piece work is not usual except in cases of special urgency, the bonus system giving very satisfactory results (the average bonus earned being about 30 per cent.) The wages paid are as follows: Fitter 1.96 maximum; smith 1.86 maximum; carpenter 1.30 maximum; 0.36 to 0.48 coolie. Up to date there have been no labor troubles worthy of mention, but the politically actuated agitator has recently appeared promising Utopias and framing exorbitant demands. They who listen and throw up their hats are at present a small minority but labor has always been ruled by articulate and noisy remnants so that the future is somewhat



**Heavy Mogul Engine:** First Engine Built in China fitted with Feed Water Heater and Superheater. Shows a 25 per cent. saving over sister engines not so equipped

hazy in this respect, though it is to be hoped that the innate conservatism of the Chinese may counteract this disturbing factor. Supervision of the shops is in the hands of seven British foremen.

The drawing office is divided into two departments—locomotive and tools, and cars and is in charge of a European chief draughtsman who controls 30 Chinese draughtsmen. It is equipped with the necessary valve gear and other models, and has a Photostat apparatus for rapid printing and plain reduction. Any tests carried out are supervised by this department, there being a 30-ton Buckton testing machine for tensile and bending tests, and a drop testing machine for axles with a 1-ton tup, and a maximum fall of 40 feet.

I am greatly indebted to Mr. F. A. Jamieson, locomotive and works superintendent, and Mr. F. Sugden, works manager, for much information which is embodied in this article, and I have also to thank Mr. L. J. Newmarch, the engineer-in-chief and general manager, of the Peking-Mukden Railway, for permission to make use of this information.

# New Tendency in Japan's Silk Spinning Industry

AT the time of the panic in 1920, the silk spinning industry was the hardest hit of all Japanese industries. Not only newly established companies were ruined but such old concerns as the Fuji Gas Spinning Co., Ltd., and the Kanegafuchi Cotton Spinning Co., Ltd., incurred great losses on their silk business, at the same time their cotton spinning business was going from bad to worse.

Towards the end of 1921, the industry took a favorable turn, and the end of the year was prosperous. Prices rose abruptly, and many of the new companies such as the Japan Silk and Wool Spinning Co., Ltd., were able to clear losses and this company was even able to pay a ten per cent. dividend for the term. With the new concerns making such profits, it is natural that the old companies with excellent equipment, and comparatively low fixed capital should have made greater profits. Kanegafuchi Spinning is said to have made a net profit of Y.3,600,000 on its silk spinning alone during the latter half of 1921. This is the company which pays 70 per cent. dividends on its paid-up capital, and whose shares are quoted at six to seven times their par value. One-fourth of the investment of the Fuji Gas Spinning is in silk spinning, so it can readily be seen that its business results the second half of 1921 must have shown a decided improvement over the other terms passed since the panic.

Improvement during the second half of 1921 has not held into 1922. Market quotations steadily declined, and raw materials have been ruling at comparatively high prices. Profit this year have varied from Y.39 to Y.52 per 10 *kwan* (82.8-lbs.), and compared to other lines of industry the silk spinning industry is in a very advantageous position.

The latest tendency in the industry is one of much interest. Spun silk yarn which used to be exported is now woven before it is sent abroad. This tendency is growing more and more marked. The cloth woven from spun silk yarn is called "Fuji Ginu"—"Fuji Silk," not after the mountain of that name, but after the Fuji Gas Spinning Co., which was the first weaver of this kind of silk material:—

The following table compares exports of spun silk, waste silk thread, and Fuji Ginu (Fuji Silk) during the first seven months of the past three years:—

(000 omitted)

| *Kind* | 1920 | 1921 | 1922 |
|---|---|---|---|
| Waste Silk Yarn: | | | |
| Quantity .. .. | 38,155 pieces | 21,621 | 39,353 |
| Value .. .. | Y.15,061 | Y. 3,386 | Y. 6,232 |
| Spunk Silk: | | | |
| Quantity .. .. | 2,952 pieces | 1,576 | 1,396 |
| Value .. .. | Y. 2,371 | Y. 1,785 | Y. 700 |
| Fuji Silk: | | | |
| Quantity .. .. | — | 15,498 yards | 16,055 |
| Value .. .. | — | Y.12,854 | Y.17,088 |
| Floss Silk, Mawata: | | | |
| Quantity .. .. | 6,987 pieces | 587 | 1,217 |
| Value .. .. | Y. 6,638 | Y. 327 | Y. 557 |

Exports of spun silk have greatly decreased. Exports of Fuji silk, which were not itemized in the monthly report of the Customs bureau until 1921, have increased both in quantity and value. This is a sufficient sign that Japanese export trade is showing a change from the report of raw silk to that of silk textiles.

Fuji silk is manufactured to-day not only by the Fuji Gas Spinning Co., Ltd., but by the Japan Silk Textile Co., Ltd., the Kanegafuchi Cotton Spinning Co., Ltd., and various mills in the Isezaki, Hamamatsu, Gifu and Daishoji districts, all silk weaving centres. Inactivity in the export of Habutae turned the attention of weavers to the production of Fuji silk. The monthly output of Fuji silk to-day reached 40,000 pieces, and the activity of this class of weave has stimulated the whole silk weaving industry of Japan.

In weaving Fuji silk, British No. 135 yarn is used for the warp, and No. 65 for the weft. About 400 *momme* of No. 135, and 320 *momme* of No. 65, make 50 yards, one piece of Fuji silk. At current costs, with wages at 7 to 8 yen a piece, the cost per yard works out at about Y.1.16 to Y.1.17. Current market prices are from Y.1.18 to Y.1.20 a yard, leaving from 2 to 4 sen a yard profit, about Y.1 to Y.2 per piece. This is the reason why the old producers of *habutae* and other silk textiles for export have been tempted to manufacture Fuji silk.

Before the war there were only 106,500 spindles in the silk industry in Japan; now there are 187,700 owned by 18 companies. Plans for expansion now under construction will add 96,000 spindles to present equipments, making the total 283,700 spindles. The following table showing the plans for each of these 18 companies for expansion will indicate how the silk spinning industry is keeping its place in the textile industry of Japan.

(In this table "mules" are estimated in their efficiency as "spindles.")

| Companies | Present equipment spindles. | Plans for extension spindles. | Total spindles |
|---|---|---|---|
| Kanegafuchi Boseki K. K. .. | 60,078 | — | 60,078 |
| Fuji Gas Spinning .. .. | 62,042 | 15,600 | 77,642 |
| Nihon Silk & Wool Spinning . | 20,000 | 16,460 | 36,460 |
| Nihon Silk Weaving .. .. | 7,500 | 7,500 | 15,000 |
| Nihon Silk & Cotton Weaving | 5,400 | 3,540 | 8,940 |
| Nihon Penni .. .. .. | 3,000 | 15,000 | 18,000 |
| Joshu Raw Silk .. .. | 840 | 3,600 | 4,440 |
| Taihei Cotton Spinning .. | 920 | 1,080 | 2,000 |
| Fukushima Cotton Spinning .. | — | 3,000 | 3,000 |
| Toyo Raw Silk .. .. | 2,400 | 2,016 | 4,416 |
| Katagura Gumi Raw Silk .. | 4,000 | — | 4,000 |
| Koriyama Cotton spinning .. | 5,640 | — | 5,640 |
| Shinano Raw Silk .. .. | 3,840 | — | 3,840 |
| Tokyo Mousselaine .. .. | 3,000 | 7,200 | 10,200 |
| Toyo Cotton Spinning .. | 3,600 | 16,000 | 19,600 |
| Nihon Silk Spinning .. .. | 1,500 | — | 1,500 |
| Nakatsu Raw Silk .. .. | — | 5,000 | 5,000 |
| Omi Raw Silk .. .. .. | 4,000 | — | 4,000 |
| Total .. .. .. | 187,760 | 95,996 | 283,756 |

# Railway Bearings

*By H. J. Moysey*

THE question of using ball and roller bearings in railway rolling stock is at the present time being very much discussed both in technical and commercial circles; not because their use is a new idea which has occurred to some engineer in a moment of inspiration; but because those who have been working on this proposition have, after many years of careful and exhaustive testing, at last arrived at ly reliable data to warrant the enormous outlay involved in making such a radical change in accepted design.

The ultimate object to be attained is, of course, increased economy of working, but as that involves not only the saving of power but questions of the cost of renewals and upkeep generally, it was essential to thoroughly study the question of durability before bringing the proposal forward as a practical proposition for general adoption.

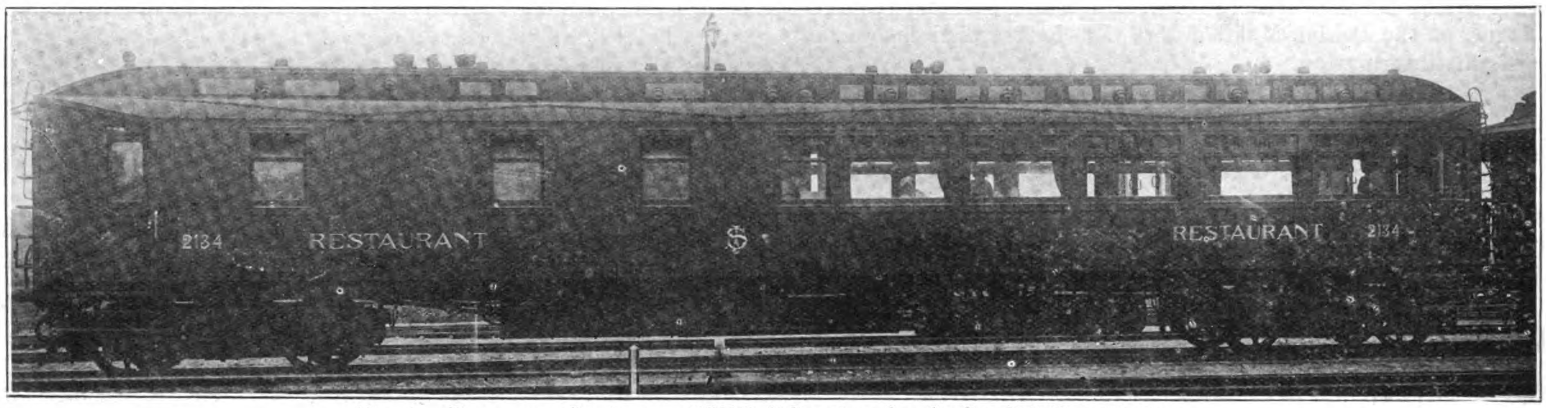



Fig. 1. Restaurant Carriage on SKF Ball Bearings for the Swedish State Railways.

results which may be fairly considered as a practical soul-tion of the many difficulties which have hitherto barred the way to the general adoption of such bearings, and it may therefore be of interest to review briefly what has been done in this direction.

The work has been carried on quietly until, now that some practical results have been obtained, a number of railways in various countries are beginning to make tests on their own lines to satisfy themselves that the results claimed can be obtained also by them; and this extended activity has attracted the atten tion, not only of engineers but also of commercial men who have taken it up as a new idea because now at last those who have been quietly testing it are sufficiently satisfied to bring it forward with confidence of success.

It is now a number of years since preliminary experiments gave sufficiently attractive results to induce a number of enterprising people to devote a lot of time and money to the carrying out of experiments on a scale that would provide sufficient-

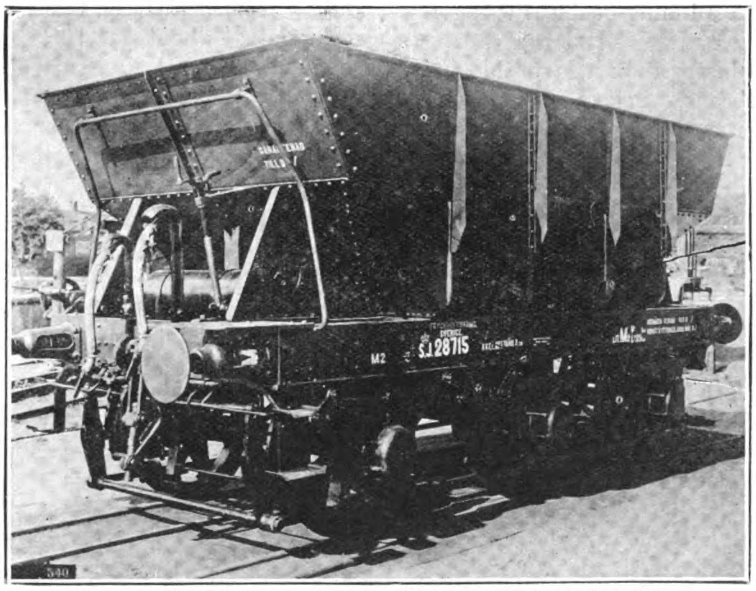



Fig. 2. Ore Wagon on SKF Ball Bearings for the Swedish State Railways.

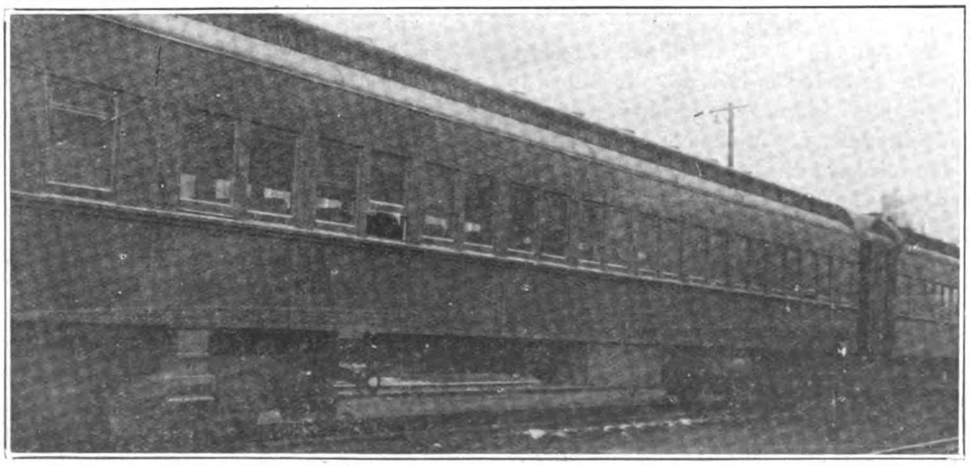


Fig. 4. Passenger Carriage on SKF Roller Bearings for an Important American Railway

It was this question of durability which has kept the matter in abeyance for so many years.

A number of more or less isolated tests were made from time to time with roller bearings with long rollers; but these gave trouble on account of the rollers tending to get out of place and nothing very practical was attained until the Swedish State Railway took the matter up in 1913 by commencing a number of tests which have been carried on ever since.

The result of these tests with ball and roller bearing has made it clear that the economy in power, lubrication, attention, etc., makes it desirable to change over to such bearings as extensively as possible; but in order to attain sufficient durability it has been necessary to depart from the original design of bearing used and adopt the later design of roller bearing which is now being extensively installed by them.

It was this characteristic of strength and durability which has been difficult to obtain in practice, and which has been reached only after long and expensive work.

In order to trace the development which has now resulted in the SKF new roller bearing construction for railway cars, a record is given below of the principal durability tests which have been carried out with SKF bearings, and which are the most extensive ones which have ever been made.

These tests were made :

In Sweden : on the State Railway and on the Bergslagernas Railways.

In Denmark : on the State Railways.

In U.S.A. : on one of the most important trunk lines.

The rolling stock involved in these tests included the following :

On the Swedish State Railways 44 axles with SKF ball bearings on 11 four-axle bogie cars (Fig. 1), during a period of seven years ; 150 axles with SKF ball bearings on 50 three-axle ore wagons (Fig. 2), during a period of five years, 33 axles with SKF roller bearings in four-axle bogie cars (Fig. 3), during one year.

On the Bergslagernas Railway 12 axles with SKF ball bearings on 3 four-axle bogie cars, during four years.

On the Danish State Railway 4 axles with SKF ball bearings on 3 two-axle passenger free-flexible-axle cars, during three years.

On an important railway in the United States, 26 axles with SKF roller bearings on four-axle bogie cars (Fig. 4), during one year.

cases only parts of bearings have been rejected the figures in the table state the values of the rejected parts as a percentage of the whole value of the total number of bearings in service on their respective sections.

REJECTED BALL BEARINGS IN RAILWAY CARS.

| Year of service | Bogie cars on Swedish State Railways. | Ore Wagons on Swedish State Railways. | Bogie cars on Bergslagernas Railways. | Free-Flexible-axled cars on Danish State Railways. |
|---|---|---|---|---|
| | % | % | % | % |
| 1st .. | 16 | 0.55 | 12 | 0 |
| 2nd .. | 18 | ,, | 1.5 | 0 |
| 3rd .. | 24 | ,, | 12 | 0 |
| 4th .. | 10 | ,, | 7 | 0 |
| 5th .. | 6 | ,, | | 6.2 |
| 6th .. | 2 | | | 0 |
| 7th .. | 10 | | | 0 |
| 8th .. | 10 | | | 0 |
| Total .. | 86 | 2.75 | 32.5 | 6.2 |
| Average .. | 12.3 | 0.55 | 8.1 | 0.8 |

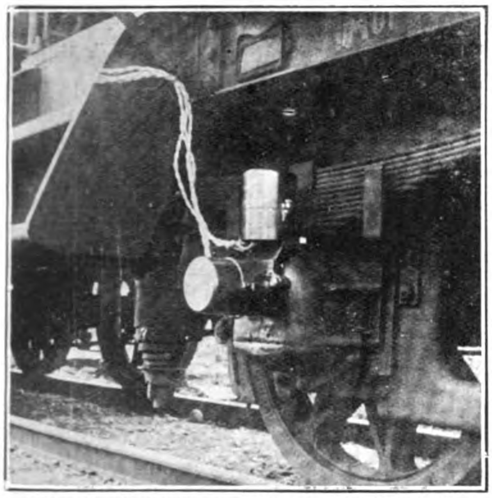


Fig. 5. **Ball Bearing Box for the Swedish State Railways, Bogie Car 1913.**

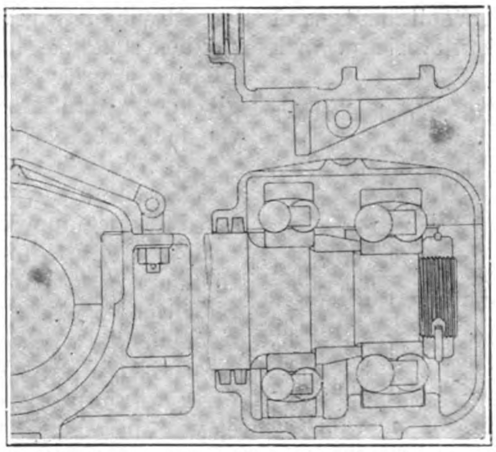


Fig. 6. **Apparatus for registering shock loads in railway boxes.**

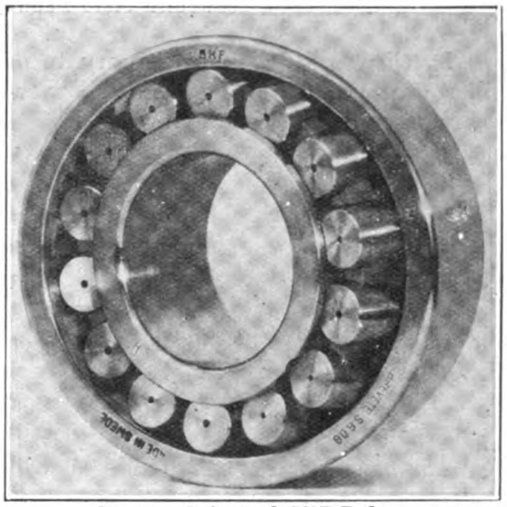


Fig. 7. Spherical SKF Roller **Bearing.**

The SKF ball bearing design which has been used for the bogie cars on the Swedish State Railways (Fig. 1), containing one spherical ball bearing, type No. 1418, and one No. 1322 in each box, (Fig. 5), was originally intended for lighter cars of this kind with a journal load of 4½ tons ; but the royal board of railway directors decided to use these bearings for sleeping cars, baggage cars and dining cars in express train service, where the journal load amounts to 5½ tons. With this increased load it was reasonable to suppose that the life of the bearings would be reduced below what it would have been had they been used for their original purposes ; but as the first tests showed good results, the greater load was considered permissable. The maximum speed at which these are run is 55 miles per hour.

In the case of the ore wagons each axle box contains one spherical ball bearing, type No. 1420, and one No. 1324, the journal load being 7½ tons and the highest speed 37 miles per hour.

The cars on the Bergslagernas Railway are equipped with the same bearings as the bogie cars on the Swedish State Railways but in this case the journal load is only abouc 4½ tons.

The free flexible-axle cars on the Danish State Railways are equipped with axle boxes each containing one spherical ball bearing, type No. 1419, and one No. 1321 and in this case the journal load is five tons.

The following table gives a comparison of the numbers of bearings, or parts of bearings, that have been rejected from service on the above-mentioned railways during these tests. As in some

The annual rejections in bogie cars shown in the above table of from 8 per cent. to 12 per cent. must be considered as unsatisfactory ; but on the other hand the results obtained in the are wagons and the cars on the Danish State Railways are rather good.

It is very important to note that none of the defects enumerated above have been of such a nature as to interfere in the least with the traffic, it having been possible in every case to run the cars on until convenient to inspect the bearings at the sheds in the ordinary way. This proves conclusively that this class of bearing is safer than the ordinary type of plain bearing, and the question resolves itself therefore into one entirely of cost of upkeep ; but as that is a point of vital importance SKF commenced an extensive investigation and experimental work in order to produce a type of bearing that would give greater durability under the conditions met with in the rapid traffic in which these bogie cars are being run.

In order to get reliable data regarding the loads arising in railway bearings under different conditions, which loads consist of static loads and shock forces in radial as well as axial direction, the shocks met with were first experimentally determined with the aid of specially constructed apparatus as shown in Fig. 6.

These measurements showed that the shocks are of such a magnitude in relation to the static journal load that they could not be satisfactorily carried by ball bearings of dimensions permitted by the limited space available in the existing railway rolling stock.

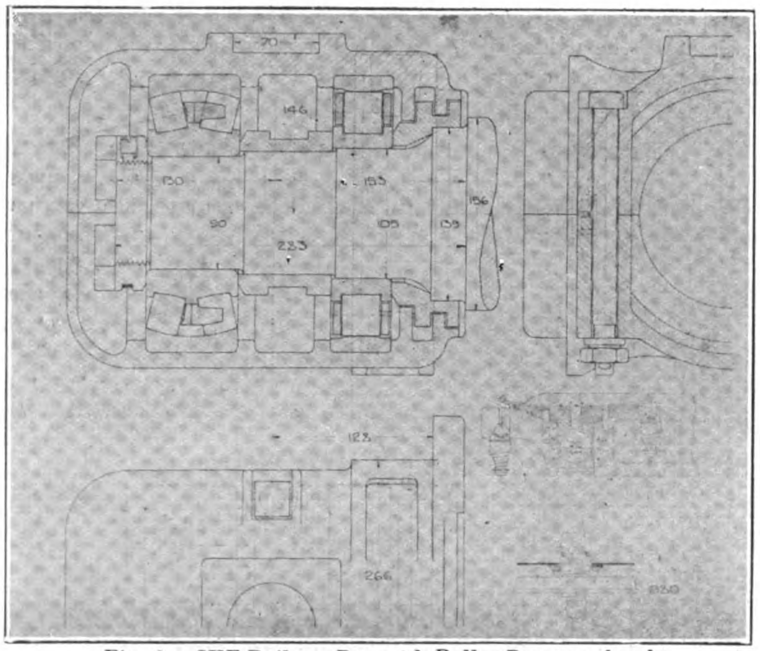


Fig. 8. SKF Railway Box with Roller Bearings for the Swedish State Railways.

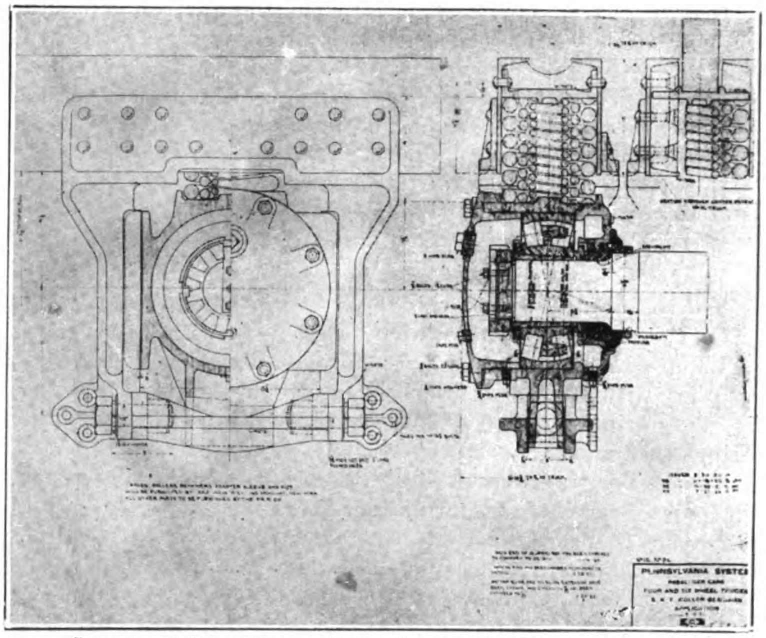


Fig. 9. Railway Box with one Spherical SKF Roller Bearing for an Important American Railroad

It, therefore, became necessary to design a suitable type of roller bearing that would combine a low co-efficient of friction with the required degree of durability.

As a result of many experiments the SKF spherical roller bearing of the type shown in Fig. 7 was adopted, it being found that these bearings possess about double the carrying capacity of a ball bearing of the same dimensions, or a life about ten times as long for the same load.

On account of the hopes thus entertained of having found a fully suitable railway bearing, the royal board of railway directors of the Swedish Government Railways decided in 1921 to equip 32 axles for bogie cars with them and carry out a new series of tests in order to determine the durability of the new bearing design.

The new design of axle box is shown in Fig. 8 from which it will be seen that each box contains one spherical roller bearing type No. 23418 and one cylindrical roller bearing No. 8321.

The cylindrical bearing takes up only radial load, whereas the spherical bearing takes the entire thrust load in addition to its share of the radial load. The tests with these axle boxes were commenced during the latter part of the year 1921 and after practically a year have only developed one small fault in one of the cylindrical bearings, representing a yearly percentage of rejection of only 0.54 per cent.

As a result of the above the Swedish State Railways have now ordered axle boxes of the above described design for 170 bogie cars, including 1,360 axle boxes with 2,720 roller bearings; which means that the greater part of the State Railway's modern cars for express train service will be equipped with these SKF roller bearings.

This, of course, means that the authorities of the Swedish State Railways consider the present design of axle box a satisfactory solution of the railway bearing question.

The tests being carried out in America have been in progress since November 1921. The cars run with a maximum speed of 74 miles per hour and an axle load of 15 tons so that this test must be considered the most severe of any hitherto carried out.

In July 1922 these cars had covered a distance of from 68,000 to 74,000 miles, and repeated inspections of the bearing had shown that they had operated in a perfectly satisfactory manner without being in any way injured. The axle boxes used by this railway are somewhat different to the ones described above and are shown in Fig. 9 from which it will be seen that each box contains only one SKF spherical roller bearing of type No. 22332 specially applied, and this bearing has to take the loads in all directions.

Having now proved in a practical manner that it is possible to produce roller bearings of a satisfactory durability and with perfect running security even for the severest traffic it will be of interest to all concerned in the economical running of railways to examine into the financial aspect of the proposition.

In considering this matter it is of course necessary to take account of all the various factors; but some of these, although of considerable importance, are not the ones which first drew attention to the possibilities of ball and roller bearings for this purpose. It is therefore natural to examine first into the results obtained in the reduction of power and starting effort, the possibilities of which originally drew the attention of designers to this subject.

It is interesting to note that these two factors, although effective in all railway work, are of different relative importance to different classes of traffic. For instance the saving of power is the more prominent factor in express passenger traffic; whereas in slow goods traffic the reduced starting effort required is of greater importance, under some circumstances, as it enables heavier trains to be hauled by a given locomotive where the weight of such trains is limited by the possible starting effort of the engine, this being particularly the case in cold climates where the starting effort of ordinary plain bearings is so very excessive before they get warmed up. Of course this question of starting effort may be of great importance in express passenger traffic also where the traffic is heavy and the length of trains is limited by it.

In estimating the amount of power that can be saved by the use of anti-friction bearings one has to first ascertain how much of the total draw-bar pull is required to overcome the friction of the bearings and how much is required to overcome the other forces which are met with, namely, the air resistance, friction between rails and wheels, curve resistance, resistance due to vibration during running, and resistance due to gradiant; for it is obvious that these resistances are quite independent of bearing friction and each differs on different tracks and with different speeds. It is therefore quite impossible at present to lay down any definite formula that would cover all these different items and become universally applicable, so that in approaching this subject with regard to any particular line one can only base one's estimate on the figures obtained by experiment on other lines on which tests have been carried out and make as accurate allowances as possible for differences of running conditions.

A considerable amount of preliminary investigation has been carried out by a number of different people to establish data on which to base calculations of individual cases and the more important of the results obtained are shown by the curves given in Figs. 10 to 13.

Fig. 1 shows the result of tests carried out in the University of Illinois, U.S.A., to ascertain how train resistance is effected by the temperature in the case of plain bearing, and it will be seen by these curves that it falls off very considerably as the bearings warm up, rising again after the first stop of 15 minutes to its original figure and again slightly after the second stop of only two minutes. These tests show that a state of permanence is attained soon after a distance of about 20 km. has been run ; so that this heating period is of comparatively little importance in long distance express service ; but becomes of some importance in local service.

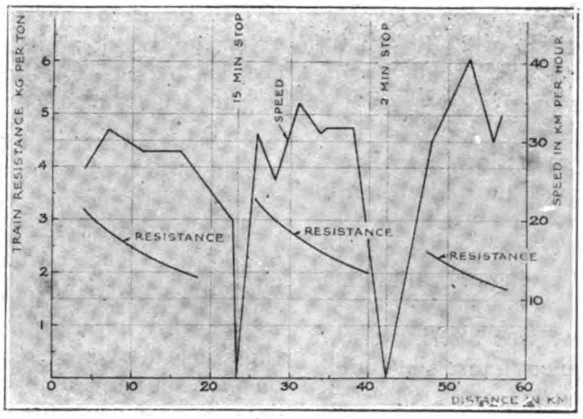



Fig. 10.

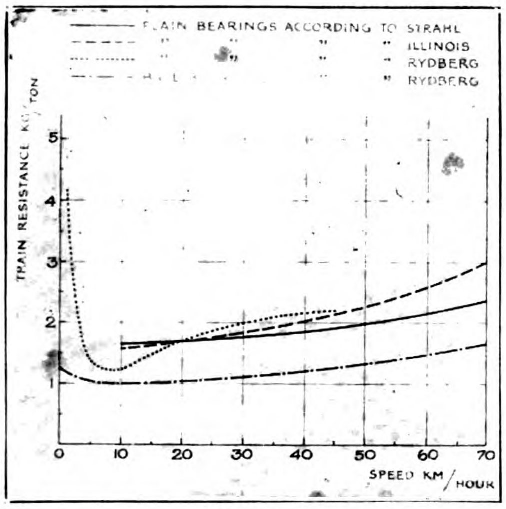



Fig. 11.

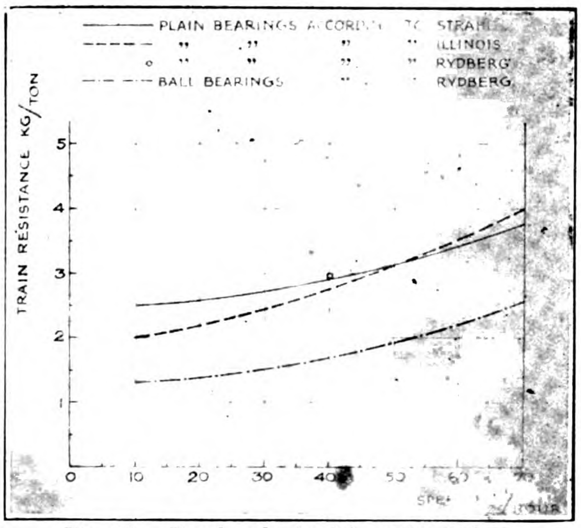



Fig. 12. Results obtained from Bogie Cars with axle loads of 10 tons.

In considering this aspect of the matter it is necessary therefore in the case of plain bearings to consider their performance during three distinct periods namely,

(1) The start
(2) The heating period
(3) The state of permanence

The resistance during starting is not dealt with in Fig. 1 but a pretty clear idea of what takes place is given in Fig. 13. Experiments carried out by Rydberg with ore waggons on the Swedish State Railway showed that the starting resistance of a three-axle loaded waggon with plain bearings weighing 46 tons was 9.5 kgs. per ton, and of a similar waggon with SKF ball bearings was only 1.35 kgs. per ton ; which is in very close agreement with the tests recently carried out in England on the Great Eastern Railway where a 27-ton bogie car on roller bearings could be set in motion by one man whereas a similar car on plain bearings required seven men.

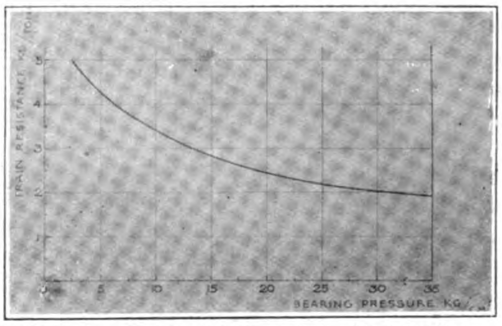



Fig. 13. Results obtained from Freight Cars with axle loads of 15 tons.

Similar tests have also been made in America where the average starting resistance for five bogie cars on plain bearings, each weighing 60 tons, was found to be 13.5 kgs. per ton, and in the case of ball bearings 2 kgs. per ton.

It has been found that this extra friction at rest in plain bearings commences immediately after the car has stopped and that, consequently, the extra starting effort required to overcome it has to be provided for no matter how long or how short a time the train has been standing.

This is of particular interest in the case of goods traffic where the length of a train is often determined by it. On the other hand the starting resistance with ball or roller bearings is practically the same as the running resistance, as will be seen by Fig. 13.

Fig. 11 shows the variation of the running resistance made up of a combination of the bearing friction and air resistance at different bearing pressures in plain bearings as given by Rydberg. Fig. 12 gives the relation between the train resistance and speed in the case of bogie passenger cars with an axle load of 10 tons, while Fig. 13 gives similar curves for freight cars with an axle load of 15 tons.

From these it will be seen that the difference in the running resistance at different speeds between plain and ball bearings is very nearly constant and may be taken as 1.1 kgs. per ton, in the case of bogie cars, and 0.6 kgs. per ton in the case of freight cars of the particular type used for the tests.

In the case of passenger traffic it is not as a rule possible to increase the length of trains and thus reduce their number on account of the service required by the public ; so that the profit derived from the reduced train resistance resulting from the use of ball bearings is due to the saving of coal and water under existing running conditions.

Practical tests of the saving of coal under normal running conditions have been carried out on the Swedish State Railways with two trains as much alike as possible, except that one was on plain bearings and the other on ball bearings. Each train consisted of one locomotive on plain bearings, weighing 107 tons, and eight bogie cars on plain or ball bearings respectively, weighing 37 tons each. The total weight of each train was therefore 403 tons. These trains were run daily during a period of ten days over a length of line of 243 km. great care being taken that the conditions of running were as near as possible the same.

The consumption of coal was measured by weighing the quantity on the tender before the start and after the finish of each trip. The maximum speed at which these trains were run was 90 km. per hour and several steep gradients had to be negotiated ; so that a considerable portion of the train resistance was due to air resistance and the gradient. In spite of these disadvantages the saving in coal worked out approximately to 10 per cent.

These same trains were also run over a length of line of 105 km. and gave a coal consumption for the double trip of 2,321 km. for the plain bearing train as against 1.989 km. for the ball bearing train ; which works out to a saving of 14 per cent. in favor of the ball bearings.

As it is reasonable to suppose that the reduction in coal consumption due to the bearing friction was the same per ton km. in both cases the difference in the percentage result must have been due to differences in coal consumption arising from other causes, and it is therefore best to consider the actual saving of coal in kms. and not as a percentage.

The saving at the above-mentioned test was 332 kms. the weight of the cars was 296 tons, and the distance run for the double journey was 210 kms. The number of ton/km. was therefore 63,000, and the saving of coal per 100 ton/km was 5.35 kgs.

It is interesting to see how these results compare with figures calculated from the curves referred to earlier, which give a reduction of resistance due to ball bearings of 1.1 kgs. per ton.

For a weight of cars of 296 tons, as above, the reduction would therefore be 296 by 1.1 or 324 kgs.

On a distance of 210 km. this represents an amount of energy of 68,000,000 kgm. or 252 h.p. hours.

As the locomotive is calculated to have a coal consumption of 1.2 kgs. per h.p. hour the reduction of friction represents a saving of 252 by 1.2 which equals 302 kgs. of coal.

As the saving of 332 kgs. was recorded in the actual tests these figures may be said to check up pretty closely and the tests confirm that the figure of 1.1 kgs. per ton, shown by the curves is a pretty safe one, so that a saving in coal of 5 kgs. per 1000 ton km. may be taken as the figure which can probably be used for most kinds of passenger traffic.

It should be observed here that the saving in coal depends on the efficiency of the locomotive and that, therefore, on tracks with steep gradients, where it is often necessary to use a later cut off in the cylinders than on level lines, with a consequent reduction in efficiency, the saving of coal per ton km. would be greater.

This point should be taken into careful consideration when estimating the possible economy on any particular line. The figure of 1.2 kgs. per h.p. hour is possibly on the low side for the conditions prevailing in the test case given above.

Turning now to the question of freight traffic, it is found that the actual saving of coal per car in a given period is less than in passenger traffic owing to the shorter distance covered, but that in addition to the saving in coal it is possible to effect a considerable economy by increasing the weight hauled by each locomotive and thus reducing the number of locomotives required to transport a certain quantity of goods, with, of course, a corresponding reduction in staff.

In order to investigate the possibilities existing in practice, extensive tests have been made on the Swedish State Railways with ore waggons hauled both by steam locomotive and by electric locomotives.

One train consisting of a steam locomotive and 30 ore waggons weighing 46 tons each on plain bearings and another train with the same kind of locomotive and 39 waggons weighing 46 tons each, on ball bearings were run ten times in each direction over a distance of 205 km. The consumption of coal and water was measured by weighing each trip.

For a trip with a loaded train in one direction and empty in the other an average coal consumption was registered for the train on plain bearings of 9.479 kgs. and a water consumption of 58.9 cubic metres, while for the train on ball bearings the coal consumption was 9.300 kgs. and the water consumption 57.8 cubic metres. It was thus possible on the line in question to increase the number of cars on each train by not less than 30 per cent. without increasing consumption of coal or using a heavier locomotive. As, moreover, the heating often met with in plain bearings during this heavy traffic is entirely absent in ball bearing waggons, it was found possible to transport the same quantity of goods with three ball bearing trains as with four plain bearing trains.

On another line with less favorable gradients and using electric locomotives, it was found possible to increase the number of cars from 30 to 35, using the same locomotive and with the same consumption of energy.

The economy to be derived from the use of ball bearings does not, however, end with the saving of power and reduction of number of locomotives as there are other items which must be taken into consideration, e.g., reduction in quantity of lubricant required, reduction in maintenance staff, freedom from dislocation of traffic due to hot bearings, etc., the last named of which may be in itself a sufficient reason to justify the change in ;the case of express passenger traffic.

Another point which is worthy of some consideration is that in large countries where rolling stock often gets away on to other lines for very long periods it is likely to get very scant attention until it returns to its own line, and the consequent wear and tear on plain bearings may be very excessive ; whereas it is scarcely likely that cars will be away on other lines for long enough periods to run them short of lubricant if fitted with ball bearings.

Taking all these results into consideration it does not seem too much to say that the problem of the application of roller bearing to railway rolling stock has now been satisfactorily solved from both an engineering and economic standpoint and that their use will become increasingly general.

# New York to Mukden!

Word comes from China, says the *New York Telegram*, that the little horse cars which used to operate on certain of the crosstown streets of New York are now giving an air of progress to the thoroughfares of Mukden.

They were first taken to Tokyo and used there. When that big town electrified its transportation system the cars went on their travels again and may end their career of usefulness in some other remote part of the interior.

It is a strange thing that these conveyances, which used to excite the derision of Westerners as an indication of what they were pleased to call " New York's backwardness," should be symbols of progress now in the dim and distant East.

Naturally, it was very irritating to have some visitor from Main street laugh and say, as he pointed at one of them jogging along, that he had never seen a horse car or a gas lamp until he crossed the Hudson River. This used to make Manhattanites glare fiercely and remark that civilization didn't depend on such things. A poor retort, but it served.

Then there was the Chicagoan who said on one occasion : " I suppose the reason they go east on Twenty-eighth street and west on Twenty-ninth street is because they are ashamed to come back the same way."

However, you never can tell. A horse car, like a man, may be down without being out.

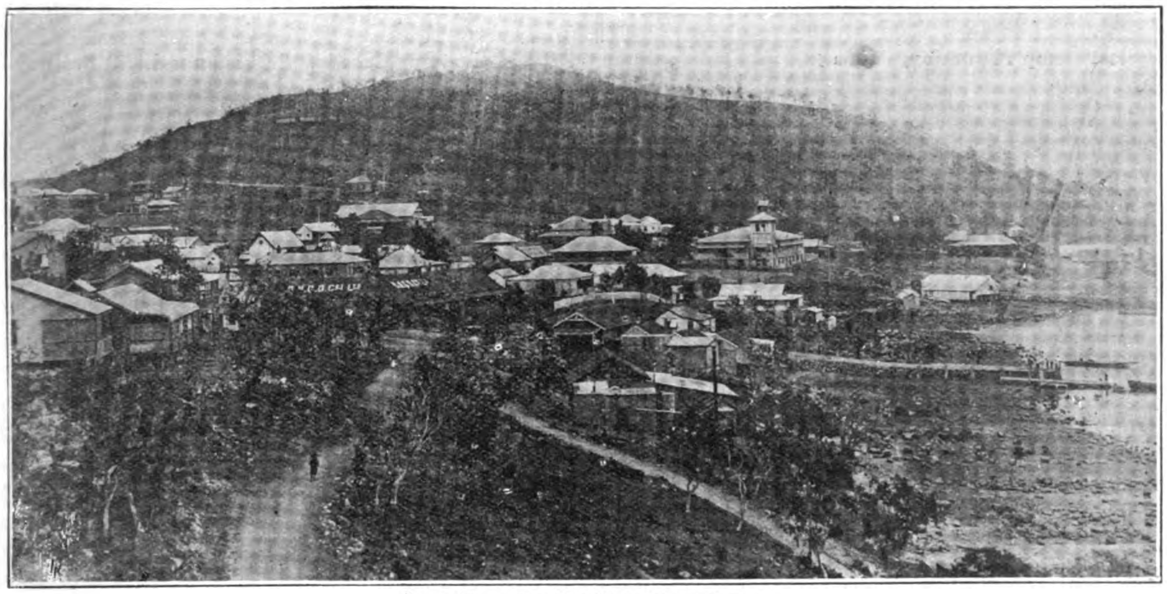
It would surprise some of the old New Yorkers if they went to Canton and took a trip out to Samshui on the railway. There would find some other old friends in the shape of old elevated railway locomotives still going strong, down but not out.

# Sisal Cultivation in Papua

*By Thos. J. McMahon, F.R.G.S.*

THERE is a world-wide demand for hemp, many tropic countries are offering supplies but by no means in the quantities required. There is a pronounced shortage with no immediate relief. This fact brings into prominence the excellent opportunities for the cultivation of hemp in the island groups of the South Pacific. Investors, having experience in the cultivation of hemp, and ready to invest are offered splendid fields in such well settled groups as Papua, German New Guinea, the Solomons, New Hebrides and Fiji.

In these islands the climatic conditions are ideal, and the rainfall just sufficient to assure plants the most vigorous growth. To prove the perfect conditions for the cultivation of sisal hemp in the South Pacific Islands, plants brought from other countries instantly improve in stamina, diseases or pests are quite unknown, and government regulations are strict to prevent the introduction of diseases or pests.


Port Moresby, the Capital of Papua

As an instance of what can be accomplished in the islands in the cultivation of sisal hemp, what is going on in Papua, that is British New Guinea, is ample evidence of the success possible. Papua is an island group of 90,000 square miles, under Australian administration. The group is famous for its grand scenery, its wonderful fertility, its varied climates, and its interesting natives numbering over 300,000. There are parts of this territory, and of great extent, peculiarly adapted to the cultivation of sisal hemp. The dry belt on the Southwest coast from Hall Sound to Port Moresby, the capital of Papua, is eminently suitable for hemp. Out back from the capital are hundreds of acres of fine cultivations, sending annually large quantities of first-class fibres to Australia, England and America. But let it be noted not one-half of the quantity that is needed or ordered. In Australia alone the merchants would like to get ten times the quantities now received.

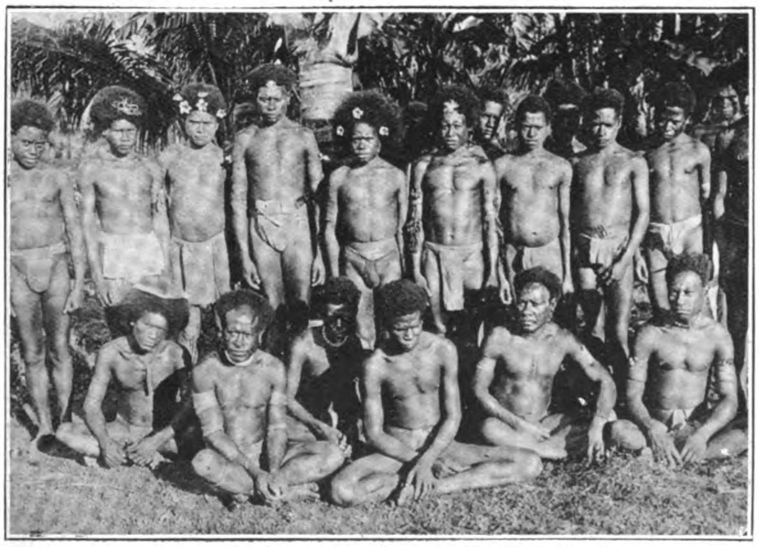
The most useful fibre known to commerce, that which comes from Florida, and the Bahamas, is the only sort cultivated in Papua. It simply luxuriates in the dry clime, the full light, and the strong sun heat. When one looks around on the brown hills and gullies, the general bareness and the poor looking soils are discouraging. Then the eye roams over the wide acres of hemp, great armies as it were of huge spiked plants that look for all the world like giant pineapples.

The rain does not fall for nine months in the year, and then in that light and limited amount essential to the perfect growth of hemp. The soil is well drained and naturally so, containing abundance of lime, one of the secrets of success in cultivating hemp.

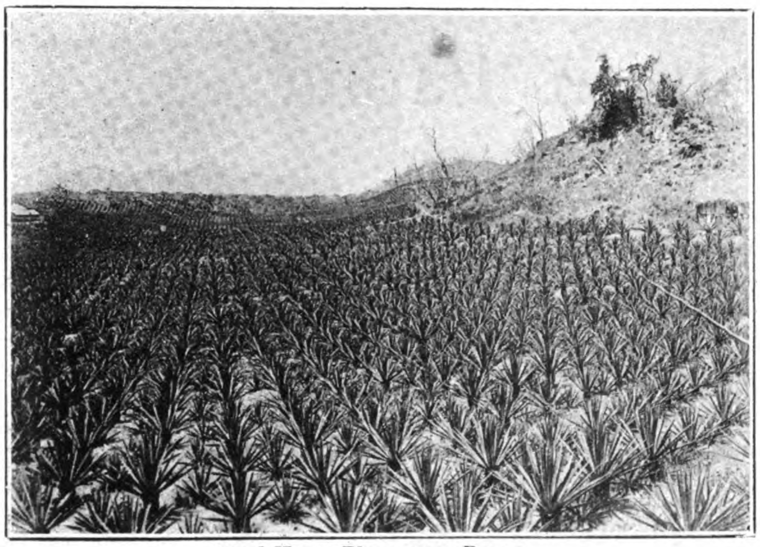
The cultivation of hemp in Papua offers inducements to men of limited capital. The outlay on clearing land, and the first cultivation is insignificant. Taking it for granted such an investor has experience in hemp, in the managing of native labor, a thousand acres should be made payable in a few years and this attained with a starting capital of £2,000 (two thousand pounds).

To describe a hemp cultivation in the region around Port Moresby will be the best way to show what is going on. Over hills and dales for what seems acres upon acres, run apparently endless rows of the stiff looking plants. In the centre of the estate is the homestead, a big village of houses and huts. The homestead is usually on a well watered river, navigable for fair sized steamers of say 200 tons, and drawing 12 to 14 feet of water.

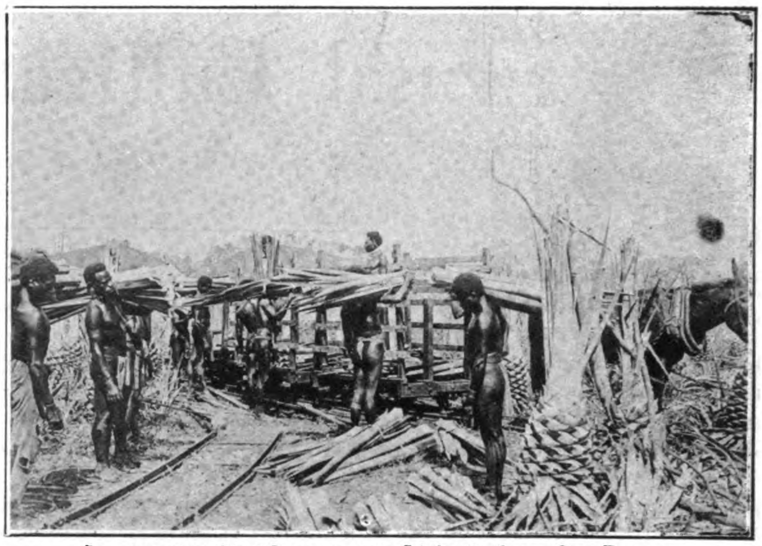
Tram line criss-cross the cultivation extending many miles and converging to the hemp mill. Under a general manager, with several assistant managers, are possibly some hundreds of boys or native labor. These are ever employed keeping the grounds clean, the grass down, poling plants, removing suckers, destroying old plants, watching for sick plants, and harvesting.


Native Workers on a Hemp Plantation, Papua

The scene about a mill is full of noise and animation. Trucks laden with bundles of hemp leaves come tearing down slight inclines, the native shunters singing and yelling, running and jumping as if it all were sport and not work, and by their eagerness and merriment telling the tale of how well they



Sisal Hemp Plantation, Papua



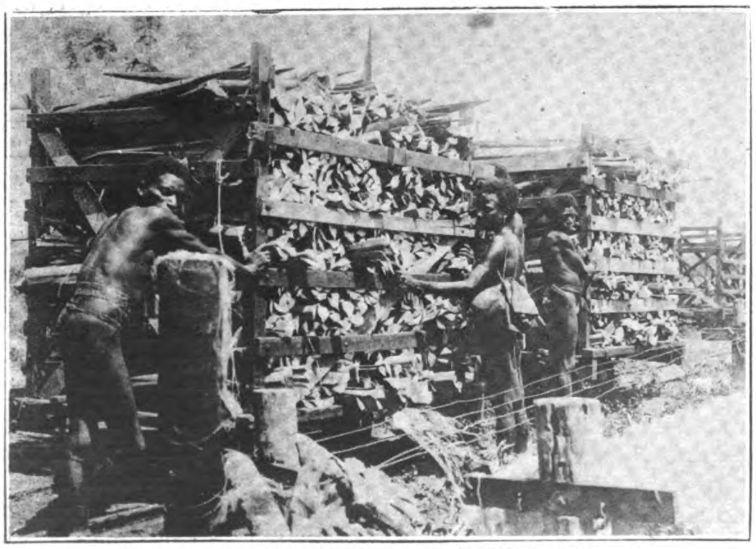
Loading Cut Sisal Leaves on to Light Railway Car, Papua

are treated. From the mill comes the crash and hum of machinery, and again the never-ending sing-song of a small army of boys as they rush here and there untying and piling the bundles of leaves before a big machine which will presently tear them to the finest of silvery threads.

Another army of boys is busy under huge loads of wet, dripping, shreded hemp, spreading it along fences to dry in the sun. More workers are gathering the glistening fibre as it dries, hurrying off to the great drying shed, where it is sorted, bagged, and baled ready for shipment. The scene is a vivid one, the black shiny skins of the workers in contrast to the silvery, silken flax.

The fibre mill machinery is interesting and with the exception of a chief a engineer, a white man and skilled man, the rest of the machinery attendants are natives. The hemp leaves are fed on to a revolving belt and carried through a long line of natives who straighten out the leaves ready to be gripped by the teeth of the crushing machine. Once within the crusher the leaves are torn or shredded, a powerful jet of water washing along the fibre, and carrying away the green pulp. The shredded fibre usually takes much washing, and is eventually thrown out of the machine when it is instantly taken up in armfuls by the workers and hurried over to the drying grounds.

A profitable sisal hemp plant must produce at least 100 leaves in its life of three years. A plant comes to maturity in about four years but its working or producing life is in Papua seldom allowed to be longer than three years. Keeping plants vigorous, those producing full long leaves is an essential to success. About 33 tons of leaves, measuring three feet in length, or 25 tons of leaves measuring four feet, are required for one ton of dry fibre. One native worker can cut and load one ton of leaves a day.



Transporting Sisal to the Shredding Mill, Papua

Native labor is cheap, the pay for a month ranging from 10 shillings for ordinary workers, to 60 shillings for competent " boss-boys " or machinery hands. Fifty good boys can plant a thousand acres in a few months, and it is estimated that one boy can take care of, and harvest, at least four to five acres a year.

Added to the wage is accommodation, food, the stated regulation hours per day, except Sundays—eight to nine—and medical attention. There is no need to exploite or overwork natives, the laws are very severe on this score. It is found that generous treatment can produce steady work with satisfactory and profitable results.

The native workers are housed with comfort, the married men have their own little huts, and the single men their long cool dormitories. All workers are fed frequently and liberally the chief items of food being rice, native fruits, and vegetable, and meat. Tobacco and biscuit are served out daily, these are free, and on some estates matches are sometimes added. Extra quantities of tobacco or matches the boys can get for small cost. On the big hemp estates boys called " gunmen " are kept constantly employed going into the jungles and shooting game, mostly pigeons, and these are given to the workers.

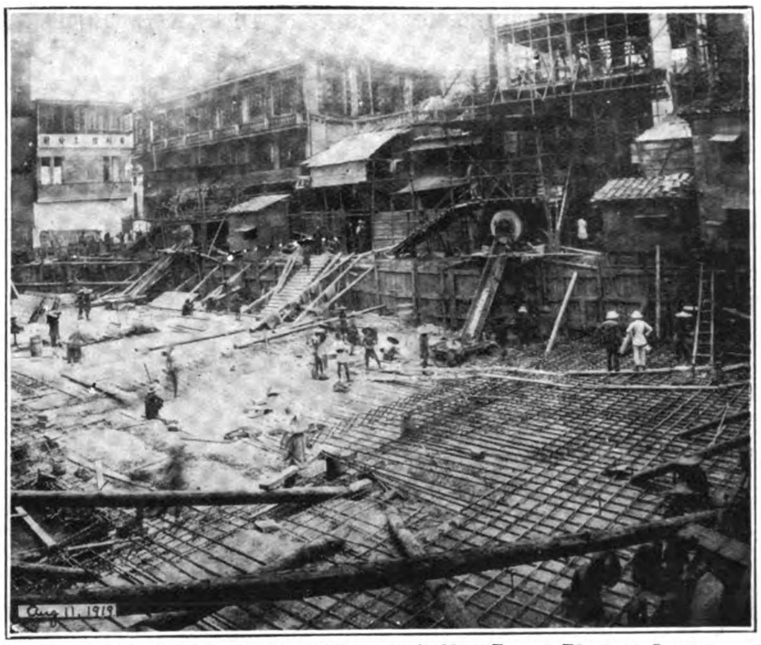
The well fed boy always looks well nourished a fact that tells in the favor of the employer when the government inspector comes round who examines the boys and questions them if they have any complaints to make. A working boy is a giant compared to the savage that roams and chases this food. The contentment of a body of native workers is manifest in their singing and dancing every night after work. As the sun goes down the beating of native drums is heard, and then with shouts of triumph and joy the singing and dancing begin. The boys would go all night but a curfew bell at nine o'clock reminds them that they must rest and be ready for the work of the morrow, and that the morrow also brings round another sing-song. From Saturday night, all night to Sunday night curfew time, there is an never ending roar of drums, and singing, and then having more time the chief dancers don the most gorgeous leaf and flower dresses.

There is not the slightest doubt within the next ten years Papua will attract much capital and a desirable and capable body of men, then the world will have little reason to complain of the shortage of hemp, for undoubtedly the cultivation of this tropic product is bound, under its perfect conditions, to spread, and thousands of acres and many mills will create a vast and splendid industry.

# Some Electrical Developments in China

## DURING 1922

WHATEVER may be said about the prospect of general industrial development in China, there can be no two opinions as to the immense possibilities for the expansion of electric light, power and traction in a country where countless cities, towns and villages await the coming of the lighting plant and the inter-urban trolley to facilitate traffic. Despite the wide spread trade depression of the past year, the development of electric light and power has increased. The use of light, heat and power is being more and more appreciated, and as a consequence, nearly all the larger plants have been compelled to increase their capacity. It is difficult to make an accurate estimate of the number and capacity of plants already in operation owing to the extreme reticence of Chinese plant owners and engineers who interpret inquisitiveness into their affairs as being in some way connected with a new schedule of taxation. The safest guide to new installations is generally the reports of the contracting and erecting engineers, but here again, it is not always possible to gather exact data because of the reluctance of giving out information that might be of service to competitors. However, we have been able to gather the following data on the principal extensions for the past year, together with some excellent photos of work in progress or installed.



Kwangtung Electric Supply Company's New Power Plant at Canton: Concrete Mat during Construction

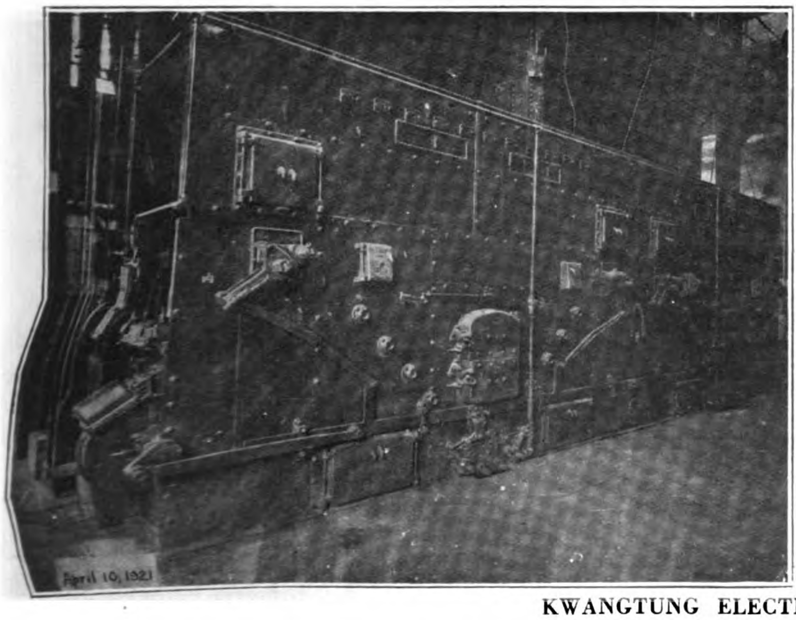
Naturally, the most spectacular showing in new work is found in the larger treaty ports such as Shanghai, Hankow, Tientsin, Canton, Foochow, Mukden, Peking and Hongkong and the Japanese South Manchuria Railway enterprises in Manchuria. These latter will be treated in a separate article in the February or March number. The new Tientsin plant was fully described in the October number of THE FAR EASTERN REVIEW.

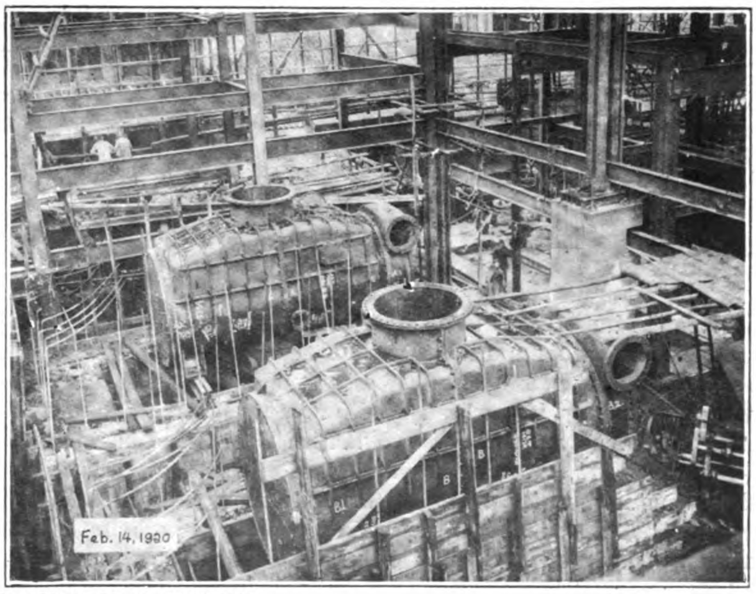
### Shanghai

Shanghai easily heads the list with 185,364,746 units sold during 1921, with a maximum demand for 41,074 kilowatts. By the end of 1921, the installed plant at the Riverside power station totalled 78,000 kilowatts, but with two additional 20,000 k.w. turbo-alternating sets and two 3,000 k.w. machines for operating the auxiliary plant in the power house, the total capacity will amount to 121,000 k.w. during 1923.

The feature of this new installation will be the two 20,000 k.w. turbo-alternating sets, one from the Metropolitan Vickers, Ltd., and the other from the C. A. Parsons & Company, Ltd. The two 3,000 house turbo-sets are also from the Metropolitan Vickers, Ltd. It is too early as yet to give the full particulars of boiler, stoker, feed pumps, coal handling, condenser, switchboard and other new plant to take care of this expansion, but we hope to do this as soon as the plant is erected and in operation. We give, however, the illustration of one of the Metropolitan Vickers 25,000 K.V.A. stators being loaded into a barge at the works for ocean shipment to Shanghai, and at the end of this article will be found a description of this set.

The Riverside power station of the Shanghai Municipal Electricity Department is not yet working under ideal conditions, and at the rate the settlement is forging ahead as an industrial centre,





KWANGTUNG ELECTRIC SUPPLY COMPANY

Andersen, Meyer & Company Installation

Murphy Automatic Stokers used with 750 H.P. Stirling Boilers

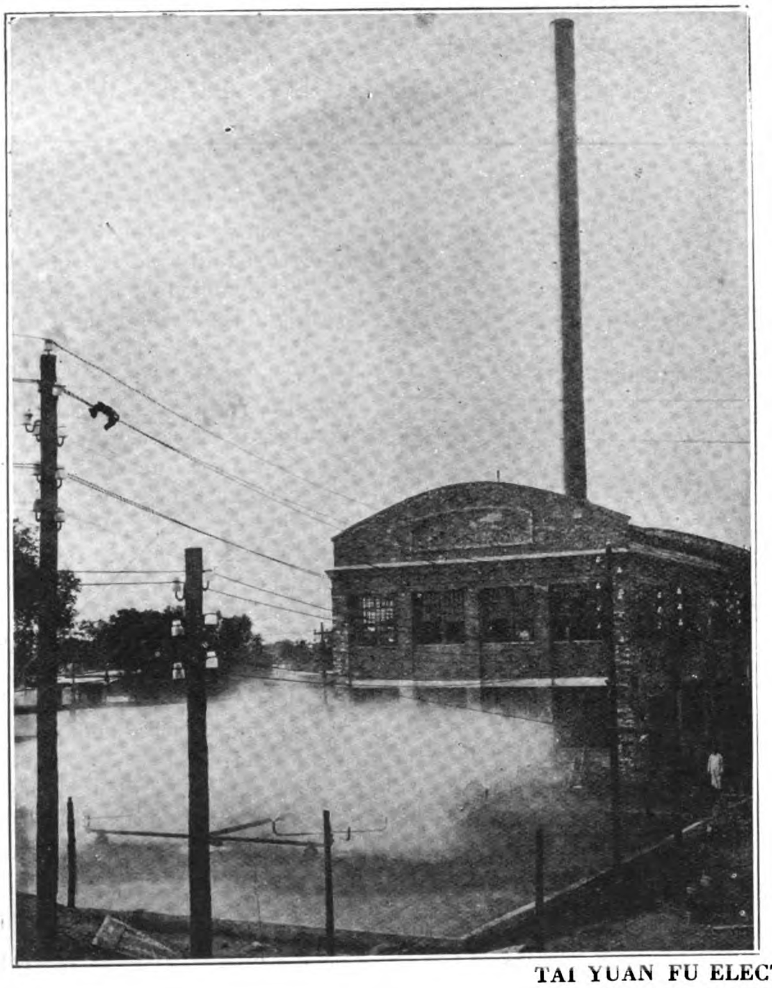
Worthington Condensers for 2—2.500 k.w. Turbines placed in position

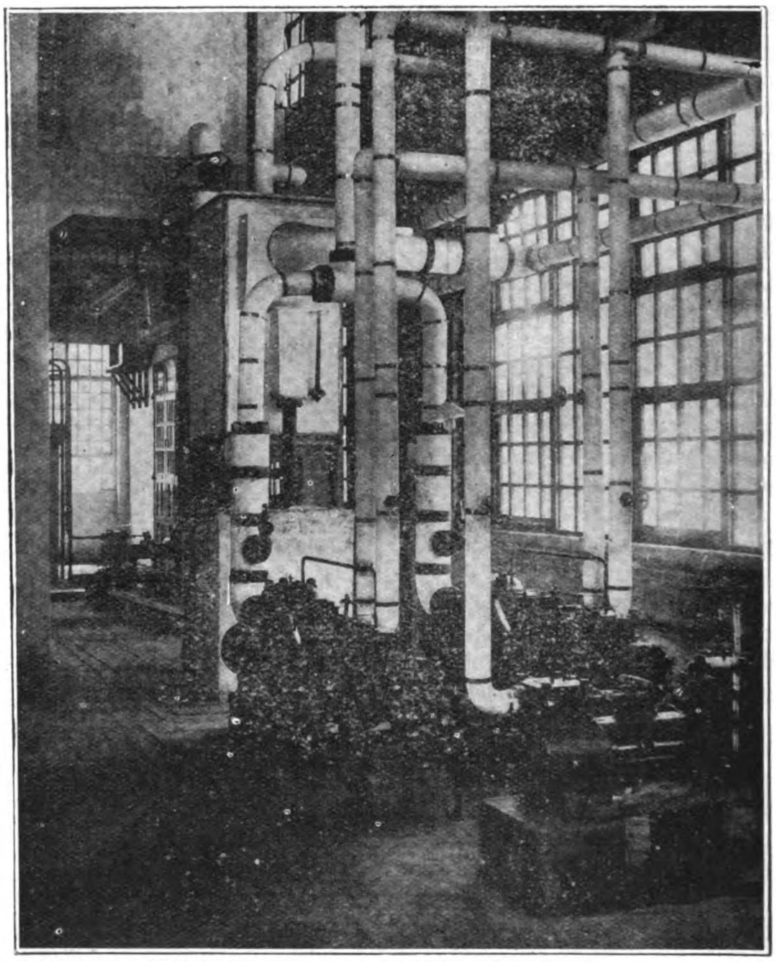
calling for the rapid expansion of the existing plant, it is quite likely that when the new equipment is in operation preparation will be under way for further extension. If the present rate of expansion is maintained, the Shanghai municipal plant will out-distance many of the larger plants in Europe and America. The following table will indicate better than anything the position of the Shanghai undertaking in comparison with others:—

| Year Ending | Undertaking | Units sold per annum | Maximum demand in K.W. | Load factor % |
|---|---|---|---|---|
| 1921 .. | Manchester | 199,618,813 | 89,500 | 25.46 |
| 1921 .. | Shanghai | 185,364,746 | 41,074 | 51.5 |
| 1921 .. | Glasgow | 154,175,830 | 76,964 | 22.87 |
| 1921 .. | Sheffield | 141,361,701 | 66,463 | 24.28 |
| 1921 .. | Birmingham | 136.921,417 | 67,100 | 23.29 |
| 1920 .. | Liverpool | 86,333,510 | 38,317 | 25.65 |

ing a vacuum of 28½-in. with cooling water drawn from the harbor. The circulating pumps are driven by standard vertical spindle motors rated at 300 b.h.p. continuously at 600 r.p.m. when supplied with three-phase current at 50 cycles, 350 volts. The extraction pumps are of the horizontal type and also motor driven. The air pumps are of the Willans Muller air ejector type, the two operating pumps being mounted on the same bed-plate as the extraction pump. Wet air filters are provided, the air ducts forming part of the turbine foundations. The clean, cooled air is drawn through the alternator by fans mounted at either end of the rotor. The voltage is controlled by automatic regulators mounted on the switchboard, erected on a gallery overlooking the generating room.

In the December, 1904, number of THE FAR EASTERN REVIEW was published a complete description of the original power plant of the Hongkong Tramway Company consisting of two units of Dick, Kerr (English Electric Co.) generators direct con-





TAI YUAN FU ELECTRIC LIGHT PLANT

Andersen, Meyer & Company Installation

Showing Cooling Pond. Note absence of smoke from stack, with boilers under full load.

Typical Piping arrangement, showing Feed Pumps, Heater Tank. etc.

## English Electric Installations
## Hongkong

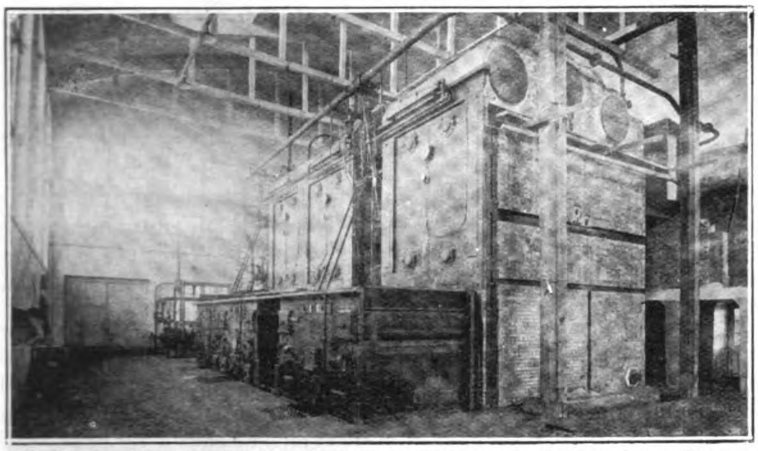
Next in importance to the 46,000 kilowatt spectacular expansion of the Shanghai municipal plant is the 15,000 K.V.A. addition to the plant of the Hongkong Electric Company, and here also the orders have been placed with a British manufacturer. The original generating plant consisted of two British Thomson Houston sets.

During 1921, orders were placed in London through the consulting engineers to the company (Messrs. Preece, Cardew & Rider) for two 7,500 K.V.A. English electric turbo-alternators of the impulse type, designed for 3 phase, 50 cycles, 6,600 volts when running at 3,000 r.p.m. The first unit was installed early in the year, as shown in the illustration, since when, the second set has been erected. The condensers are of the standard surface type capable of maintain-

nected to two 557 b.h.p. Yates and Thom condensing engines. With the new addition to the power house of the Hongkong Electric Company, the old tramway plant is being dismantled and advertised for sale. This original tramway plant ran successfully for eighteen years with only one shut-down of half an hour's duration during this period and is still in excellent condition, a rare testimonial not only to the excellence and design of the machinery but the efficiency of the operating staff.

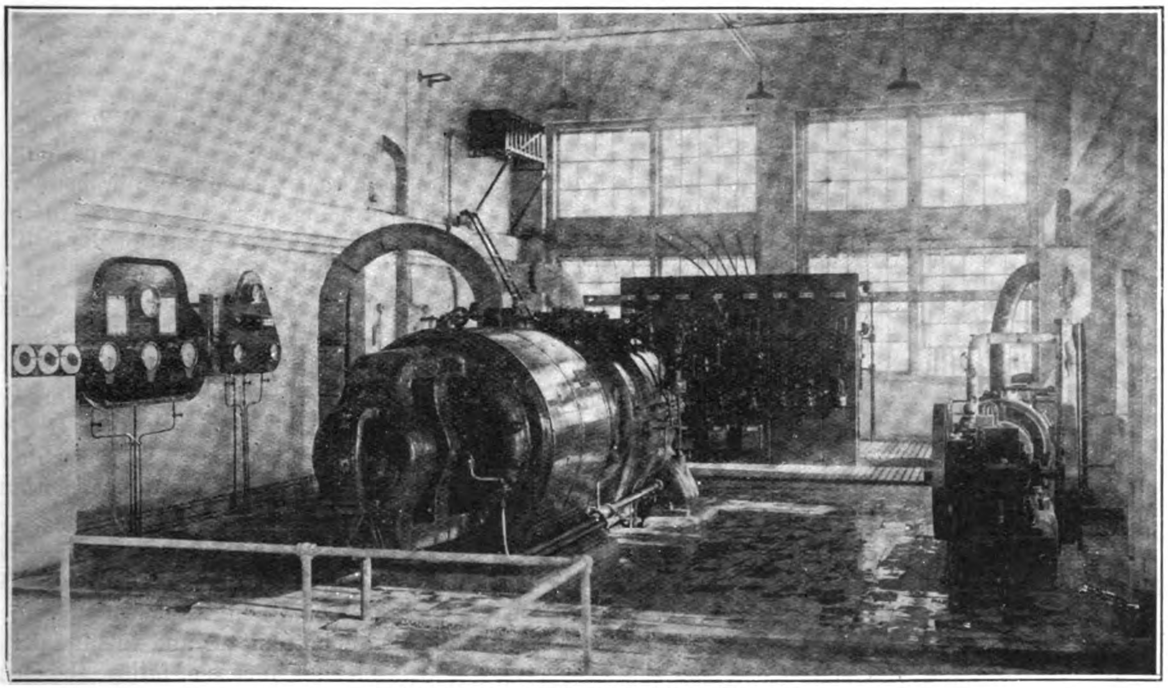
## Mill Work

In addition to the Hongkong extensions, the English Electric Company has supplied three 1,250 K.V.A. turbo-alternating sets, two to cotton mills and one a Chinese government railway department. All these sets are of the disc drum type, designed for a steam pressure of 200-lbs. per square inch, superheated 200 degrees



Heng Yuen Textile Company: 3 Stirling Boilers with Murphy Stokers.

Fahr. The condensers in each case are provided with rotary jet air extractors, the pumps for which are driven by the motor driving the condensate extraction pumps. Vertical spindle circulating pumps are provided to deal with water under wide variations of head. The sets are designed for a vacuum of 27 inches with cooling water at a temperature of 90 degrees, and the condensers give 29.5 inches with cold water.



Heng Yuen Textile Mill: Power Plant
Andersen, Meyer & Company Installation

## Traction

As regards traction work, the English Electric Company has supplied 20 sets of 40 b.h.p. motors with controllers for the new railless cars for the Shanghai Electric Construction Company operating the tramways in this port. These motors are designed for a maximum speed of 20 miles per hour when the motor car is loaded to its utmost capacity and drawing a trailer car also fully loaded. These motors are wound for 500-550 volts.

Considerable new equipment was also supplied to the Hongkong Tramway Company, largely of the two motor type consisting of standard ventilated tramway motors with "D. K." controllers. These ventilated motors seem specially adapted for working in the hot and humid climate of Hongkong under severe conditions as to traffic and loading.

## Peking

In Peking, the French associates of the English Electric Company (Les Constructions Electriques de France) secured the contract for the supply of the rolling stock for the new tramways through the Anglo-French-China Corporation. This equipment is also of the two motor type, with series parallel controllers and the trucks are of metre gauge. Three important contracts for industrial motors were completed. Acting as sub-contractors to the turbine-builders (Belliss & Morcom, Ltd.) the English Electric Company also supplied the Peking Chinese Electric-Light & Power Company, with a 2,500 k.w. turbo-alternator with dry air filter, motor-driven pumps and high-tension transformers.

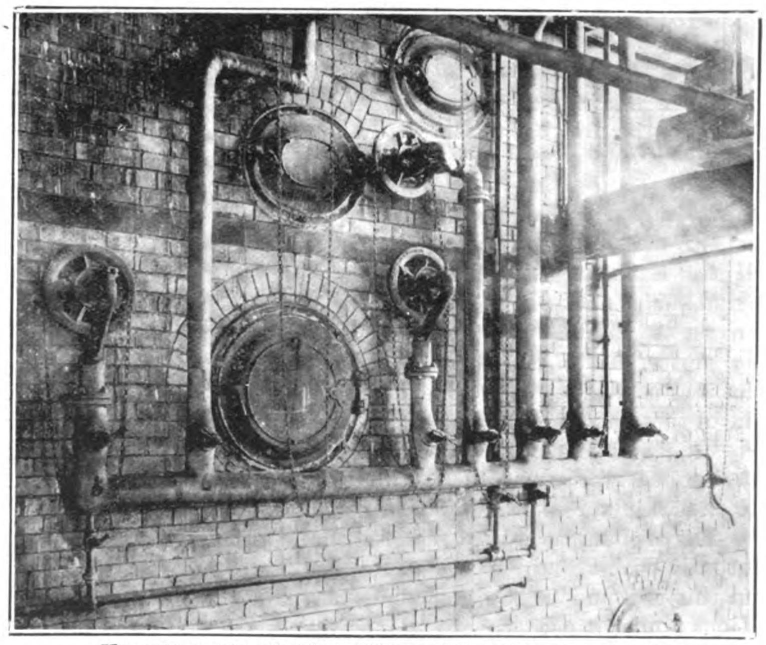
## International General Electric Additions

The most active in advancing the sale of American electrical machinery in China during the past year has been the firm of Andersen, Meyer & Company, acting as the representatives of the International General Electric Company. In fact, this firm has taken the lead for several years in purely Chinese electrical installations, and during the past year obtained contracts for the extension of several power stations in order to take care of the increased demand. The most important of these extensions is the plant at Canton.

## Canton

The demand on the system of The Kwangtung Electric Supply Company has grown so rapidly, it became necessary to refuse requests for power because the load would have been such that no proper reserve would be available in case of breakdown or equipment being out of service for necessary overhauling or repairs.

The present boiler room equipment consists of four Babcock and Wilcox Stirling water-tube boilers, each having approximately 7,500 sq. ft. of heating surface, constructed for a continuous working pressure of 225-lbs.

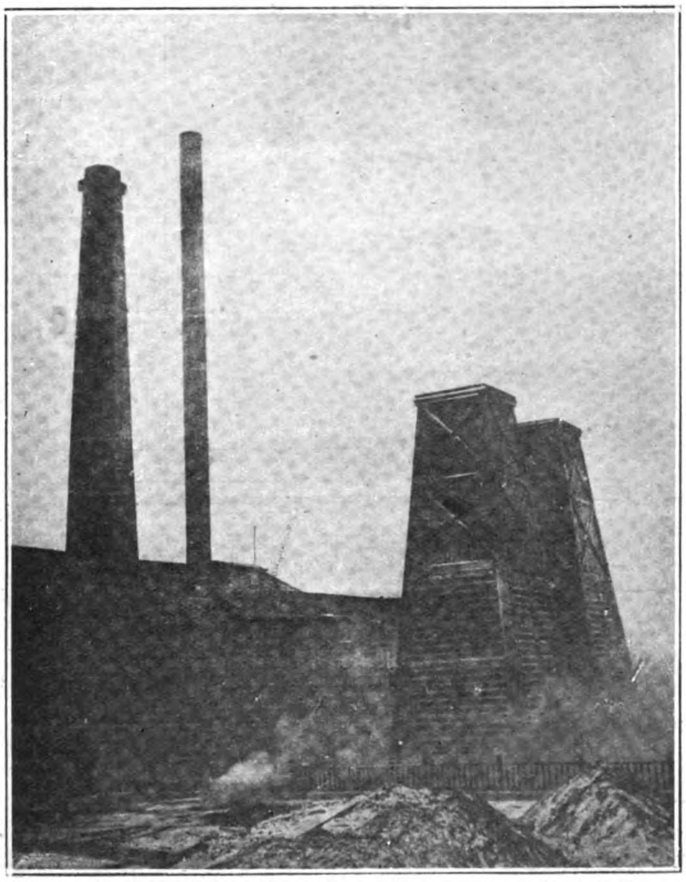


Heng Yuen Textile Mill: Diamond Soot Blowers attached to Stirling Boilers

per square inch, and fitted with Babcock & Wilcox integral superheaters, capable of imparting a superheat of 150° to the steam when the boilers are operated at normal rating. These boilers are equipped with Murphy automatic stokers of suitable size so that the boilers may be operated at a rating or approximately 160 per cent. of normal rating. Green economizers are installed, as is also Green induced draught fan equipment. The boiler equipment is arranged in two batteries, of two boilers each, which face one another across a firing aisle, and one economizer is mounted above each battery of boilers, together with its induced draught fan—one unit, therefore, consisting of two boilers, one economizer and one fan.

The boilers are fed by means of Worthington centrifugal turbine driven boiler feed pumps, water being taken from the hot well to a Harrison Safety Boiler Works' open type metering feed water heater, and from there to the feed pump suction. The feed pumps deliver the water to the economizers, and thence into the boilers.

The generating equipment consists of two International General Electric Co.'s turbo-generators, each rated at 3,125 k.v.a.



Kirin Electric Light Plant: Note absence of Smoke; Boilers under Full Load. Andersen, Meyer & Company Installation

3 phase, 60 cycles, 2,300 volts, 3,600 r.p.m., constructed for a steam pressure of 210-lbs., with a superheat of 140° and a vacuum of 28½-in. Each of these turbo-generators is superimposed on a Worthington surface condenser of appropriate size, which condenses the exhaust steam and from which two Worthington hot well pumps—one motor driven and one turbine driven—withdraw the condensate and deliver it to the hot well tank previously mentioned. One of these hot well pumps, of course, is normally in reserve ; and it is usual to operate the turbine driven pump in order to obtain a maximum temperature of feed water in the heater and also to allow of the maximum output of the turbo-generator.

The air pumps for the condensers are of the well-known Worthington R.D.V. type. One air washer is used for the two generators, and this is found to be a very suitable arrangement. Local conditions render it necessary to adopt this procedure.

The switchboard consists of the International General Electric Co.'s benchboard type for the control of each of the above-mentioned turbines, and also the motor-driven exciters which are provided as reserve, and further a number of outgoing feeders. The main switches for these circuits are located in concrete cells on the floor below the switchboard and are electrically operated. The direct current side of the spare exciters is controlled by a vertical board separate from the benchboard.

In addition to the above-mentioned electrical equipment the station is equipped with voltage regulators for the outgoing feeders in order to maintain the voltage on these feeders at a constant value, thereby increasing the length of life of all connected apparatus and also the necessary lightning arresters, choke coils, etc.

As stated above, it has recently become necessary to increase the capacity of this station, and a contract has been closed for an extension, consisting of two boilers duplicates of those at present existing, to be set singly on opposite sides of the firing aisle, each having an economizer approximately half the size of each of the existing economizers set above it. The boilers will be operated by compartment type stokers in order to burn successfully an anthracite coal. All of this boiler room equipment is of Babcock & Wilcox Co.'s manufacture.

Each boiler unit will be provided with a forced draught turbine-driven fan and an induced draft motor-driven fan in order to allow of the boilers being brought up to a high rating at very short notice. This is necessary on account of the exceedingly steep load curve which applies to this station at certain periods of the day. It is interesting to note that the boiler equipment is capable for short periods of time of being operated at a maximum of about 300 per cent. of normal rating. The fans are of the well-known Green Fuel Economizer Co.'s manufacture.

The International General Electric Co.'s turbine being supplied under this contract is 6,250-KVA, 3 phase, 60 cycles, 2,300 volts, separately excited, and is suitable for the same steam conditions as the existing machines. It is in the same manner mounted over a Worthington condenser, which is equipped with two Worthington hot well pumps, one motor and one turbine driven, and two air ejectors, with inter-coolers, for the extraction of gasses from the condenser.

In regard to the pump house : there will be installed, when the present extension is completed, three 20-in. Worthington centrifugal pumps, two of which are motor driven, and the one now to be installed being both motor and turbine driven, with suitable arrangements, such that in case of failure the current on the motor for any reason the load will automatically be taken up by the steam turbine. An air washer having a capacity of 19,000 cu. ft. of air per minute, is also provided.

With regard to switchboard-equipment : exciter panels of the benchboard type are being provided to control the generator and numerous feeders, among which are included four underground feeders. A spare exciter, driven by a 2,300 volt electric motor, is also provided, of sufficient capacity to give the necessary exciting current for all three machines when operating at the same time.

It is expected that this equipment, when installed and in running order, will take care of the then existing load and allow of one of the smaller machines as spare. It is contemplated to put this machine into operation about the 1st of January, 1924.

## Tientsin

Another contract for extension which has been placed this year is that of the Pei Yang Cotton Mill in Tientsin. This plant originally consisted of one 800-k.w., 3 phase, 60 cycles, 600 volt turbine to deliver power to the cotton mill.

The boiler room equipment consisted of two Babcock & Wilcox longitudinal drum boilers, each having 4,020 sq. ft. of heating surface and being equipped with integral superheaters. The boiler equipment delivers steam at 225-lbs. per square inch, with 2,000 superheat. The boilers are also equipped with Babcock & Wilcox stokers, complete with necessary engine and shafting for drive.

Installed in this station is a Green fuel economizer, it being found very desirable in cotton mill power plants to install economizers by virtue of the high load factor under which these plants operate.

The condensing equipment consists of a Worthington surface condenser, having 3,500 sq. ft. of cooling surface and two 12-in. circulating pumps, one motor driven and one turbine driven. These pumps are located in a pump house on the river bank, which is some 3/400 feet away from the power station. One motor-driven and one turbine-driven hot well pump is provided, one of these pumps being normally in reserve; and the air extraction is carried out by means of a R.D.V. pump. All of this condensing equipment is of Worthington Pump & Machinery Corporation manufacture.

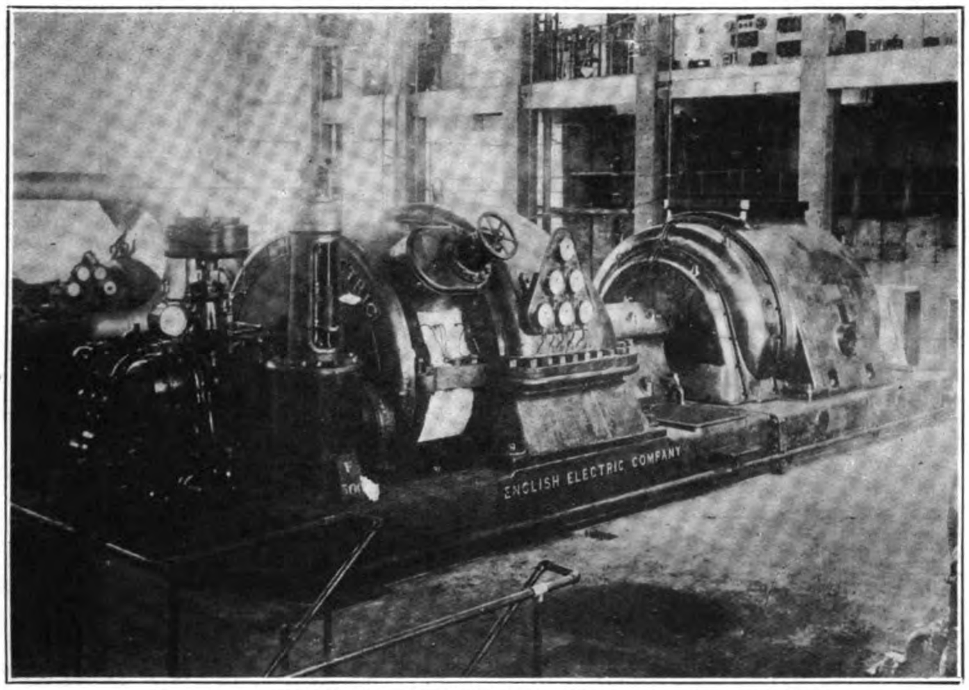
This station is complete with an open type feed water heater, an induced draught fan, feed pumps, feed water regulators and feed pump governors, and it is also complete with Diamond soot blowers with each of the boilers, which enable the soot and dirt to be removed from the external heating surface of the boiler without interfering with their operation.

## Kirin

The Kirin Electric Light Co., who as recently as 1920/1 put into service a 500-k w. extension to their existing engine—this extension being supplied by Andersen, Meyer & Co., and consisting of an International General Electric Co.'s turbo-generator, complete with Worthington condensing equipment and also a Babcock & Wilcox Stirling boiler, together with Babcock & Wilcox superheater, fired by means of a Murphy automatic stoker — this year entered into a further contract for a further extension of 500-k.w., consisting of practically duplicate equipment of that in existence at the present time.

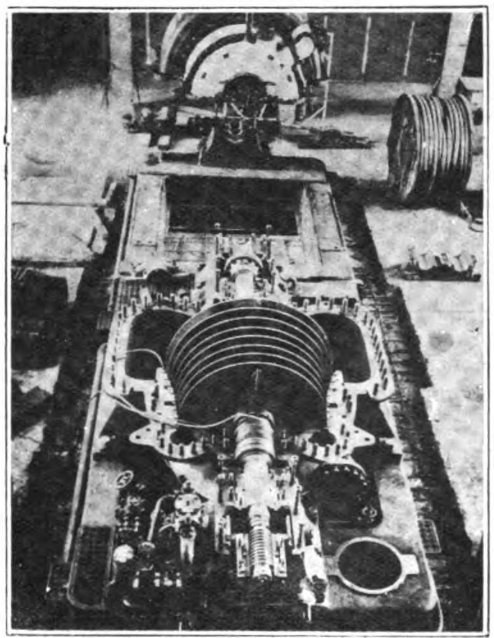
It will be noticed from the illustration the excellent combustion properties of the furnace equipment, as evidenced by the absence of smoke from the stacks, even though the boilers at the time the picture was taken were operating at full load.

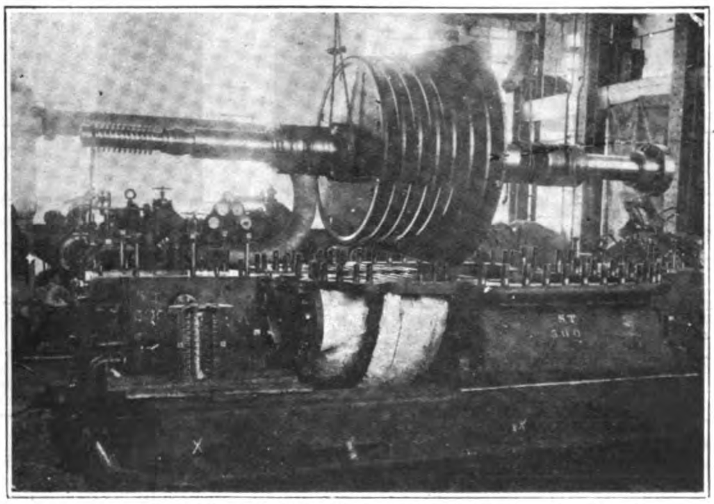
The same picture shows the two cooling towers used in conjunction with the condensing equipment, and it is interesting to know that during the winter months it becomes impossible to use the cooling towers as the water in descending from the top of the tower to the bottom is turned into ice. The water is during some of the winter months simply circulated through the cooling pond and back into the condensers again.





One of two 7.500 K.V.A. English Turbo-Alternating Sets supplied to the Hongkong Electric Company.





Views of 7,500 K.V.A. English Electric Turbine for the Hongkong Electric Company during Erection

## Foochow

The Foochow Electric Light Company have for some little time now had difficulty in meeting the demand for load, and a contract has recently been concluded for supply of the necessary material for a 1,000 k.w. extension to their existing station.

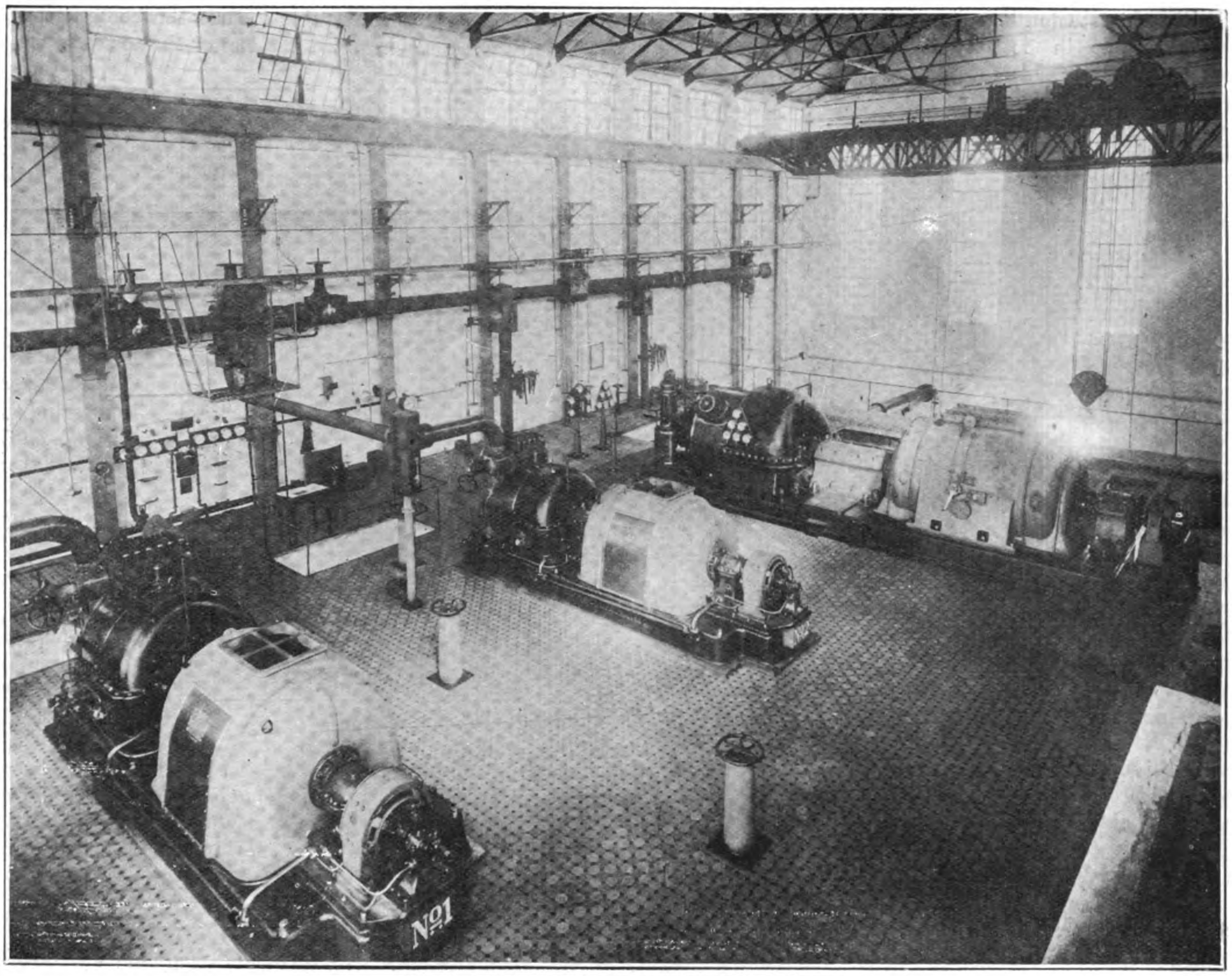
The equipment in the present plant consists of one500-k.w. and one 1,000-k.w. International General Electric Co.'s turbo-generator, complete with Worthington surface condensing equipment, together with necessary circulating pumps, hot well pumps and Edwards air pumps.

The boiler equipment consists of two Babcock & Wilcox W.I.F. type boilers of 1,218 sq. ft. each and two of 2,531 sq. ft. each, each of these boilers being equipped with a Babcock & Wilcox enclosed chain grate stoker.

This equipment has proved exceedingly satisfactory for the service it has been used for in the past, but recently it has become necessary for the Foochow Electric Light Co. to use an anthracite coal, and for this reason they have added forced draught under boilers. It speaks highly for the versatility of the chain grate stoker that they have been successful in burning this coal up to the normal rating of the boiler. It has been impossible, however, to obtain any overload capacity from the boilers with this coal.

The extension to this plant consists of the two more Babcock & Wilcox W.I.F. type boilers of 2,531 sq. ft. each, complete with special forced draught stokers manufactured by the Illinois Stoker Co. of America. The stokers introduce a more or less new principle in burning hard coal, and have been thoroughly tried out in other parts of the world, and there is a considerable boiler plant using these stokers now in operation in Manila, P.I.

In addition to this boiler equipment the extension will include an International General Electric Co.'s turbo-generator of



**Hongkong Electric Company: Generating Room**
**(Jardine, Matheson & Co., Ltd. English Electric Company Installation)**
Showing the two original British Thomson-Houston 1,000 k.w. sets, and the first of the 7,500 k.v.a. English Electric Sets. A second 7,500 k.v.a. set has since been installed in the space to the rear of the first set.

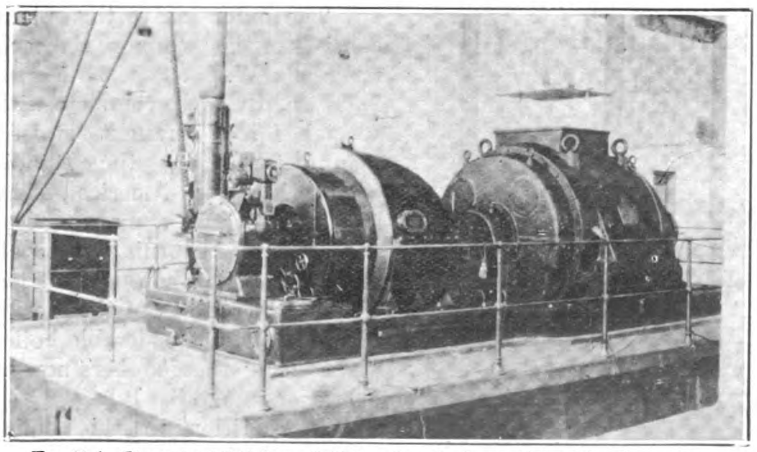
1,000-k.w. capacity, together with necessary controlling switchboard, also, a Worthington surface condenser, complete with hot well pumps, R.D.V. pump and a circulating pump, which will take care of 2,000-k.w. capacity by itself. This latter pump in connection with the pumps already in existence in this station will afford a very flexible circulating water system, which under all conditions of load on the station will be operating at the maximum possible efficiency of pump and motor or turbine drive.

The steam conditions for the boilers at this plant are 160-lbs., and the Babcock & Wilcox superheaters are such as to give a superheat of 120° capacity or more.

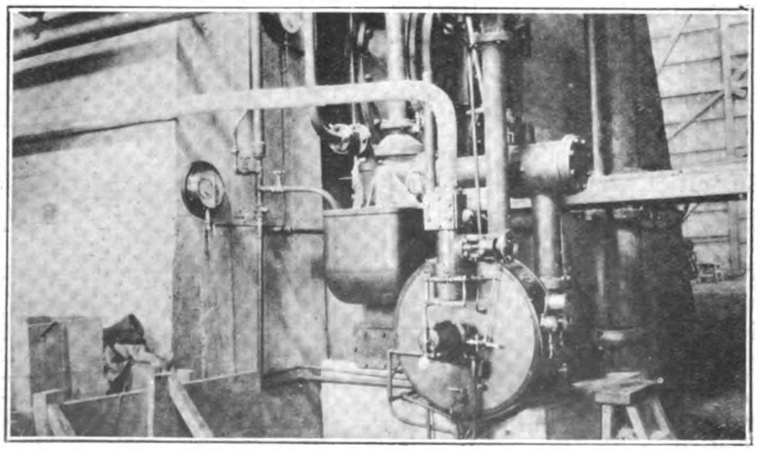
## Mukden

Mukden Government Electric Light Works was in the market for extension this year and purchased a complete 3,125 KVA. extension to their present plant. The new equipment consists of one 3,125 K.V.A. International General Electric Co.'s turbo-generator, complete switchboard equipment of International General Electric Co. manufacture.

Two Babcock & Wilcox W.I.F. type water-tube boilers, with superheaters and chain grate stokers, each boiler having 6,182 sq. ft. heating surface of 175-lbs. working pressure per square inch and



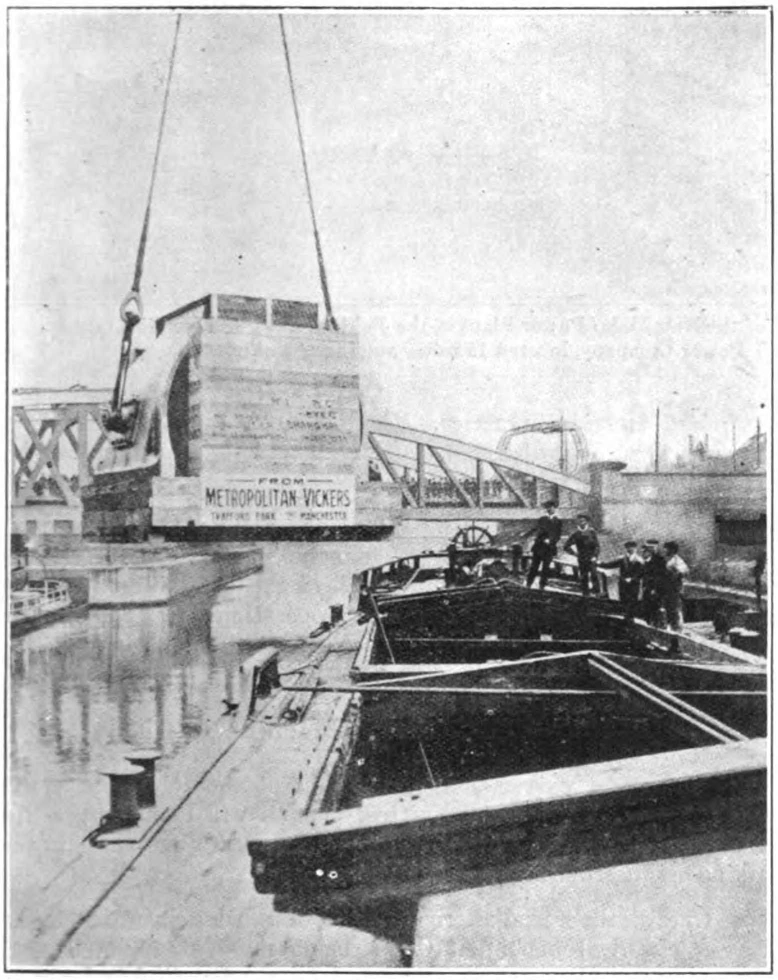
**English Electric 2,500 k.w. 5,250 volts, 3 phase, 50 cycle, Generator, driven by a Belliss and Morcom Turbine installed at the Mahu Station of the Peking Chinese Electric Light & Power Co.**



**Bellis and Morcom Condenser at the Mahu Power Station**

120° F. superheat. This boiler is equipped with Diamond mechanical soot blowers.

The condensing plant, consisting of surface condenser Worthington Simpson Edwards type wet air pumps, and centrifugal




**Stator of 25,000 k.v.a. Turbo-Alternator for Shanghai being loaded into a barge at Manchester Docks, Trafford Swing Bridge—the heaviest lift ever taken here**

**(Arnhold Brothers "Metrovick" Installation)**

circulating are all of Worthington manufacture, as well as the hot valve type boiler feed pumps, tank pump and 2,500 h.p. boiler feed water heater.

The air supplied to the generator is cooled and purified by a Carrier Co.'s air washer and motor control is adopted for the exhaust line connection between the turbine and the surface condenser, and a cooling pond will be constructed to cool the circulating water from the condenser: this pond is equipped with Schutte & Koerting Spray nozzles.

A 25-ton overhead traveling crane is supplied for the turbine room.

The present equipment of this power plant consists of an 1,875 K.V.A. International General Electric Co.'s turbo-generator with complete switchboard, one Babcock & Wilcox W.I.F. type boiler of 4,020 sq. ft. h.s., 175-lbs. working pressure and 120° F. superheat, equipped with superheater, Babcock & Wilcox chain grate stoker and Diamond soot blowers.

The condensing plant and pumps are all of Worthington manufacture and the type of the pumps are the same as described above.

The 1,875 K.V.A. installation was supplied in 1920, and before this time the plant was operated by three Babcock & Wilcox W.I.F. boilers each of 2,823 sq. ft. h.s., 175-lbs., each equipped with superheater 1,200 and Babcock & Wilcox chain grate stokers. The Diamond soot blowers for these boilers were ordered this year. The generating units were one 500-k.w., one 350-k.w., one 160-k.w. International General Electric Co.'s turbo-sets and one 120 K.V.A. Fairbanks-Morse & Co. direct connected oil engine set.

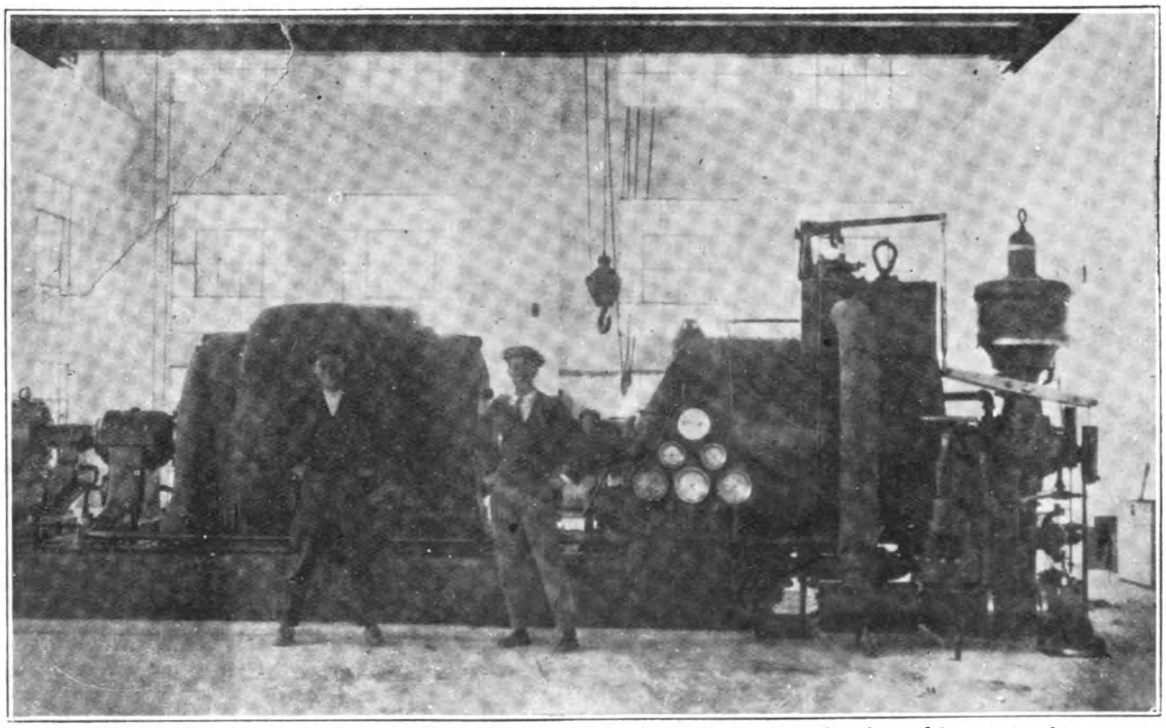
During the year just closing numerous installations have been completed by Andersen, Meyer & Co., in China and some representative pictures are included with this article to illustrate in some degree the magnitude of this work.

## Westinghouse Installations in China, 1922

Although comparatively new in the Chinese field with its own organization, the Westinghouse Company has made decided progress, and if installations in Manchuria are added to its credit, it has held its own in the face of keen competition.

One of the most notable power installations completed during the year is that at the Han Yeh Ping & Coal Company's Hanyang plant at Hankow. This comprises a 2,000 k.w. turbo-generator wound for 5,250 volts, 3 phase, 50 cycles and is complete with a direct connected exciter, necessary switching equipment and surface condenser. The switching equipment furnished is rather elaborate as it not only controls the main generating station but also distributes power to three other stations as well as to the distributing house near the wharves, in all of which is installed switchgear applicable for the apparatus operated there. At this plant there are also a number of rotary converters for the changing of alternating current to direct current, thus furnishing necessary power for the direct current mill motors, crane and industrial motors, the latter being of the famous rolled steel frame design.

Across the river from Hankow at Wuchang the Hankow Dee Yee Cotton Spinning Company have this year completed the erection of Westinghouse 1,875 k.w. turbo-generator which has the following characteristics: 3 phase, 400 volts, 50 cycles. This

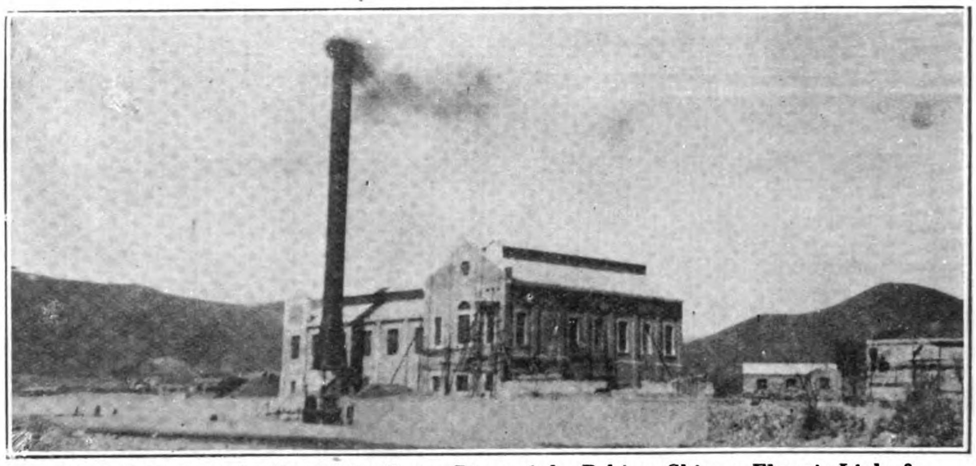


**1,000 k.w. Westinghouse Turbo-Alternating Set, 600 volts, 3 phase, 60 cycles, furnishing power for the Dah Shing Cotton Spinning and Weaving Mill at Shihkiachwang, Chihli Province**

**(Westinghouse International Installation)**

machine has the necessary direct connected exciter and is a duplicate of one previously installed in the same mill. The usual accessories comprising switchboard and condenser have also been installed. The latter is one of the few applications of the jet condenser in China. The addition of this machine, which doubles the capacity of the power plant, enables this mill to furnish power for all the spinning and weaving operations.

At Tientsin, the Yu Ta Spinning Company placed in operation two 750 k.w. Westinghouse turbo-generator units to furnish power for their cotton spinning and weaving factories. These machines are complete with the necessary surface condensers and switchboards, the current being generated at 600 volts, 3 phase, 50 cycles. All the mill machinery is direct driven by individual motors of these characteristics.



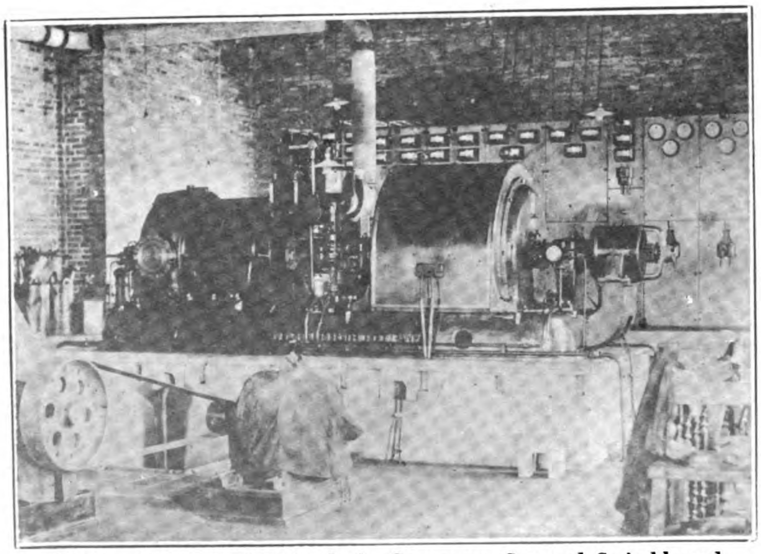
**General View of the New Mahu Power Plant of the Peking Chinese Electric Light & Power Company, located 15 miles outside of Peking**

One of the quickest pieces of installation work was done at Hangchow, where the Dah Yoh Lee Electric Light Company installed an 800 k.w. turbine in less than two months and had it operating in time to supply the extra power required for lighting the town during the Chinese new year last February. This set was constructed for 5,250 volts, 3 phase, 50 cycles and, as in the other installations mentioned above, the usual accessories were furnished including in this case in addition to condenser and switchboards, the necessary distribution transformers and control panels since this is a high voltage installation.

The Chee Hsin Cement Company purchased and installed at Tongshan a 1,400 K.V.A. turbo-generator set to supply power for the motors and lighting at their cement works. This is one of the few 25-cycle plants in China, the characteristics being 2,200 volts, 3 phase, 25 cycles. The usual exciter, switchboard and condenser were also furnished.

The most recent installation is that at the Dah Shing Cotton Spinning & Weaving Company's mill at Shih Kia Chwang at Chihli. This plant was erected and placed in operation ten months and ten days after the order was entered and this in spite of one month's delay on account of the Chihli-Fengtien war. The turbo-generator was started on September 18 and since that time has been in continuous operation, furnishing power for driving 20,000 spindles of textile machinery, for operating the humidifying system which requires 100 h.p., for running motors for pumping water from underground wells and motors for driving machine shop tools, as well as current for lighting the whole mill. This current is furnished at 600 volts, 3 phase, 60 cycles, which is in accordance with latest standard American practice. The turbine is rated at 1,000 k.w. and is furnished with the usual accessories comprising exciter, switchboard and surface condenser.

The Westinghouse Company have extended to China their policy of having a trained erection engineer present at the startine of their turbine generating units to check the installation and makg recommendations as to its care and operation. His services are available at all times for purposes of consultation and inspection.



**500 k.w. General Electric Turbo-Generator Set and Switchboard of the Foochow Electric Company, Foochow**

## The Largest Electrical Machine in China

The recent extensions to the plant at the Riverside power station of the Shanghai municipal council will demonstrate the remarkable progress that British manufacturers have made in the China engineering field.

One of the turbo-alternator sets now being installed is the largest electrical machine in China, being rated at 25,000 K.V.A. The complete plant consisting of a turbine, alternator and surface condenser was built by the Metropolitan Vickers Electrical Co., Ltd. at their Trafford Park Works, near Manchester, England.

The turbine is of the Rateau type, and turns at 1,500 r.p.m. Its output is equivalent to about 28,000 horse-power, and its steam consumption will be less than 9-lbs. per B.H.P. hour. The alternator is of the enclosed ventilated type, rated at 25,000 K.V.A., 3 phase, 50 periods, 6,600 volts. An interesting feature is the Metropolitan Vickers patent air cooler, by means of which the necessary cool air is supplied to the machine in such a way as to eliminate the possibility of any dirt being drawn in and deposited on the windings.

The ordinary air filter does not exclude all the dust in the air, and if of the wet type is liable to cause damage to the machine owing to moisture being drawn into the windings. With this patent air cooler a very limited quantity of air is used, which not only keeps the machine clean and cool, but also has the advantage of reducing the danger of fire to a minimum, as the small quantity of oxygen would soon be used up. With the ordinary air filter a fire once started, is fed with a constant draught of fresh air and almost certainly results in total destruction.

Another advantage is that the air cooler is placed immediately below the alternator, and the long bulky air ducts usual with a filter, are unnecessary.

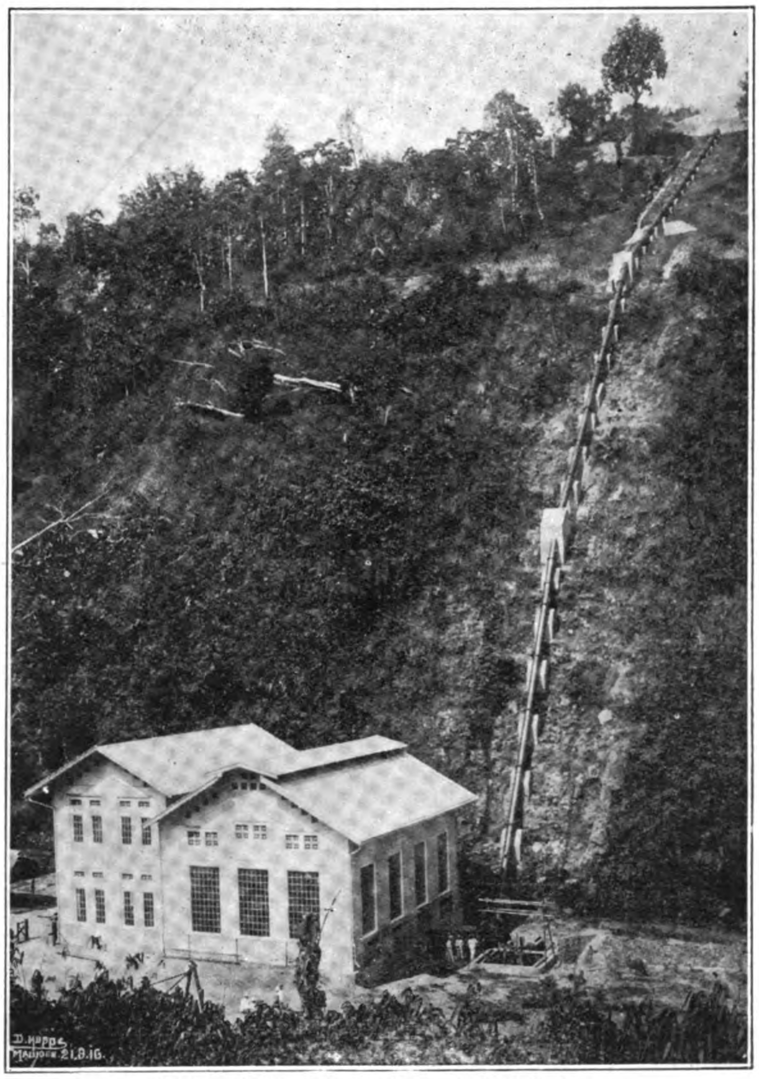
The condenser is of the surface type, the total length of tubes being nearly 30 miles. When operating at full duty, the condenser will require a supply of 40,000 gallons of water per minute.

In addition to this big machine at Riverside power station the Metropolitan Vickers Company have also installed two 3,000 k.w. turbo-alternator sets, and three 750 k.w. rotary convertors.

# Hydro-Electric Power in the Netherlands East India

*From a paper read before the Royal Institute of Engineers of Batavia, by A. Groothoff*

SINCE 1910, when the first director of the department of government industries entered upon his duties, the government began to take the study of the problem of hydraulic power in the archipelago in hand, the purpose in view being in the outset only confined to the future electrification of the state railways, but which was also extended later on to the supplying of a more powerful source of energy as an important factor for the industrial development of the Indies.



**Tjatoer Hydro-Electric Plant in Middle Java**

Equipped with 2—1,000 H.P. Francis Spiral turbines; 750 r.p.m. driving 2—800 K.V.A. 6,300 volt, Brown, Boveri Generators.

Since August 1917 the new service of waterpower and electricity has been detailed to utilize in a practical way the hydraulic energy, now for the greater part still lying dormant in different parts of this island empire, as well in the interest of the state as in that of private industry. The central office of this service is established at Bandoeng and composes three technical divisions, viz., the Division of Electricity, the Building Division and the Hydro-technical Division. The Division E (Electricity) carries out all work, which is to be done in electro-technical lines. The Division B (Building) attends to the building of the government power stations and the task of the Hydro-technical Division comprises the systematic searching for and examination of water powers, the drawing up of an inventory of those powers and the subsequent enlightenment of interested parties, who wish to utilize them. The natural conditions, which everywhere contribute to create important waterpower supplies may be said to be very favorable in these countries.

Amongst the favorable factors should be mentioned:

*a.* The heavy tropical rainfall (which in Java attains an average of from 3,000 to 4,000 m.M. per year, even in more mountainous regions to 8,000 m.M.), which causes, notwithstanding the dry East monsoon, to have, under normal conditions, always sufficient river water at disposition for hydraulic power;

*b.* The large lakes in Sumatra and Central Celebes, the virgin forests in Borneo, as well as the snow and ice-clad summits of the mountains of New Guinea, which all regulate the supply of water to the rivers, are dependent upon those conditions;

*c.* The vertical shape of the large island, causing on the one hand the formation of extensive basins of the rivers with high conveyance figures and on the other hand elevations of ground, which are highly suitable for the development of hydraulic power.

According to a very rough estimate, which does not include the smaller islands and the as yet little-known Dutch part of New Guinea, the minimum capacity of hydraulic power in the Dutch East amounts to 5,500,000 h.p., viz.:

| | | |
|---|---|---|
| Java | .. | 500,000 h.p. |
| Sumatra | .. | 2,000,000 h.p. |
| N. Borneo | .. | 2,000,000 h.p. |
| Celebes | .. | 1,000,000 h.p. |
| Total | .. | 5,500,000 h.p. |

The regions containing the most water power are West Java (especially the Preanger mountain region), North Sumatra (especially the Asahan region), Central Borneo and the lake territory of Central Celebes.

## I. West Java

West Java is the part of the island, containing the most hydraulic power and in this region the utilization of hydraulic power has been the most developed. This applies as well to enterprises undertaken by private persons as by the government. In West Java there are actually large hydraulic power stations being built, which will supply the necessary energy for:

*a.* Electric railways Priok-Batavia-Buitenzorg c.a.;

*b.* different purposes at Batavia and suburbs and at Buitenzorg;

*c.* the general supply of electricity of Bandoeng and the neighborhood of the radio station at Malabar on the Pengalengan plateau.

For A and B the state hydraulic works are in course of construction in the Tji Anten (Tji=river) near Buitenzorg (28,000 installed h.p.) and near the Tji Tjatih (7,500 h.p.) to the South of the first station is destined to generate the large top-charges of the projected electric railways. For C and D are being built the state hydraulic power station in the Tji Kapoendoeng near Dago (3,000 h.p.) and in the Tji Saroewa, a branch river of the Tji Sangkoej (4,500 h.p.) near Pengalengan.

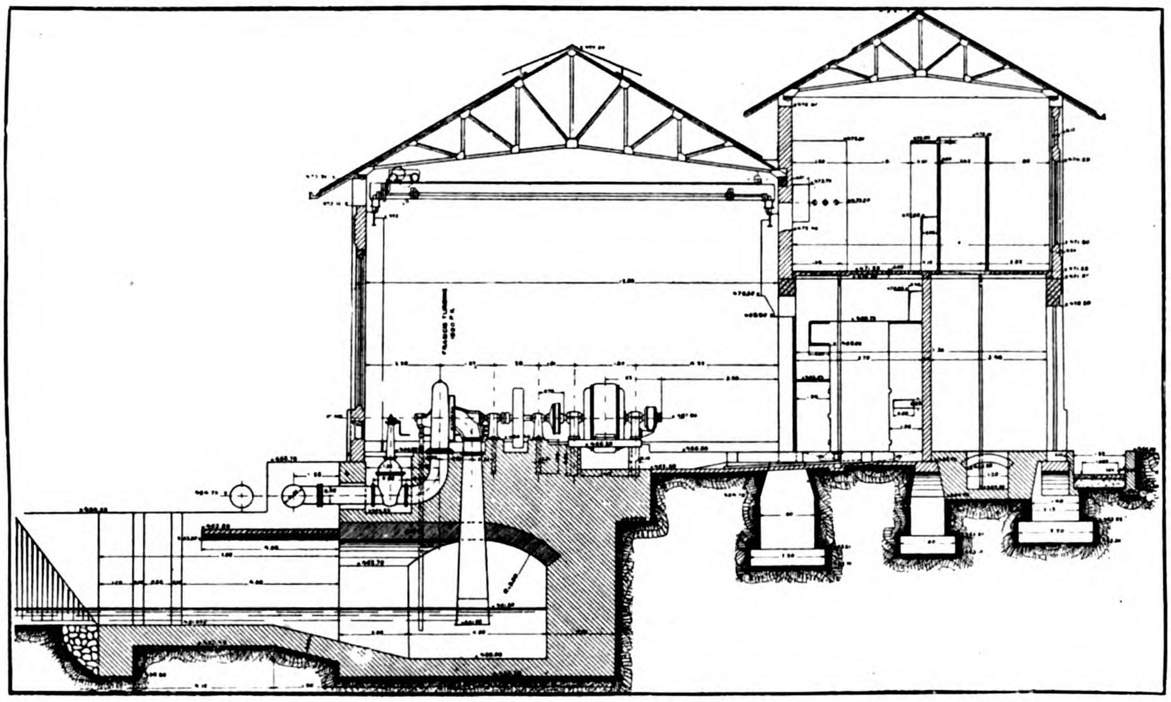
Furthermore there are also being built two caloric stations, viz., a small auxiliary station of 400 h.p. at Bandoeng (Tji Hapit)

in order to re-inforce temporarily the already overcharged old station near Dago, and a second station of about 1,000 h.p., South of Bandoeng (Dajeuh Kolot) for radio purposes. Both stations may later on co-operate with the four already mentioned hydro-electric stations, when this is necessary during the dry-monsoon.

River basins offering a profusion of hydraulic power should be mentioned in the first place:

1st. The Tji Mandiri territory with an aggregate capacity of 18,600 h.p. on 8 points (the largest energy source has at least 5,000 h.p.),

2nd. The Tji Taroem territory with 43,700 h.p. on 10 points (largest energy source at least 12,500 h.p., viz., to be supplied by the second Tji Sangkoej hydraulic power station, now being studied).



Elevation of the Tjatoer Power Plant

3rd. The Tji Laki territory with 31,500 h.p. on 4 points (largest energy source at least 15,000 h.p.).

4th. The Tji Manoek territory with 30,100 h.p. on 7 points (largest energy source at least 1,000 h.p.).

In these four territories together there is, thus, a total available hydraulic power aggregate of at least 123,900 h.p. or about one-fourth of the toal estimated capacitytof the important hydraulic forces above 1,000 h.p. in Java.

The region of the Preanger regencies is the one containing the most hydraulic power of the entire island. Here there are about two-thirds of the total number of hydraulic installations to be found for private enterprises, to wit, about 240 having a total capacity of about 9,000 h.p. as against about 12,000 h.p. in the whole island. It is also very remarkable that nearly 95 per cent. of the hydraulic power energy installated in tea factories has been centralized in the Preanger regencies, with a total capacity of 6,000 h.p.

Power Plant and Water Observation Station at Tjikapoendoeng, West Java

## II. Central Java

Central Java, which comprises the residencies of Pekalongan, Semarang, Banjoemas, Kedoe, Djocjakarta and Soerakarta, is not so rich in hydraulic power as West Java.

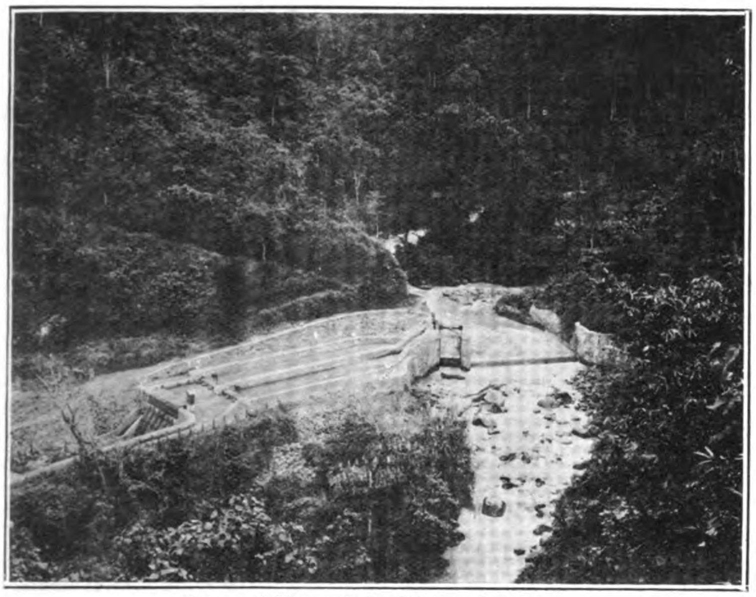
Yet also here various important sources of hydraulic power have been discovered, especially in the Serajoe basin, in the Toentoeng and in some rivers along the North coast. In the Toentoeng 13.000 h p. have been found to be available, which may be worked on three or four levels. The most favorable portion of the basin, which is that one in which the Toentang cataracts are situated, has already been given out for exploitation to the A. N. I. E. M. (General Netherlands Indian Electric Company), which company already since 1913 works at that spot a hydro-electric station with an installated capacity of 2,200 kilowatts for the supply of electricity to Semarang and Salatiga.

On behalf of the government a project has been drawn up for a larger hydraulic power house on the Toentang river, which may also serve to supply energy to the electrifying of tracks of the Netherlands Indian Railway Company.

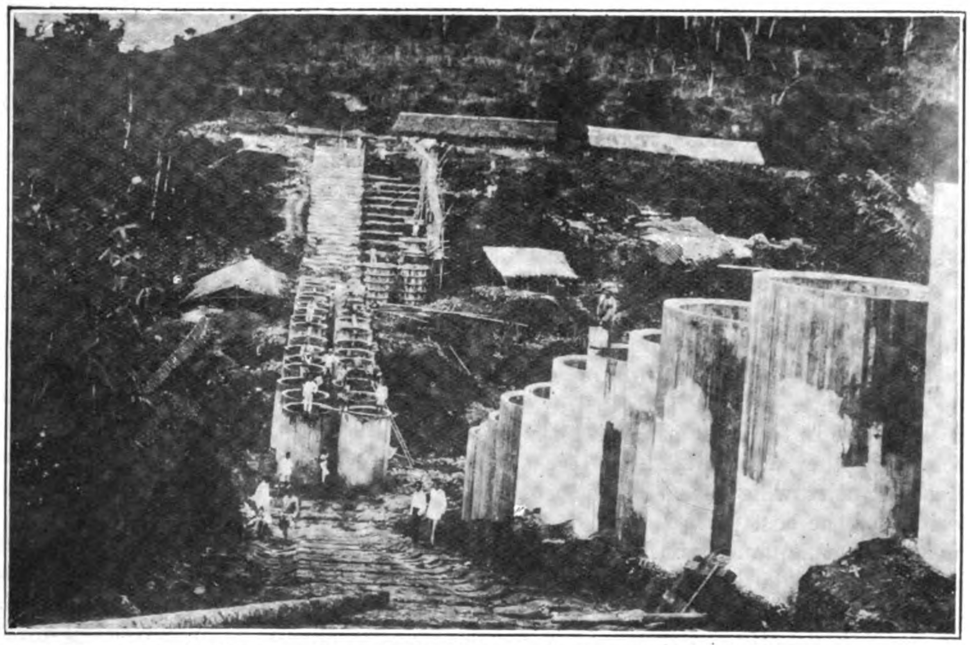
In this river an important amount of hydraulic power is stored, which will become available when constructing the projected Rawa-Pening reservoir, having a capacity of 237 million cubic metres. When this reservoir will be completed the supply of available river-water will be doubled, which will enable the utilizing of an additional 13,000 h.p. Also the Serajoe river in mid Java may come into consideration as an important source of energy.

## III. East Java

In East Java on behalf of the government the smallest number of energy sources has yet been discovered. The smaller hydraulic forces are here pretty numerous and are being utilized by several estates to get their energy from. But also with regard to the larger hydraulic sources of more than 1,000 h.p., the rivers in East Java are not by far so destitute as many suppose on the strength of climatological factors. Since 1917 the government station in the Tjatoer valley is in exploitation to supply energy to the state railway


General View of the Tjatoer Intake

workshops near Madioen. This power station has two turbines o 1,000 h.p. each, operating under a volume of water of 110 m. height The canal through which the water is supplied has from the *prise d'eau* till the tubes of the turbines a total length of 2,200 metres, in which there have been constructed two tunnels of respectively 240 and 360 metres length. The electric energy is conveyed under 55,000 volts along an aerial conductor, the latter being 15 k.m. long, rigged on iron masts, to the sub-station at Madioen. Plans have been drawn up for the building of a government - hydraulic power plant along the Kali Konto, with a capacity of 10,000 h.p., destined for the electrification of the state railway lines in and near Sourabaya, and at the same time for the general supply of electricity in the districts of Sourabaya, Kediri and Pasaroean.


Manufacturing Concrete Pipes for the Tjikoeja Syphon of the Tji Tjatit, West Java

The hydraulic forces in the Kapongan main canal are being reserved for general purposes (radio station, pumping up of irrigation water, and the illumination of Sitoebondo).

## IV. South Sumatra

The works already completed and the plans being taken in study in South Sumatra may be divided into the following large groups:—

A. The many primitive native water-wheels, which chiefly serve to drive the rice husking mills in Bencoolen;

B. The pretty large hydraulic power plants of the private mining companies and the state-mine Tambang Sawah in Bencoolen. Simau has harnessed 1,300 h.p. on the Ajer Loesang and Ajer Gloemboek, Redjang Lebong disposes of 1,550 h.p. in four plants in the basin of the Ajer Ketahoen and gets its supplementary energy from the state waterpower plant, situated on the shores of the lake of Tes, in which two aggregates of 1,000 h.p. each have been constructed. This power plant built for the state gold and silver mine has been taken in operation in the beginning of 1920, the building of it having taken three years.

C. The hydraulic power plants for various agricultural estates in Palembang.

D. The plans to utilize power in connection with the following industrial purposes:—

*a.* for the manufacture of nitrogen, for which purpose concession has been given to draw the water from the Moesi river or from the Ranau lake with a tunnel through the Barisan to the Indian Ocean;

*b.* for the manufacture of iron in the Lampong districts, for which purpose permission has been asked to draw the water from the Wai Sekampong and the Wai Besai.

For the future the hydraulic forces in South Sumatra represent a considerable reserve for the supply of hydraulic power in Java, which in proportion to its population and future industrial development, is not so very large. The large distances of some hundreds of kilometres will certainly not form a drawback against that time, neither the crossing of Soenda Straits.

## V. Mid-Sumatra

For mining and industrial purposes the following hydraulic power plants exist at present:—

I. A hydraulic power plant of 1,000 h.p. for the mine Tambang Salida on the Salida river;

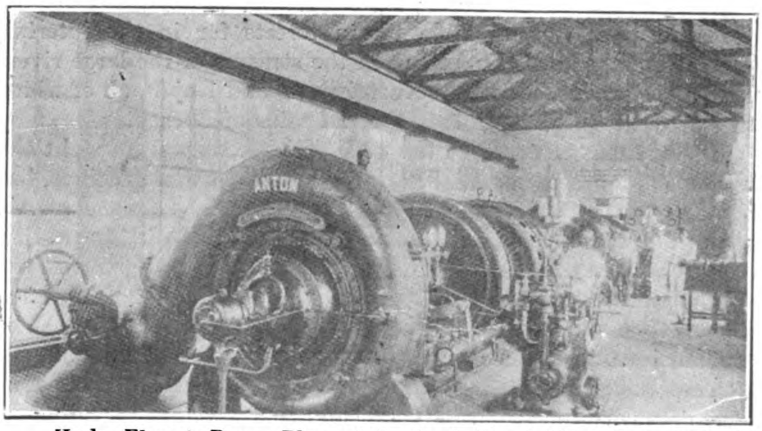
II. On the Padang river a plant of 1,500 h.p. to supply energy to the Netherlands Indian Portland Cement Factory at Indaroeng;

III. A second hydraulic power station for the cement works above mentioned in course of construction on the Koerandji river, having a capacity of about 3,000 h.p.;

IV. Various hydraulic power plants of the Mining Company Equator at Manggani, having an aggregate capacity of about 1,000 h.p.;

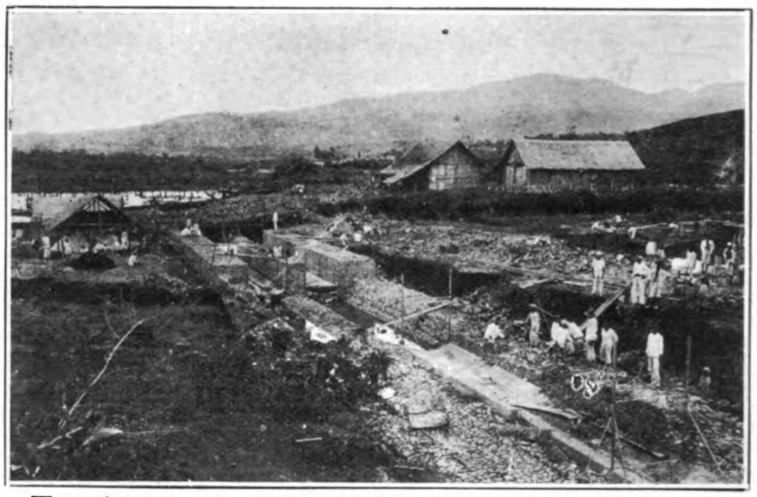
V. Three plants of a total of 275 h.p. for the mine Kinandam.

On behalf of the government so far the following hydraulic forces have been discovered in these regions:—



Hydro-Electric Power Plant of the Anglo-Dutch Plantations, Ltd.

Autographic Water Stage Register in the Tji Taroen, near Bandoeng, West Java



Water Conduit under Tji Leuntja lake dam in construction, West Java

1. In the Ombilin river 16,000 h.p.;
2. In the Agam river two of 10,000 h.p.;
3. In the Anei river 4000 h.p.

## VI. North Sumatra

Of the whole of the islands the most northern part, which comprises the district of Tapanoeli, Sumatra's east coast and Atcheen, contains perhaps most waterpower. On four exploration expeditions, of which three were sent to the Asahan territory and one to the Peusangan river, there have been discovered a total of 800,000 h.p. Also the upper stream basin of the rivers in the territory under cultivation of the east coast of Sumatra contains a profusion of hydraulic power, be it of a more modest capacity.

The great problem in hydraulic power in regard to the east coast of Sumatra is the utilization of the Asahan waterpowers. Along this river (see the four photographs on page 3) which streams from the Toba lake, at least 500,000 h.p. may be harnessed in four consecutive power plants. Of these 200,000 h.p. have been given out in concession in the interest of the building of a factory of nitrogenous manure and other electro-chemical industries. The plans have reached a very advanced stage of preparation and are, according to authorities, very promising.

As far as is known, nowhere else in the Dutch East is such an enormous capacity found close together, within a radius of about 10 k.m., which may be utilized at such low figures as to the costs.

In order to give some idea of the cost price it may be mentioned that the energy, transported at a quantity of from 10,000 to 20,000 h.p., over a distance of about 200 k.m. to the neighborhood of Medan, should at the latter place cost not more than that supplied by the new government hydraulic power plants in the Preanger regencies, viz., a few cents per kilowatt hour.

Also for the future electric railways in the basin of the Toba lake, with its steep slopes, energy will be supplied from the Asahan river, for which purpose already part of the available power has been reserved.

## VII. Borneo

Hidden in impenetrable virgin forests far in the interior, gigantic energy forces are stored in the streams of the large rivers Kapoeas, Baritoe, Mahakam (Koetei river) and Kajan, all of which are fed by the inexhaustible equatorial rains of Borneo.

A very small corner of the veil, which covers from sight the enormous quantities of energy lying dormant in those regions, has been lifted in 1918 temporarily only, by the civil engineer A. G. A. van Eelde, who has explorated the Bem Brem falls in the Kajan river. Many hundred thousands of h.p. were shown to exist in the basin of the Bem Brem falls, of which to a certain extent, detailed hydrometical and topographical data have been given. The economical value of these mighty hydraulic powers, though naturally cheap to harness and work, is actually still small on account of the great distance from the coast and the extraordinary difficulties and excessive costs, which the establishment of industries to be operated by them, entails in such a primitive country as Borneo. On that score the government does not for the time find it necessary to launch upon special hydraulic power investigations in this island.

## VIII. Celebes

In Celebes the service of hydraulic power and electricity has made sure of the following hydraulic powers in 1918 and 1919 :—

I. Malili Basin.

Total about 150,000 h.p. in four power plants. These powe-plants are being reserved for the future development of the iron and nickel industries. The first one is situated in the immediate vicinity of the important Larona iron ore field. The height of the fall is from 15 to 80 metres, and the energy costs approximately 35 Guilders per kw-year.

II. Laa Basin.

Here a minimum of about 50,000 h.p. are waiting to be worked.

III. Posso Basin.

Between the Posso lake and the sea, two energy sources of 100,000 h.p., situated in the Posso lake, have been discovered.

The Minahassa will be soon investigated in view of the possible laying out of electric tramways.

The above survey and figures demonstrate plainly that in regard to hydraulic power the Dutch East may be called a blessed country, the more so because the hydraulic power in general will not cost so much more to work here than in Europe.

And the government as well as private enterprise have all reasons to continue their efforts to utilize the yet dormant hydraulic powers in the archipelago, which, in the future, will certainly raise the prosperity of the native population.

# Building in Japan

A new development which has affected Japanese trade very considerably is the ferro-concrete mania. The building of Japanese houses makes a large and continuous demand for wood which cannot be satisfied from Japan's own forests, though cheap wood for house-building from the state forests is one of the promises made by way of a government contribution towards the lowering of prices. For all other purposes than house-building concrete is the fashion, and it is not uncommon to see single-story places being erected with a tiny tower, hoist, and concrete-chute all complete. The new style of building has offered opportunities for foreign enterprise in Japan. The greater part of the work is done throughout by Japanese, but an American firm has done much work in Tokyo and has built the largest structure owned by any foreign concern in Japan—the new office block in Kobe for Messrs. Brunner, Mond & Co. Even more than actual building by foreign firms, foreign architects (American) have supplied plans for the new style of structure. But that is only a passing phase, and the Japanese architects are rapidly taking up this new fashion.

# Far Eastern Timbers

## I

## Some Facts Concerning Their Properties and Commercial Value

*By C. A. Middleton Smith, M.Sc., M.I. Mech. E.*

**(Taikoo Professor and Director of the Engineering Workshops and Laboratories of the University of Hongkong)**

THERE are three classes of individuals interested in Far Eastern timbers. They are: (1) the botanists; (2) the commercial men, the vendors, merchants, etc.; (3) those who use the timbers such as the architects and engineers, the furniture makers, owners of match factories and others.

It is from the point of view of the engineer that the subject will now be considered. It may be well to say, at the outset, that there is a scarcity of information concerning the physical properties of many of the Far Eastern woods. It was with the object of obtaining some definite information of use to engineers that the writer has made various tests on Far Eastern timbers during the past four years.

Concerning the woods grown in China there is very little information available. Mr. Woon Young-chun, B.S.F., M.F., professor of dendrology in the college of agriculture and forestry, University of Nanking, recently produced a book entitled "Chinese Economic Trees," which is of interest.

Mr. Woon is under the impression that his is the first book on the subject of important Chinese trees that has been written in any language. It is designed as a text-book for colleges and is written from the point of view of the botanist. It seems to be an excellent beginning. Its chief interest to the engineer lies in the fact that it enables him to trace certain timbers, giving him a rough idea where the woods are to be found in China. There is no data concerning physical properties of timber, but there are statements as to the provinces where the various trees are to be found. It must be confessed that the knowledge of Europeans concerning the forests of China is very limited. The fact that nearly all of the timber used in structural work in South China is imported leads us to suppose that no suitable woods can be obtained in Kwangtung. There are, however, supplies in Kweichow and Kwongse which are but marked.

The profusion of forests in South Eastern Asia has led to various enterprises of a commercial nature. The trees in that part of the world have also been of considerable interest to scientists. During the past ten years a great deal of data has been accumulated but again chiefly from the botanist's point of view. In this connection, praise is due to the governments of the Philippine Islands, British North Borneo and Federated Malay States.

What is now needed is complete data and information concerning the strength of these Far Eastern timbers. In that work some progress has been made during the past few years, but a great deal still remains to be done.

### Early Records

It is probable that the first authentic record concerning timbers in the Far East was contributed by a Spanish Jesuit, Father Juan Josê Delgado. After a residence of forty years in the Philippines, he commenced, in 1751, to write a book. We learn that "he was studious, observant and an excellent critic." The next record also comes from a Spanish priest, one Manuel Blanco, who arrived in the Philippines in 1805. After some years of travel and study in the various islands, he wrote a book "Flora de Filipinas" which he modestly called "the daughter of simple curiosity." It contains a scientific description of more than 1,200 species with full notes about their properties and uses.

We next come to an engineer who afterwards became a professor in the school of forestry in Spain. His name was Sabastian Vidal. He had a distinguished career as an engineer in Spain, studied in Germany, and finally (1871) became inspector-general of the forestry department of the Philippines. He wrote many valuable works the merits of which have been fully acknowledged by botanists. He discovered 100 new species, and he won the affection and respect of those with whom he worked. There is a monument to perpetuate his memory in the Philippines, a fitting recognition of his services to the peoples of those islands. He was a man who may well be remembered with pride as one of the pioneers of science in the Far East.

His brother, Romingo Vidal, also devoted his life to forestry problems of the Philippines. He lost his life through over-work.

Mention should be made of an Englishman, Mr. Henry Brown, who succeeded his brother in the timber business in the Philippines in 1870. He was one of the commercial pioneers.

The American occupation immediately stimulated interest in the Philippine forests. It was soon recognized that American enterprise and capital could be used to exploit the forests of the islands and the new administration did a great deal to encourage lumbermen. In a government publication, dated 1901, it was stated that the forestry bureau in Manila granted licences without fee, for forest products from public lands. The timber was classified into six groups, and the price per cubic foot for the valuation of state timber, varied from 14 cents for the superior group to one cent for the last group. Only the last three groups could be cut for fuel. In the "superior group" there were twelve woods, including yacal.

Finally we come to the work of Dr. Foxworthy. It is probably not too much to say that he has made a more thorough study of the woods and timbers of South Eastern Asia than any other individual.

It is unfortunately difficult to find copies of his various contributions but the writer has in his possession two issued by the government of British North Borneo, department of forestry. One of these is by Dr. Foxworthy (Bulletin No. 1) and is concerned with the timbers of British North Borneo and minor forest products and jungle produce. The second publication is by Dr. Foxworthy, professor of forestry, University of Philippines, and Mr. D. M. Matthews, conservator of forests, British North Borneo. It is bulletin No. 3 and was published in 1917.

Recently the writer has obtained a copy of the "Malayan Science Bulletin" (No. 1 April, 1921) which is a bulky pamphlet on the commercial woods of Malaya, written by Dr. F. W. Foxworthy forest research officer F.M.S.

Thus it will be seen that Dr. Foxworthy has done valuable work in the Philippines, in British North Borneo, and in Malaya.

The government of the Federated Malay States has a forestry department which is doing much useful work. Recently the high commissioner of the Federated Malay States, Sir Laurence Guillemard, expressed the opinion that the forests were one of the great assets of the country, and a source of much potential wealth. He

added that an accurate knowledge of what they contain is essential to their development. There may now be some regrets in Malaya that, not many years ago, tracks of forests were ruthlessly destroyed to make way for rubber estates.

The conservator of forests in British Malaya is Mr. G. E. S. Cubitt who has published some valuable reports and bulletins. It is noticeable that in spite of the present commercial depression in Malaya the government has strengthened the forestry department in its administrative and scientific branches. They employed a number of planters, who were out of work, during the past year; and in this way, the forestry department has been able, not only to explore forests, but to make a trustworthy estimate of the contents by linear enumeration surveys extending to one per cent. of the total area examined. Perak seems to have great timber possibilities and the other states contain large areas of various woods of value.

An important function of this department is to provide advice to consumers about the uses of different woods. Incidentally it may be mentioned that two of the Malayan timbers have been suggested as suitable for golf club shafts. Mr. Davis, a recent American visitor to South China, is sanguine that bamboo will be suitable for these shafts.

It is evident that the demand for commercial timber of all sorts is increasing and that there are experts in Malaya, Borneo and the Philippines ready to co-operate, on behalf of their governments, with those who may wish to use Far Eastern timbers.

It may be mentioned that large quantities of timber are used in southern area as fuel. It is estimated that, in the F.M.S, more than 90 per cent. of the wood consumed is used as firewood, most of it for domestic purposes. Tin mines consumed in 1919 810,000 tons or 4,050,000 cu. ft. of wood as fuel. Railways, rubber factories, brick and lime kilns also used a great deal.

## Popular Fallacies with Regard to Timber

There is a general idea abroad that Far Eastern timber are mainly hard and heavy ornamental furniture or cabinet woods. This is probably due to the fact that only ebony, satin wood and other of more valuable species for furniture work have reached the European markets. In actual fact, the largest part of the timber in the Far East is of another family which, although it supplies many valuable hard woods, also supplies the most widely used soft and medium grade woods.

In the past, there has been a great deal of confusion in the use of the common names of the different woods. This is very largely due to the numerous dialects in use in the Far East. Some years ago, when the writer first arrived in the colony he asked a well-known local architect whether he considered a wood called in British North Borneo selangan batu, one with physical properties suitable for use as beams. The architect condemned this wood but spoke very favorably of a wood known locally as yacal. This wood Yacal is a Philippine word and is given to the wood which grows in the Philippines islands. In actual fact, serangagg batu, and yacal are same wood. In Singapore and F.M.S., this wood is called balow or chengal.

Dr. Foxworthy has performed a most valuable service in tabulating the various names of these Far Eastern wood. In the British North Borneo department of forestry, bulletin No. 1 there appears a list of fifty-eight Far Eastern woods with the names by which each is known in British North Borneo, Philippine Islands, Singapore and F.M.S., Dutch Borneo, Sarawak. Some of these woods have entirely different names in these different places. Thus oba, macaasim, kelat, djambu and ubar are the local names of the same wood. Similar instances can be given for other woods. Perhaps it may be well to mention the case of the Philippine wood molave. The five names for these are kuiling papa, molave, leban, heleban and calipapa. This wood molave has a large number of local names in the Philippine Islands.

On this subject, Dr. Foxworthy (Philippines *Journal of Science*, October 1907) has written as follows :--

"A wood is often variously designated on the same or in different provinces and again, several different kinds are frequently found under identical names; for example molave has more than forty different names in the archipalego (Philippines) and this multiplicity for the same wood naturally results in confusion which is very much increased when, as often happens, the same name applies to different woods in different localities. This makes very easy for the unscrupulous dealer to substitute a poor quality for a better.

## Physical Properties of Timber

It is much more difficult to state with any degree of exactness the physical properties of any particular timber than it is given the physical properties of other materials used in engineering work, such as steel or cement. The quality of timber is largely influenced by the soil and climate, the age of the tree, the season of felling and the duration of the seasoning process. The vegetable cells, termed wood-fibres, arrange themselves, nearly parallel to the axis of the stem. If a stress is applied to a transverse section, the fibre must be broken across. A stress, if applied to a longitudinal section, separates the fibres from each other. The strength of the fibres determines the strength along the grain, but it is the adhesion of the fibres that determines the strength across the grain. The ratio is by no means constant. In pine wood, for example, the lateral strength is only one-tenth to one-twentieth of the longitudinal strength; but in leaf-wood it is one-sixth to one-fourth. Roughly speaking, the needle-leaved trees ("coniferous" trees) provide soft wood and the broad-leaved trees supply the hard wood. After felling all timbers require to be seasoned, and during this process, the wood shrinks and loses from one-fifth to one-seventh of its weight.

The strength of timber and other physical properties varies so much that it may be as well to quote a summary of about two thousand tests from twenty-six different trees made by the U.S.A. department of agriculture. These tests were made on long leaved pine (Pinus palustris). The heaviness in pounds per cubic foot varied between limits of 28 and 64.8. The tensile strength in tons per sq. in. varied between limits of 1.85 and 13.4. The crushing strength varied between limits 2.04 and 4.15 tons per sq. in. The coefficient of bending strength varied between limits of 1.9 and 7.65 tons per sq. in. The shearing strength varied between limits of 0.21 and 0.58 tons per sq. in.

These figures show how very difficult it is to state, with any degree of accuracy, the physical properties of any particular timber. On the other hand, we can accept mean values of a number of tests as a guide for comparative purposes. The variation of these figures only emphasizes the need for making commercial tests on timbers to be used in constructional work.

In this connection, the writer has noticed that he has frequently seen results of tests made on steel and cement used for reinforced concrete work in the Far East, but he has seldom heard of tests on specimens of timber to be used in structural work.

## Special Requirements

The most formidable enemy to timber in the Far East is the white ant. It eats through most woods and, it has been asserted, although it is hardly credible, "that even the surface of iron is effected by these insects if left long enough where they are." This quotation is from a book published in London in 1892. "The Philippine Islands" by John Foreman; it would be interesting to know whether there is any real foundation for such a curious assertion, which, it is only fair to add, Foreman was unable to confirm. Experience in the Far East teaches us, however, that white ants are a deadly foe to many woods. If they really take possession of the wood-work of the building not constructed of the best timber, the case is hopeless. Packing cases have been so eaten away that when lifted they fell to pieces. In the University of Hongkong all of the floors, doors, window frames, benches, etc., were made of teakwood. The original electrical wiring was done before the

writer arrived in the colony. It was carried in wood casing, a very common system in Hongkong ten years ago. After a comparatively short time, the white ants attacked these casings in one of the residences. The casing was near to a wooden floor. The white ants did so much damage that the wires were short circuited and the casing burst into flame. Fortunately some one was in the room, or the results would have been most serious. The whole building would have been gutted.

This led to close inspection of the wood casing throughout the University buildings, with the result that steps were at once taken to replace the whole of it. Incidentally it may be mentioned that experience in Hongkong has shown that where possible the best system of wiring is to use porcelain cleats fixed in the walls ; where householder object to the appearance of this system lead covered wires are used, but the expense is much greater and there are occasional shorts with such lead covered wiring.

White ants do not seem to be afraid of painted wood. They work under the paint and destroy the wood. They will completely destroy Oregon pine and other pines. They will attack but are not fond of molave (a wood known in Singapore as leban). And, so far as the writer is aware, they will not attack teak-wood, yacal and some other hard woods.

It is said that ants will bore through teak to get at yellow pine. As far as the observations of the writer go these ants will not attack billian.

The white ants reproduce with extraordinary rapidity and grow very fast. These insects live together in large colonies and in a number of their habits resemble true ants. In the tropics, white ants destroy railway sleepers, telegraph poles, beams, joints, floor board, fencing, furniture and in fact, all forms in wood work. Woods may be artificially protected from the ravages of this insect by impregnation with some suitable anticeptic such as creosote.

Beetles will also attack wood and the only remedy is saturation with some noxious fluid. Corrosive sublimate dissolved in spirit wine is recommended.

The ship-worm or toredo is a most serious enemy to piling, boat keels and other wooden articles which are emerged in sea water.

These small animals are such a serious nuisance as to render any but few of the very hard woods useless for piling.

All vegetable substances when divested of life are liable to decay. All woods are not equally affected ; some are liable, under the same conditions, to detericate more rapidly than others. It is now universally admitted that some process for the preservation of wood is desirable. The use of preventative solutions is increasing, and it is claimed that, in some cases, the life of the wood can be quadrupled by preservative treatment.

There are two kinds of decay, wet-rot and dry-rot. The former takes place in the tree standing and the latter takes place in dead wood. It occurs in confined spaces where the gases evolve, finding it impossible to escape enter into new combinations and produce fungi which derive their nourishment from and thus destroy the wood.

### Timber from Siam

Recently the writer has made a number of tests on specimens of Mai-Takien and Mai-Yang timbers from Siam. The various trees from which these timbers were obtained were all grown in sandy and gravelly soil. The specimens of Mai-Takien were of light-brown color. Those of Mai-Yang were of dark brown color.

Twelve specimens of each type of wood were supplied for bending tests and eighty specimens of each type were supplied for compression tests.

A hand-power Avery testing machine was used for the bending tests. All of the specimens tested for bending were rectangular in shape and of dimensions 2-in. by 2-in. by 36-in. The system of loading employed was that known as the " Third Point Loading." The span used was thirty inches.

Deflections during the loading of each specimen were measured and the values for Young's Modulus of elasticity (e) have been calculated.

The compression tests were made on specimens 2-in. by 2-in. by 6-in. In all of the compression tests failure was caused by shear except in the case of four of the Mai-Takien specimens in which failure was caused by splitting. In all cases cardboard pads were used and there was no variation in the system of loading. One of the Mai-Yang specimens supplied for compression tests was accidentally injured and was discarded.

### The Results Obtained

It is to be expected that there will be some variation in the results of any tests on timber even if the specimens are taken from the same forest. The average results of several specimens are, however, of value.

The remarks given with the full results of each series of tests give the life-history of the timber, as far as it was possible to obtain this information.

The co-efficient of bending strength (f) was determined from the equation

$$f/wl/bd2$$

The highest figure recorded for any specimen during the bending tests was 6.19 tons per sq. in. for Mai-Takieh. The mean average of the bending tests for all of the 12 Mai-Takien specimens gave a bending stress of 5.380 tons per sq. in. The lowest figure recorded during these tests for Mai-Takien was 4.56 tons per sq. in.

For Mai-Yang the highest figure recorded during the bending tests was 3.86 tons per sq. in. The mean average of 12 specimens of Mai-Yang gave a bending stress of 2.993. The lowest figure recorded for Mai-Yang was 1.89 tons per sq. in. but this specimen was faulty and it is probably fairer to accept the next lowest figure which is 2.34 tons per sq. in.

The results obtained for Mai-Takien were much better than those for Mai-Yang.

For practical purposes, in comparing strength of woods, the figures recorded for the bending tests are those that should be primarily considered. The results obtained for the compression tests are, however, of interest, especially as showing uniformity of strength.

In the compression tests Mai-Takien again gave better results than Mai-Yang.

The highest figure recorded in the compression tests for Mai-Takien was 3.38 tons per sq. in. The lowest figure 2.18 tons per sq. in. The mean average of 80 specimens was 2.89 tons per sq. in. The highest figure recorded in the compression tests for Mai-Yang was 2.12 tons per sq. in. and the lowest figure was 1.04 tons per sq. in. The mean average of 79 specimens was 1.69 tons per sq. in.

(*To be continued.*)

## Batignolles Awarded Siam Locomotive Order

The tenders for the supply of locomotives to the Siamese department of state railways were opened on 15th September, and the results published in October. There were forty-five tenderers in all : Germany (14), England (13), Belgium (7), France (3), United States (2), Italy (2), Switzerland (2), Canada (1), and Holland (1).

The lowest British quotation (f.o.b.) for the supply of six engines was £31,857, and the highest £43,710. Out of thirteen firms tendering, ten asked for £28,000 odd. The lowest German tender was £27,150, which two firms quoted, and the highest £29,109. The American quotation was £40,505, and the Canadian G.$224,400. Italy's lowest quotation was £30,000 and the highest £54,085. Belgium quoted in francs, her lowest being 1,248,000 and highest 1,539,000.

The tender for ten locomotives and tenders and spare parts has been awarded to Messrs. Societe de Construction des Batignolles of Paris, at the total price of Fr. 2,988,000. The Compagnie General Francaise pour la Commerce et l'Industrie are their Bangkok agents. The original price submitted was for Fr. 3,422,000, but the firm was able to reduce the price on their original designs.

# NORTH BORNEO

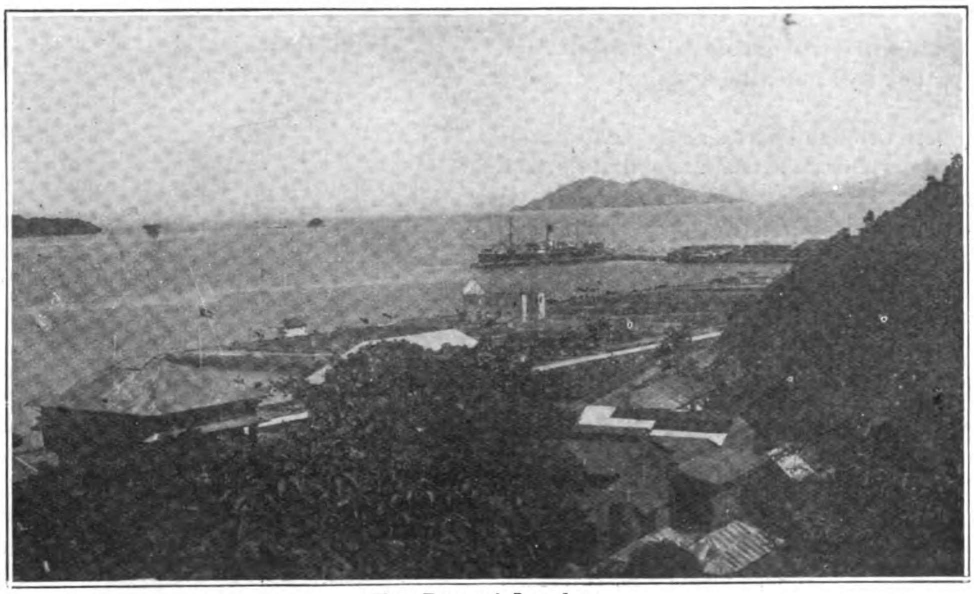
## Her Economic Position and Outlook

*Illustrated by Photos from Mann Singh, Jesselton*

*By G. C. Irving*

THE position of North Borneo, her constitution and her economic condition render her unique amongst the nations and states in the Far East. The territory is the domain of a company of landlords whose rights and privileges are as jealously guarded by the forces of the crown as though they were actually a part of the British empire. Their affairs are purely of a domestic character and they leave to the British government the protection of their sea routes and the safeguarding of their interests should they in any way clash with those of their neighbors.

The governor of the Straits Settlements enjoys the title of British agent for North Borneo. He takes no active part in the administration or the policy pursued within the state to which, on infrequent occasions, he pays a stately and formal visit. Many of the admirals of the China fleet have taken a personal interest in the fortunes of the country and have paid visits to Sandakan or Jesselton. Admiral Sir Alexander L. Duff recently visited the latter port in H.M.S. *Hawkins* and was greatly interested in what he saw. Finally His Royal Highness the Prince of Wales was pleased to include North Borneo in his wonderful Eastern tour, an honor which set the seal of royal approval upon the enterprise of a private company.



The Port of Jesselton

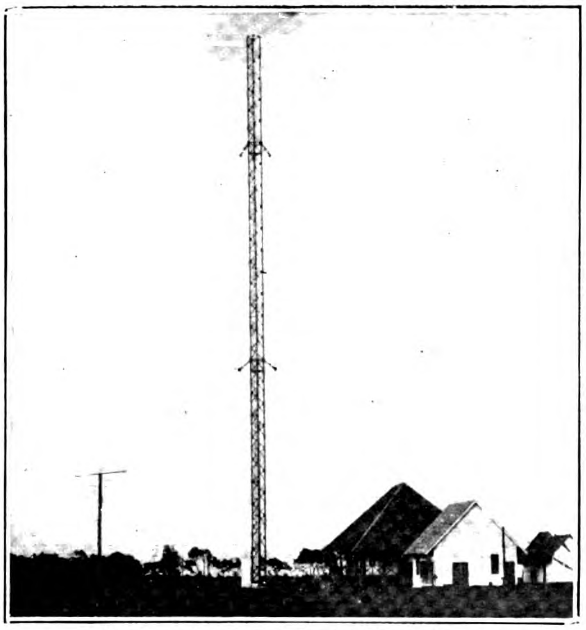
There can be no possible doubt that Great Britain values very highly the British influence which has been established in Northern Borneo.

The granting of the charter was very hotly debated in parliament forty years ago. It was thought by many that a small independent state, calling for protection, might bring upon the government more trouble and expense than it was worth. Actually the government's bill must be a very small one indeed. On two occasions North Borneo has been given the assistance of a warship to deal with local rebellions but beyond that she can have given little or no anxiety to the parent nation.

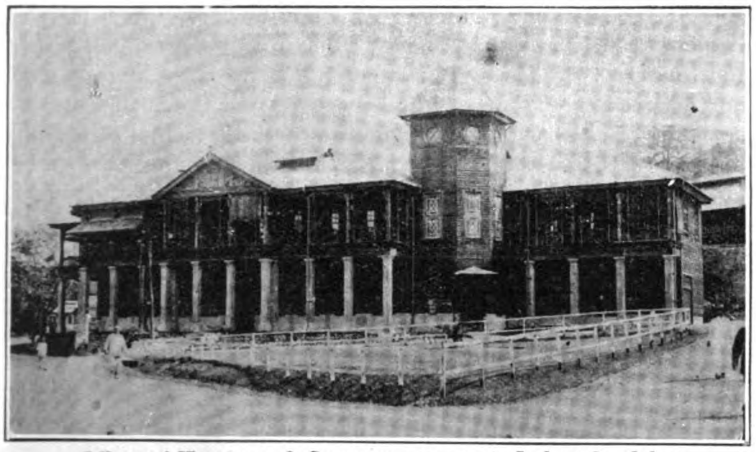
Her position to-day is one of such complete security within and without her borders that she can begin to study the problem of her economic expansion.

Twenty years or more ago when the writer first came to the country, the government's attention was centred upon native affairs. More or less unknown districts were being opened up, courts of justice established and legislation introduced to meet with emergencies and conditions as they arose and were developed. In the wake of the district officer came the Chinese trader who pushed farther and farther inland as stable conditions expanded.

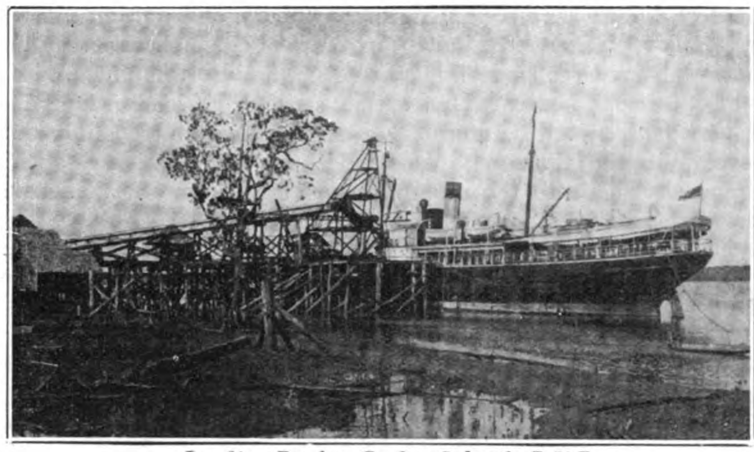
European capital began to creep in, attracted by the richness of the soil and the immense stores of timber in the forests. Though progress has been slow it has been most emphatically sure. In 1900 our imports were valued at £337,761 and our exports at £353,453 whilst in 1920 they were respectively £1,284,438 and £1,405,771. A second comparison of interest is that between the census of 1911 which placed the population at 208,183 and that of 1921 at 258,355, another proof of progress slow though it may be for a country which relies to so great an extent as this does on immigration to improve its fortunes. Those are but puny figures when placed alongside those of any moderate sized city, but they tell their own tale of how a handful of pioneers, without spectacular resources in the way of capital, can build on such slender foundations and organization complete in administrative detail and adequately equipped for the economic progress of the country. With but a paltry quarter of a million souls, the majority of whom are concerned solely with the cultivation of foodstuffs it is a sign of great promise that surplus production for export should amount to over $10,000,000 a year. For much of this we have to thank European capital which has exploited our forests, planted our rubber and tobacco estates and developed our coal mine. Communications, of which we shall treat in another article, are in the early stages of development. Thousands upon thousands of acres remain untouched, the secret fastnesses of the wild life of the country. Docked behind the forbidding walls of jungle or buried beneath the massive mountain ranges may be, and probably are resources of which we dream but still know comparatively nothing. Geologically the greater part of the country is a sealed book ; samples have been found and assayed of gold, copper, manganese iron and even diamonds. Oil there must be because our neighbors of



Wireless Station at Kudat, B.N. Borneo



Offices of Harrisons & Crosfield (Borneo), Ltd. at Sandakan

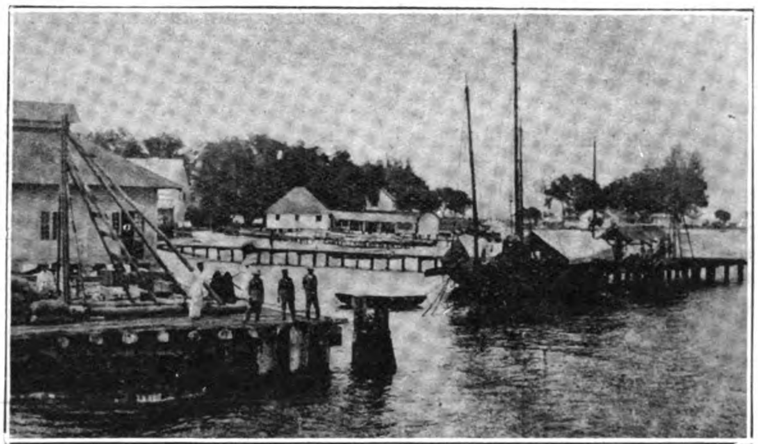


Loading Bunker Coal at Sobatik, B.N.B.

Sarawak and Dutch Borneo are enjoying the profits of wells the like of which we may yet live to see enrich the country. For the time being we must content ourselves with such exports as we have. We can be satisfied that all are based on sound economic principles. Nothing nowadays is over capitalised. Our Chinese do their business on a system of credits all their own, cajoling and almost bribing the natives to make long journeys into the forests in search of rattan and damar. Of late years the Chinese have done the country an immense service by investing their profits in coconut and rubber gardens. To such an extent has the development of such lands progressed that the government has created a well staffed agricultural and forest department of which Mr. D. D. Wood, an American citizen, is the director. Our European companies are for the moment starved of capital. Money is expensive and conditions must become a great deal easier before we can expect investors to turn their attention to so out-of-the-way a corner of the globe as Borneo.

During the rubber boom we were so well in the limelight, with our ideal soil and climatic conditions that £3,500,000 of capital was attracted to our shores. It is a startling proof of the suitability of the country for rubber growing that at the close of the long-drawn-out slump but one minor company has succumbed to the want of the sinews of war.

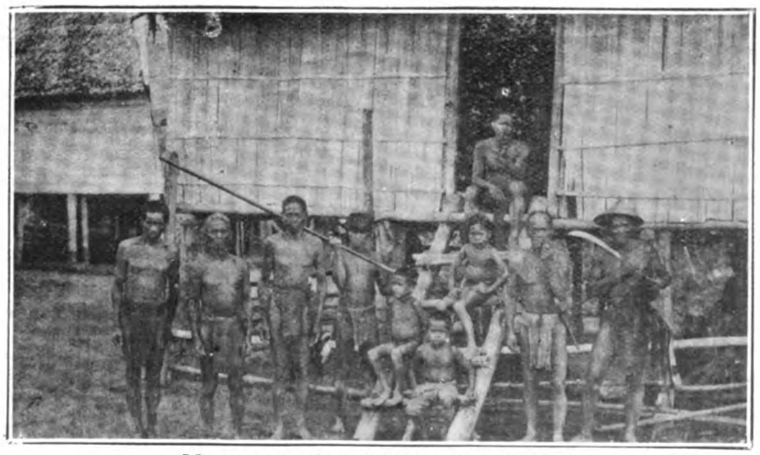
In agriculture, obviously our leading industry the future is more or less assured. With 50,000 acres of rubber planted and the market of the future a matter of the gravest uncertainty, one cannot look forward to any great increase in planting. With coconuts it is a different question altogether and we have every reason to foresee a natural and ever increasing development in so sound an investment. Progress in coconut planting has been so rapid that since 1914 the planted area has increased 100 per cent. to nearly 30,000 acres. On the East coast alone these thousands could easily be converted into millions of acres as there is no lack of ideal land with inexpensive transport facilities. It is not for us to dream of expansion such as this but to be grateful for every acre rescued from the wild and turned into a profitable plantation.



The Port of Kudat, B.N.B.

Coffee, once a promising and profitable cultivation, cannot at present be grown in competition with Java and other countries. Tea would certainly do well but will not be seen in Borneo until the population increases enormously and labor can be hired at rates which make tea plantations profitable. Both Manila and Sisal hemp find conditions in Borneo entirely to their liking but have not yet been proved to offer sufficiently attractive profits. Many of our natural products have been handled only in small quantities and some not at all. From all our boundless Nipah Palm swamps not one gallon of alcohol nor a pound of sugar go to provide the wants of mankind. The easy going native cuts, here and there, a few of the waving leaves of the palm to thatch the typical Borneo house. The alcohol and the sugar continue year in and year out neglected if not forgotten. Two comparatively small companies are engaged in cutting and exporting timber. They work upon the fringe of forests that stretch in an unbroken line from the Dutch Borneo to the northernmost point of the island. The forests of Borneo are its

A Dusun Harrow at Work in Rice Field, after a Rain



Muruts, A tribe of the Interior, B.N.B.

greatest known wealth. Modern machinery and equipment are gradually replacing the primitive methods of our pioneer companies but even they have made but slight inroads into the jungle. The subject is one to be treated in a special article in which it is intended to give more detailed information of what can and possibly will develop in the timber trade. Under the same heading can reference by made to the extraction of cutch from the mangrove forests. This again is an industry with boundless possibilities but dependent to such an extent on the world's markets that further capitalisation cannot be expected for same time. The introduction of cheaper means of production may revolutionise this business which, if other by-products from the bark and tree could be made use of, would offer more attraction to investors than the rather uncertain returns from the cutch markets of the day.

North Borneo has often been described as the grave of disappointed hopes. The traces of abandoned plantations are to be found in many places. The cause of such failures has not been the fault of the country, its climate or its productivity. The opening of any estate or plantation incurring expense in the importation of labor, the building of houses and the clearing of the forest entails heavy capital costs. A fall in the market at a critical time may leave a company or individual planter stranded for want of money to carry on.

With the exception of the Cowie Harbor Coal Company's mine at Silimpopon there is no active mining in the country. Prospectors and geologists have at times made expeditions from which great results were expected but from which nothing concrete has yet been produced. This is not to say that North Borneo is barren of minerals or oil. Geological surveys are so costly that it has not been possible to find the money for the purpose. People are inclined to draw the conclusion that nothing will ever be discovered, a view with which we disagree and will not accept until the geological examination of the territory has been undertaken.

How is the chartered company preparing to develop all the resources of their territory ? The building up of the government and trade of North Borneo has been gradual, the work of patient endeavor, not the result of vast out-pourings of capital. To have burdened a young country like this with a crushing debt would have been and would still be a suicidal policy. Particularly at the present time the company sternly refuses to commit itself to heavy capital outlay. It is ready to meet commercial expansion halfway should our trade begin to show renewed signs of life. Filed away ready for action are plans for increased docking accommodation in Sandakan and Jesselton, waterworks, reclamations and roads. A year ago it was thought that the time had come to force the pace but the trade conditions of 1921 and 1922 have had the effect of bringing a heavy hand on to the brake.

The foundation of North Borneo's future lies in the census returns. Our native population, now completely domesticated, is becoming better equipped and more intelligent as our influence is felt. There are no obstacles to a gradual increase of immigration for which we can draw upon China, Java and the Philippines. In a previous paper we showed that Borneo is suitable for Chinese colonization ; it is equally so for Philippines and Japanese.

As we stand to-day with our present population and our rate of increase one of 25 per cent. in ten years, there is no hope of our taking anything but a negligible position in the economic progress of the Far East. We are even in danger of a set-back if the country be swept again as it was in 1905 by an epidemic. The normal reproduction of the native tribes is slow owing to the heavy rate of infant mortality. Chinese settlers have large families and are a great asset but their numbers are too small for their increase to have much effect. Probably our best asset is the fact that we can afford to wait. If we are contented to live on our limited resources we can, as a country enjoy a moderate income and let progress come our way but if we intend to take a hand in the game of competition we must find means of supplying the money to do so.

The government is urged by interested parties to spend money on big engineering schemes, there are others who would rather see £10,000 spent on immigration than £100,000 on works which in themselves are not productive of profit however much they may benefit those who enjoy them. One thing is certain and that is that our cash resources are not enough to do both, at least not to any appreciable extent. Major Owen Rutter, the author of a work entitled " British North Borneo " predicts that great changes will take place within the ten years. What those changes are to be it is a little difficult to prophesy. If they are to take the shape of developing some of our natural resources we may look forward to prosperous years and the growing respect and admiration of neighboring countries.

## Chinese Student Invents Smallest Super-Receiver

The smallest super-regenerating receiver in existence has recently been completed by Wei Yoh-wu, a Chinese student who is taking a post-graduate course in physics at Columbia University. This remarkable piece of apparatus is contained in a cabinet measuring twelve by eight inches and six inches deep.

Within this small space Mr. Wei has succeeded in placing a two-tube super-regenerator with two stages of audio frequency amplification, the entire set comprising four vacuum tubes. Another remarkable feature is the system of switches which he has included in such manner that he can, at will, transform the circuit from a super-regenerator into the ordinary type of regenerative circuit. The switch system also includes arrangements to bring in as many tubes as are required, those tubes which are switched out of circuit having their filament current cut off automatically.

The set is complete within itself. It has a loop aerial measuring 10 by 6 inches wired into the lid, there being eighteen turns of wire in it. Variation of the inductive relationship between the primary and tickler coils is obtained in a very novel manner. The former is wound in a little panel which is hinged to the left side of the cabinet. A knob working a geared wheel, which is held in place by a spring, controls the movement of this panel, and thus permits the necessary tuning by means of varying the coupling between the two coils.

The radio frequency amplification unit is contained in a compartment on the right side of the cabinet, which measures three inches in width. The two tubes, the transformers and the switches are built into this compartment with the greatest possible economy of space. The front panel is bakelite and carries nine control knobs.

The U. V. 201 type of tube is used in the four sockets. Only 45 volts pressure is used on the plate of each of these four tubes. With this receiver in the Columbia University radio laboratory Mr. Wei has received the concerts from Atlanta, Ga.; Detroit, Mich.; Pittsburgh, Chicago and several other stations, the energy in each case being picked up on the ten-inch loop only.

In an office, located on the fiftenth floor of a steel constructed building, signals loud enough to be reproduced on a loud speaker were picked up by the tiny receiver from WOR and WJZ, eighteen miles away, despite the fact that the building is one of the worst shielded places in New York City. Only 45 volts were used on the plates of the tubes in these tests.

The normal wave-length range of the set when switched over to a plain regenerative circuit is 200 to 1,000 metres. By means of specially placed binding posts however, loading coils can be inserted in the circuit and the range increased to 25,000 metres without any loss of efficiency.

It took Mr. Wei two months to construct this wonderful set, working only in his spare time at his apartment, 541 West 124th Street. The workmanship is remarkable considering the fact that he had no adequate tools at his command.

Every detail of the set was carefully planned and executed. In the lid of the cabinet, where the loop aerial is wound, there is a schematic diagram of the circuit employed carefully drawn and then pasted to the lid. This diagram contains the constants of every piece of apparatus in the set. The control knobs on the front are all indicated with neatly engraved titled and gradations shown as a guidance in tuning. Mr. Wei was born in Honan, China.

# Japan's Great Coal Mines

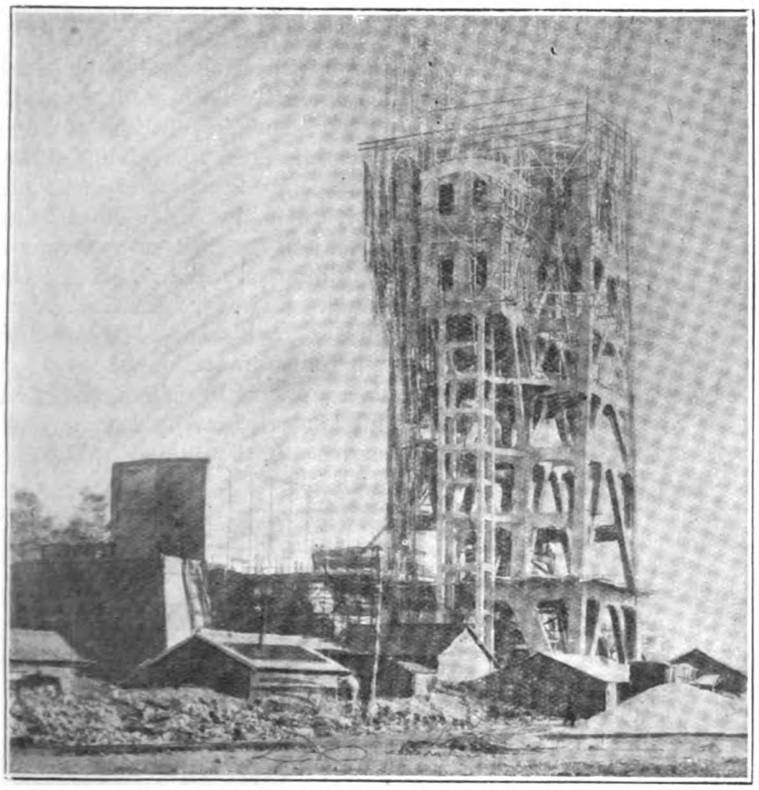
## 1. The Miike Collieries of the Mitsui Mining Company

THE greatest coal mine field in Japan is situated in the island of Kyushu, about ninety miles south of Moji on the main line of the Kyushu railway, some 2½ miles from Omita station. According to the report of the Mitsui Mining Co., which owns the mines, at the end of November 1921, the working area was then 50,445,967 *tsubo* (*tsubo*=36 sq. ft.)

There are six pits in operation in this mine field which is known as the Miiké district.

| *Name* | *Diameter of Pit Mouth Feet* | *Depth of vertical Pit Feet* | *Galleries Length Feet* | *Galleries Width Feet* | *Galleries Height Feet* |
|---|---|---|---|---|---|
| | | | No. 1 2,200 | 13 | 9.5 |
| Oura .. | 10 | — | No. 2 2,400 | 13 | 9.5 |
| Miyanoura .. | 12 | 176 | 9,600 | 18.8 | 9.1 |
| Katsutachi .. | 12 | 391 | 6,100 | 15 | 10 |
| Miyanohara . | 23 | 468 | 3,000 | 15.5 | 10 |
| Nanaura .. | 14 | 237 | 2,900 | 16 | 9.7 |
| Manda .. | 12 | 896 | 9,000 | 16 | 9.7 |

A Pit Mouth of the Miike Collieries



Reinforced Concrete Head-Frame at the Yotsuyama Pit of the Miike Collieries of the Mitsui Mining Company

### The Seam

Altogether there are eight seams found in this field. The first seam is the most important, its average thickness being ten feet, increasing in places to 25 feet. The coal in this seam in free from any shale or stone, and it is from this seam that the "Miiké Coal," famous all over the Far East, is mined.

The second seam runs at a depth of 8 to 10-tf. below the first seam which is called the "Hasshaku So." This second seam averages only about 5-ft. in thickness. Surveys show that this seam is found in all parts of the field and outcroppings are found in many places, especially about the Oura pit. These two seams are the only seams which are at present mined, the others all being of minor, or little commercial importance. However, with the object of reaching the lower seam of the Manda pit, which lies mainly under the sea-bottom, a new vertical pit was begun in April, 1918, and in May, 1920 had been sunk a depth of 1,348 feet. Since then preparation for mining has been carried out, both inside and outside the pit. The pit is round in shape, with an inner diameter of 23-ft. Its inside wall is built up with concrete and brick. It is intended to sink this pit to a depth of 1,800 feet, reaching the coal by horizontal galleries by piercing rock-seams so as to reach the deeper coal levels.

Miiké coal is light brown in color, and it has a high thermal value producing ample gas. As its moisture content is low it is particularly suited for boiler use, as well as for the manufacture of gas and coke. Miiké coal has no rival in Japan for use as a smithy coal. An analysis of the "Hasshaku So" coal shows :

| | |
|---|---|
| Water .. .. .. | 0.350 |
| Volatile matter .. .. | 40.100 |
| Coke .. .. .. .. | 53.217 |
| Ash .. .. .. .. | 6.333 |
| Sulphur .. .. .. | 2.285 |
| Calories .. .. .. | 8.140 |
| Specific gravity .. .. | 1.275 |

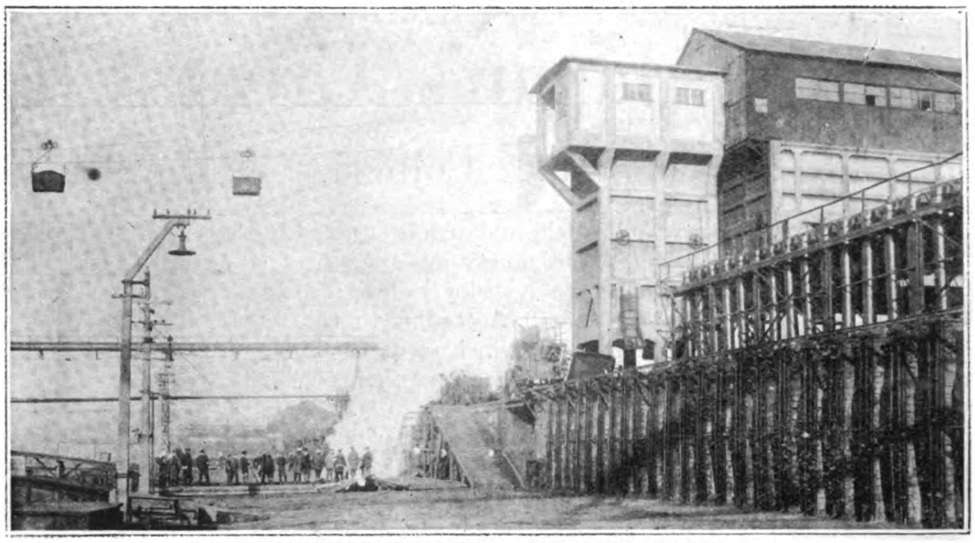
At Work in a Miike Pit

Its great steaming power owing to its high heating value and the uniform quality of the coal, have won for it the reputation of being the standard coal in the Asiatic markets. The average evaporative value of one pound of the lump coal is 9.72 pounds of water at the boiling point. This coal is particularly suited for forging purposes, and commands a wide sale at home and in China for such uses. Miiké coal cokes easily, and coke of excellent quality is made in "Kopper's" regenerative coke-ovens with a by-product recovery plant, of direct process, which is installed at the colliery. The average results of such reduction are:

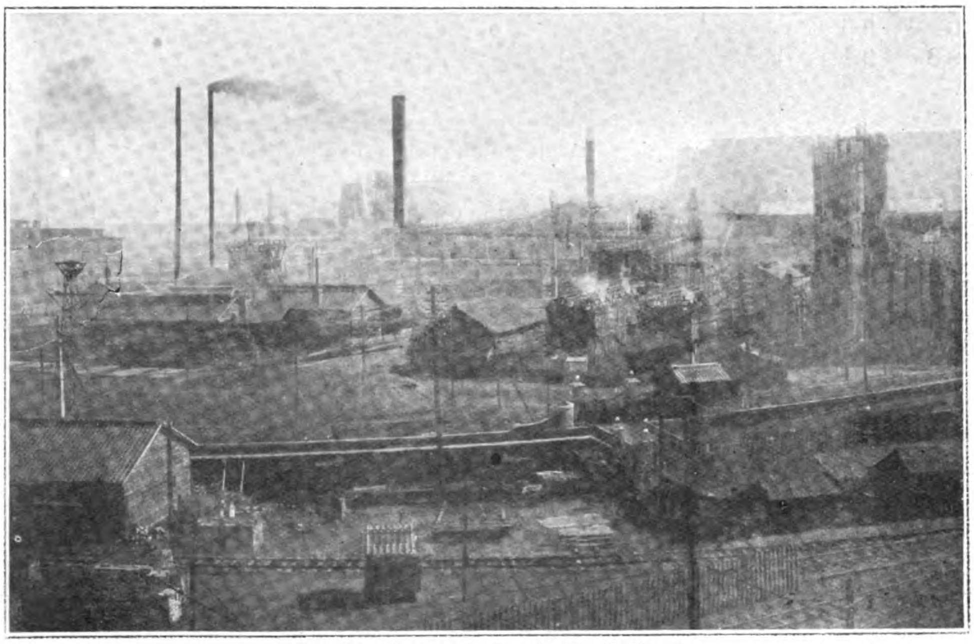
Per ton of Miiké Coal.

| | |
|---|---|
| Coke | 1,500 pounds |
| Gas | 11,000 cubic feet |
| Coal tar | 166 pounds |
| Ammonium sulphate | 21.3 ,, |

Coke produced from Miiké coal is hard and



Miike Chobai-Coke Works at the Miike Colliery



Dye Works attached to Miike Colliery

compact and is not to be distinguished from the best English coke.

## Method of Mining

Within the galleries the walls are either coal-walls or bricked, except at the points of intersection of the drainage and ventilation galleries. Even within the same gallery several coal walls are made by limiting the divisions of the pit, so that in case of emergency damage may be confined to the smallest possible area.

In the main excavation of the seam is carried out by leaving coal posts. These are 66 sq. ft. in a room of some 15-ft. width. However, in parts of the Miyanoura and Manda pits the coal posts are 112 sq. ft., and the rooms 20 feet wide. When the coal post is being cut, it is dug out from top to bottom.

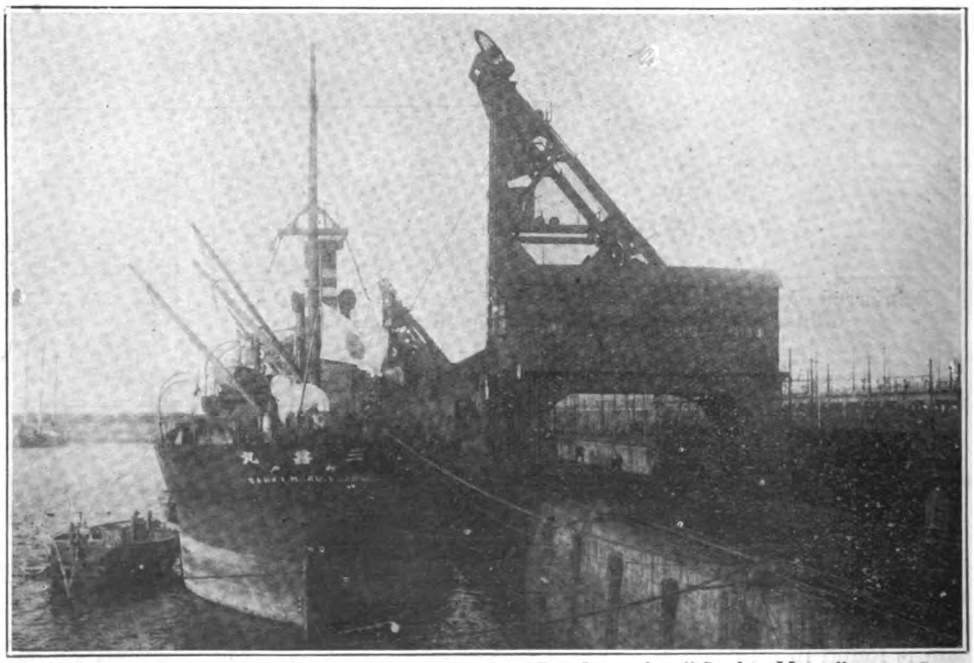
As a rule mining is performed exclusively by picks. The coal seams at Miiké have many cracks (one of the characteristics of the Miiké coal), so it is not practicable to blast. When the seam is more than 10-ft. thick mining is carried on by working in tiers, two or three, from the top of the seam to the bottom. Often at the bottom of the seam silica rock is found, and this required blasting of the second or third tier.

When mining in the coal rooms four miners compose a gang. Their daily average is about eight tons of coal, two tons a man. But when the coal posts are being dug this production is usually increased about 20 per cent.

Although the chief cutting is done by picks, all the pits have recently been equipped with several coal cutters, and in cutting through faults, air-compressors and rock drills of the "Little Wonder" type are brought into use.

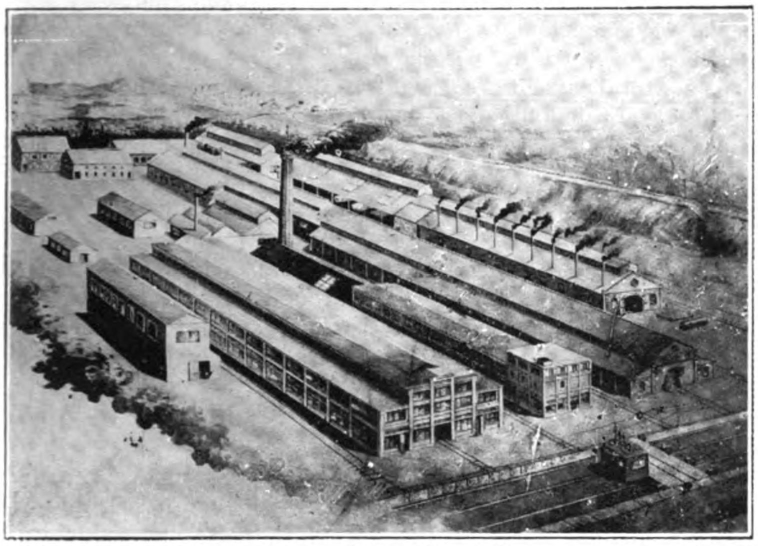
The upper seam of the Miiké field being very hard it is hardly necessary to use timber supports when mining is carried on by the coal room method. However, in the neighborhood of faults, a rock-seam of some 2-ft. thickness is often found in the upper seam; in such places timber supports 10-ft. long are used.

When mining is carried on by leaving coal posts, the pressure of the upper rock-seam



Miike Port: Showing Coal Loading Devices Loading the "Sanka Maru" owned by the Mitsui Bussan Kaisha

often becomes too great for the post to support, and the posts are suddenly crushed. In order to prevent this timbers 6-ft. long are built up in box form and the inner space is filled with rocks, so that the heavy upper seam may be supported without the coal post. The timber used is pine, and for every ton



Machine Shops of the Miike Collieries

of coal mined about one-eight of a piece—ten feet long—is required, in the coal rooms. At intersecting points, or in the machine rooms within the galleries, steel and brick supports are built up.

Recently, although the coal post method with reinforcing props of timber and rock is most in use, the sand flushing method is being adopted. This almost guarantees safety both inside and outside the gallery. At the mouth of each pit, special apparatus is installed, except at Oura, by which sand, sand-rock, and sea sand are flushed into the vacated rooms.

The total seepage in the galleries of the Miiké mines is 2,000 cubic feet a second, or 80,000 tons every 24 hours. For every ton of coal produced there is a seepage of 16 tons. During the rainy season (June-July) the quantity of water in the galleries is often increased 200 per cent. Each gallery is drained into one or two ditches, so that the water may be led off into the smallest possible area, this effecting an economy of pumping, and promoting the safety of operation. Both electric and steam pumps are used, except that pumping operations at the bottom of galleries are all performed by electric power. The pumping equipment of the Miiké mines at the end of September, 1921, was as follows :—

| | | | |
|---|---|---|---|
| Davy pumps .. .. | 8 | with a total of | 6,180 h.p. |
| Duplex pumps .. .. | 18 | | 7,568 |
| Centrifugal pumps directly connected with steam turbines of low pressure | 2 | with a total of | 1,560 h.p. |
| Electric plunger pumps .. | 36 | | 1,203 |
| Centrifugal electric pumps | 56 | | 6,980 |
| Total .. .. | 115 | | 23,491 h.p. |

## Ventilation

As these mines employ the coal-post system of mining the difficulties of ventilation increase with the progress of mining. Consequently each gallery has its own ventilation apparatus. The kinds of fans in operation and their capacities are as follows :

| Location | Kind | Capacity air replaced every second | Units | Total h.p. |
|---|---|---|---|---|
| Oura .. | Champion | 70,000 cu. ft. | 1 | 30 |
| Miyanoura.. | Sirroco | 150,000 | 1 | 200 |
| Nanaura .. | Giebal | 150,000 | 1 | 90 |
| Miyahara .. | Sirocco | 81,000 | 1 | 139 |
| Katsutachi.. | Giebal | 200,000 | 1 | 92 |
| Manda .. | Walker | 200,000 | 1 | 200 |
| | (?) | 300,000 | 1 | 500 |
| For partial use in each gallery | centrifugal | from 1,500 to 50,000 .. | 23 | 164.6 |
| Total .. | | .. .. .. | 30 | 1,315.5 h.p. |

## Lighting System

Within the galleries Wolff and Zaiper type lights are in use The important traction lines within the galleries and the machine rooms are equipped with a total of 2,600 electric lights of low pressure 100 volts.

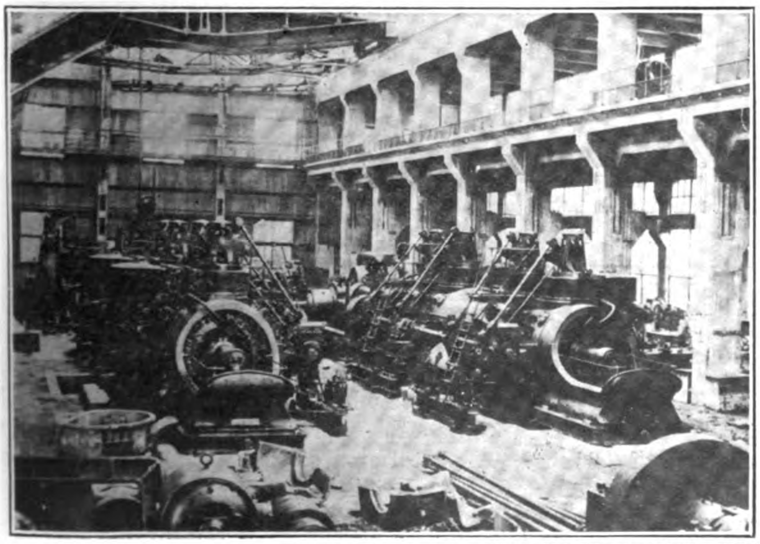
## Underground Conveyance

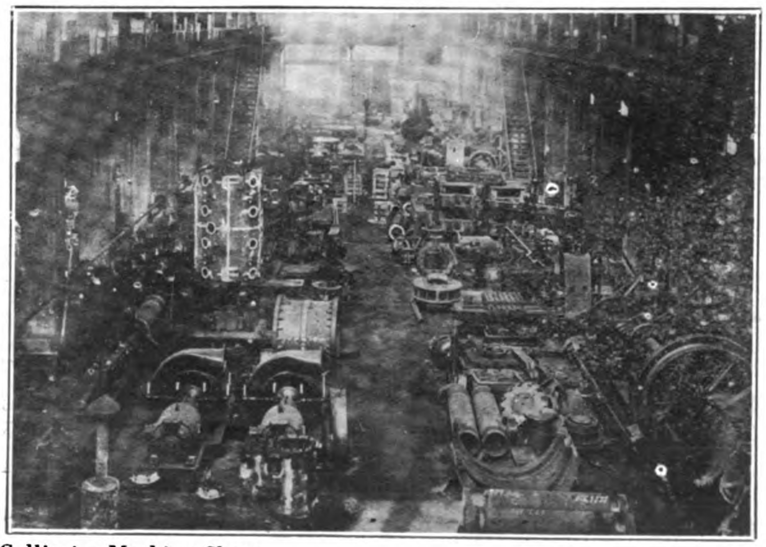
All the galleries are tracked with 16 or 24 pound rails, gauge 1-ft. 6-in. The Manda pit has a 2-ft. gauge line.

The Manda pit is equipped with steel coal cars, with a capacity of 9.65 tons. The rest of the pits have wooden coal cars with a capacity of 0.45 tons. Short distance transportation is carried on by horses, but long distances are covered by electric or cable cars. There are something like 350 horses in the Miiké collieries, some of which have been working for eight years, although their average efficiency is only three years.

Winch and endless-rope system is used for cable transportation. In the sloping galleries winches with a horse-power 10 to 60 are in use. These endless ropes are used in places where there are curbs, or where the slope often changes in degree ; the horse-power of these engines ranges from 20 to 220.

At the mouth of the vertical pits and at the bottom of the galleries creepers are in use, especially in short steep slopes.





Interior Views of the Miike Collieries Machine Shops

Electric cars are used in the Manda pit, where there are 2.2 miles of lines underground. Twenty-three cars are in use, and each car weigh 4 tons ; they have a speed of six miles an hour, and a traction power of 1,300 pounds. The list of traction equipment follows :

| | Power | Number | Total Horse Power |
|---|---|---|---|
| Winches .. | Steam | 2 | 23 |
| ,, .. | Electric | 33 | 1,100 |
| Endless rope.. | Steam | 3 | 240 |
| ,, ,, .. | Electric | 29 | 1,950 |
| Creepers .. | Electric | 7 | 63.3 |
| Electric Cars.. | — | 23 | 460. |
| Total .. .. .. | | 97 | 3,839.3 h.p. |

## Transportation at Vertical Pits

Steam winding engines have been in general use at all the pits, furnished with hand and steam controllers. However, the number two pits of the Miyanoura mine (recently opened) is equipped with an electric hoist with hand and compressed air controller. The cage is of steel with wooden slides, equipped with safety-catch and safety-hook.

Recent head frames constructed at the No. 2 Miyanoura, at No. 1 and No. 2 pits of the Manda mine, are of steel. There are nine hoists at the mouth of each pit with a total capacity of 3,450 h.p. The Katsutachi, Mihara and Manda pits are equipped with steam-winding engines, six in all, with a total of 470 h.p.

## Mine Railway System

Each of the mines is tapped by the railway system owned by the Mitsui interests. One line reaches Yokosuhama, another meets the Kyushu line of the government railways at Omuta, and the third transports coal to Miiké port, whence mining materials are also forwarded to the mines.

The Miiké mine field railways were licensed for construction in July, 1890, and construction was completed in July, 1891. In November, 1902, a great plan was adopted to build a harbor about 2½ miles south of the city of Omuta. The first part of the scheme was completed in November, 1908, and in March, 1910, the port of Miiké was opened. Since then the greatest part of the coal produced in this mine field is transported to the docks at Miiké by the colliery railway, and shipped to domestic centres by vessels owned by the Mitsui Mining Company, and abroad on vessels of all nationalities.

The total length of the railways is 43 miles 72 chains. The gauge is 3-ft 6-in., and the rail used is a 60-pound one. The coal-cars are made of steel, and wood, and of wood and steel. The steel cars have a capacity of 8 tons ; the wooden cars of 4 tons, the wood and steel cars of 7 tons. All of these cars can be emptied from the bottom. There 742 coal cars, and 310 freight cars in operation. Sixteen steam locomotives are in use, each having a traction power of 4,000 to 8,000 pounds ; and they range in weight from 14 to 24 tons. Between Miiké port and Miyanoura, there are twelve electric locomotives in operation, weighing 20 tons each, with a traction power of 8,000 pounds.

## Method of Grading

Grading plants are built at each pit mouth, except at the Oura pit. In the neighborhood of Ichimairu a washing plant is in operation.

## Dry Grading

Coal is directly transported to the screening plant in the cars sent from the pits. It is classified into small and dust. The large lumps are graded by hand, into big and medium. At Miyanoura, Katsutachi! and Miyanohara, two screening machines are set up. The Manada pit has four screening machines. All these are operated by steam with the exception of those at Miyanoura which are operated by electricity.

## Wet Grading

Coal sent from the screening plants is under 1¼ inches in size. This cannot be graded by hand, so it is sifted and graded by water at the washing plant by a picking machine. Two lines of these machines operated by electric power are set up in this plant, baving a total capacity of 1,500 tons in 24 hours. Another water-grading plant handles coal dust under ⅜-in. This plant has a capacity of 600 tons every 24 hours, and its product is chiefly used for coke making.

## Power Plants

There are two central electric power stations to supply the power required for various purposes around and in the mines. One of the plants is equipped with six Curtis steam-turbines of 1,000 kilowatts each. This plant is located at Yotsuyama coal storage yard. The other plant consists of four Nurenberg type gas engines of 3,000 h.p. each, and is operated by gas from the coke oven. When there is need of more power, or in cases of accident, the Yotsuyama power plant is able to turn in two 1,260 k.v.a. alternators, using power received from the Kumamoto Hydro-electric power company.

The maximum use of power to-day is 6,700 kilowatts. The daily average of power generated is 160,000 k.w. h.

The equipment of the plants is as follows :

STEAM POWER PLANT

| | | |
|---|---|---|
| Steam boiler : Sterling type, water-tube . | 420 h.p. | 10 units |
| Babcock and Wilcox, water-tube .. | 411.3 | 4 |
| Curtis, vertical steam turbines .. .. | 1,000 k.v.a. | 5 |
| Curtis, vertical steam turbines prime-mover | 1,850 k.v.a. | 1 |
| Generator: direct connected, alternating current, connected with turbine ; 3 phase, 40 cycle, 2,300 volts .. | 1,000 k.v.a. | 5 |
| Same .. .. .. .. .. .. | 1,850 k.v.a. | 1 |
| Alternator: 60 cycles, 40 cycles ; 2,300 volts .. .. .. .. .. .. | 1,260 k.v.a. | 2 |

GAS POWER PLANT

| | | |
|---|---|---|
| Prime mover: Nurenberg, horizontal compound 4 cylinder gas engine .. | 3,000 h.p. | 2 units. |
| Generator: direct connected to gas engine, alternating current, 40 cycle ; 2,300 volts .. .. .. .. .. .. | 2,600 k.v.a. | 2 |
| Boilers : Lancashire .. | 83 | |
| Cornish .. .. | 3 | |
| Water-tube type | 10 | |
| Total .. .. | 96 | |

## Employees

The average number of employees in the mines during 1921 was 14,049.

## Production

Production of the Miiké mines during the past five years was as follows :—

1917, 2,007,934 ; 1918, 1,885,881 ; 1919, 1,970,266 ; 1920, 1,932,798 ; 1921, 1,626,927 tons.

The Mitsui Bussan Kaisha has the exclusive right to market the Miiké coal.

## The Port of Miike

The inner port of Miiké is embraced between two piers which jut out to the north and south separated from each other by a distance of 6,000-ft. The total area of the port is 150,000 *tsubo*, and there is ample accommodation for coal ships and other cargo vessels.

The channel from the inner port to the outer port is 6,000 feet long, and at low tide is 18 feet deep.

The piers showing the channel are built 1 foot higher than the high water level; they are 12 feet wide, and 450 feet long.

A dock belonging to the Mitsui interests is also a part of the port equipment. Its area is 40,000 *tsubo*. By means of the water gate the depth of the dock is maintained at 28 feet at its lowest. At the mooring wall the depth is maintained at 30-ft. and at high water this is increased 8-ft.

The mooring wall is 1,380-ft. long, with a capacity of three steamers of 10,000 tons at one time. The height of the wall is 41-ft. 6-in. There are three speedy loading machines on the wall, each having a capacity of 5,000 tons in 24 hours.

## 2. The Mines of the Hokkaido Colliery & Steamship Co., Ltd.

### (Hokkaido Tanko Kisen Kaisha)

THE Hokkaido Tanko Kisen K. K. is exclusively engaged in coal mining in the island of Hokkaido where it operates the following nine mines with a total area of 46, 715,106 *tsubo* (*tsubo*= 36 sq. ft.):—

1. Yubari Mine, located at Yubari, Yubari Machi, Yubari Gun. Area, 7,924,774 *tsubo*.
2. Shin Yubari Mine, located at Shin Yubari, Yubari Machi, Yubari Gun. Area, 2,231,220 *tsubo*.
3. Wakanabe Mine, located at Wakanabe, Yubari Machi, etc. Area, 7,890,789 *tsubo*.
4. Mayachi Mine, located at Mayachi, Yubari Machi, etc. Area, 5,520,836 *tsubo*.
5. Noborikawa Mine, located at Noborikawa, Yubari Machi, etc. Area, 4,774,323 *tsubo*.
6. Manji Mine, located at Manji, Kurisawa Mura, Sprachi Gun. Area, 5,622,572 *tsubo*.
7. Sorachi Mine, located at Utashinai, Utashinai Mura, Sorachi Gun. Area, 9,879,530 *tsubo*.
8. Horonai Mine, located at Horonai, Mikasayama Mura, Sorachi Gun. Area, 1,508,817 *tsubo*.
9. Ikuharubetsu Mine, located at Ikuharubetsu, Mikasayama Mura, Sorachi Gun. Area, 1,362,245 *tsubo*.

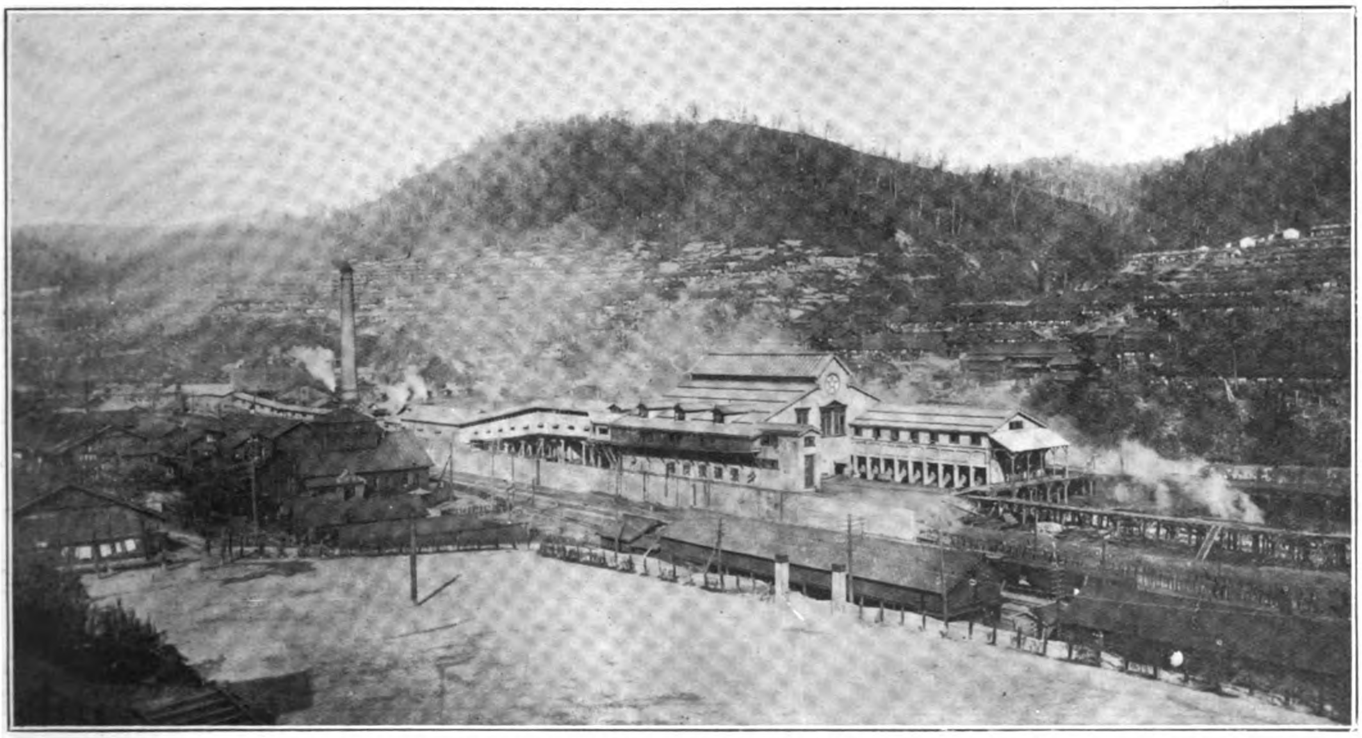
These mines are located at inland points and connected by rail with the ports of Muroran and Otaru, distant some 80 to 110 miles from the mines. The production is constantly being increased by opening up new galleries, and by the installation of better and more modern machinery. Plans for development now under way will eventually bring the total output up to 4,000,000 tons a year. The output for the past two years was as follows:

| Name | 1920 | 1921 | When present extensions are completed |
|---|---|---|---|
| Yubari .. | 739,925 tons | 574,500 tons | 1,300,000 tons |
| Shin Yubari .. | 205,700 | 176,300 | 300,000 |
| Wakanabe .. | 174,918 | 196,400 | 500,000 |
| Mayachi .. | 147,400 | 103,700 | 200,000 |
| Norborikawa .. | 216,600 | 167,800 | 250,000 |
| Manji .. | 330,800 | 314,150 | 450,000 |
| Sorachi .. | 352,096 | 261,300 | 550,000 |
| Horonai .. | 202,500 | 175,100 | 250,000 |
| Ikuharubetsu . | 144,500 | 126,300 | 200,000 |
| Total .. | 2,514,439 | 2,095,550 | 4,000,000 |

The coal mined in the Hokkaido is used in stove, factory locomotive, steamship, and in the manufacture of coke. The coal from the Yubari mine is best suited for the distillation of gas and coke. That from Horonai and Ikuharubetsu is particularly valuable for use as fuel in the production of gas. Hokkaido coal is sold on the Siberian coast, China, and North and South America, as well as in the Japanese domestic markets. The Mitsui Bussan Kaisha are the sole selling agents of the Hokkaido Tanko Kisen K. K.

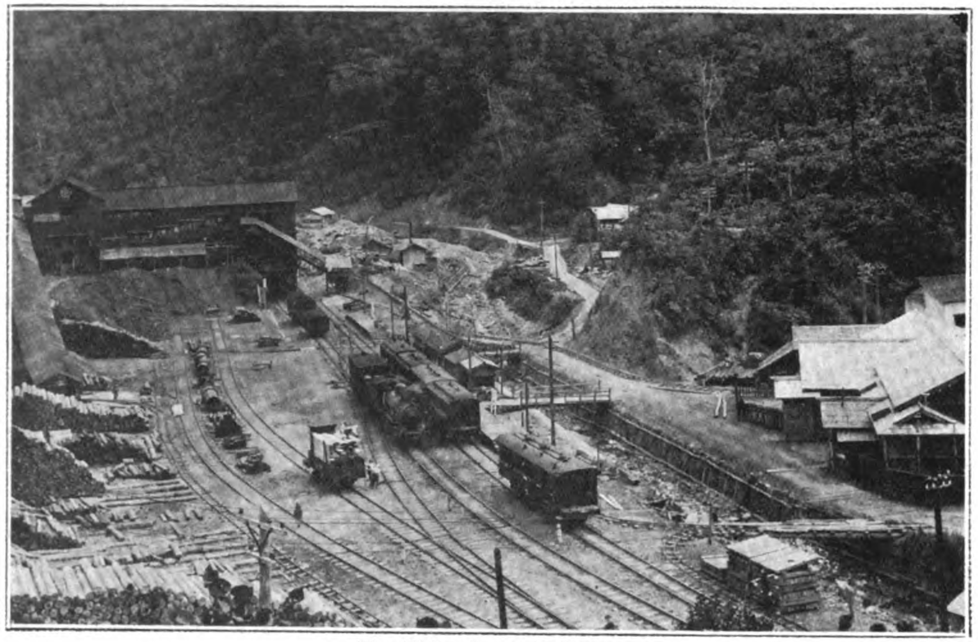
### The Yubari Mine

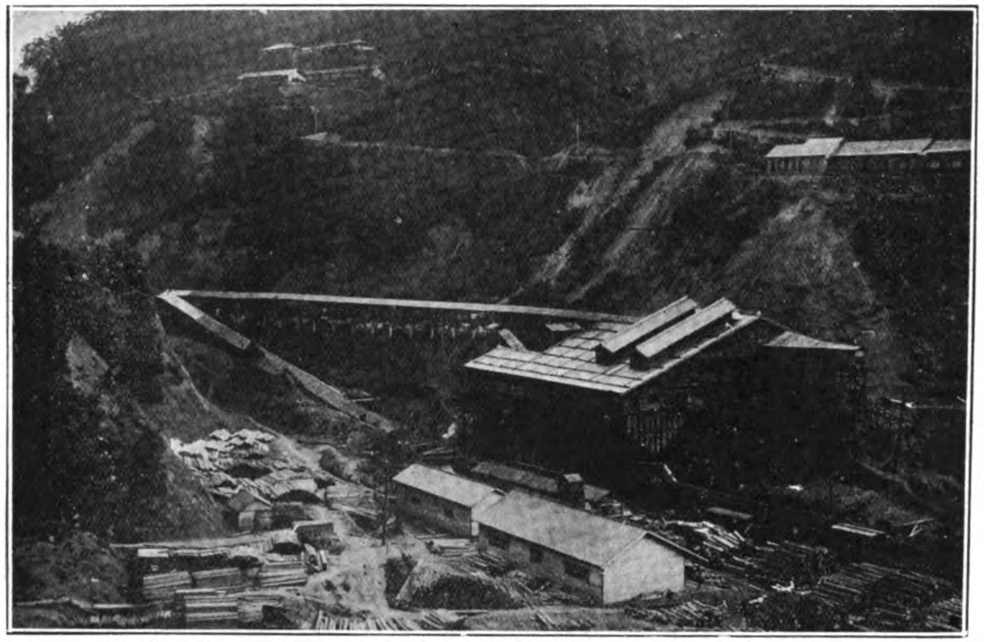
The Yubari mine was discovered in 1888, and in 1889 the Hokkaido Tanko Kisen K. was organized to operate it. In 1892,

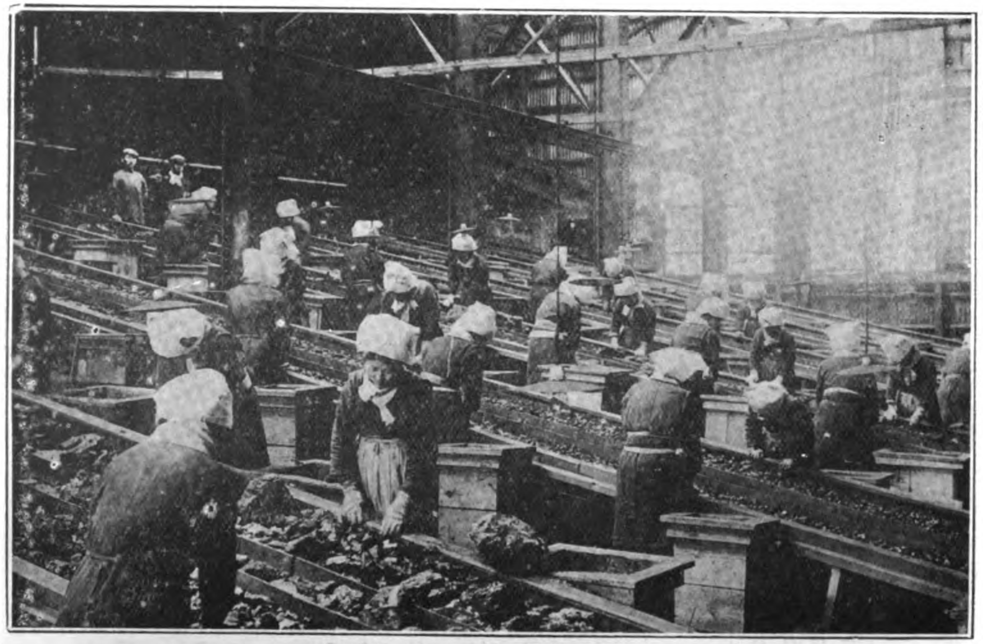


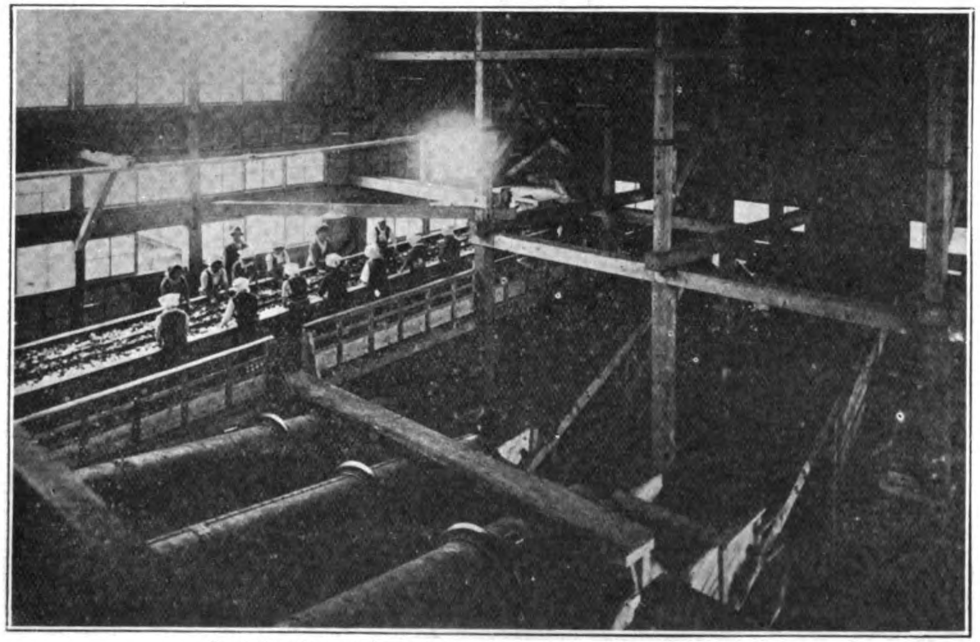
The Main Pit of the Yubari Colliery of the Hokkaido Tanko Kisen Kaisha

# VIEWS OF THE HOKKAIDO TANKO KISEN KAISHA'S COLLIERIES IN HOKKAIDO

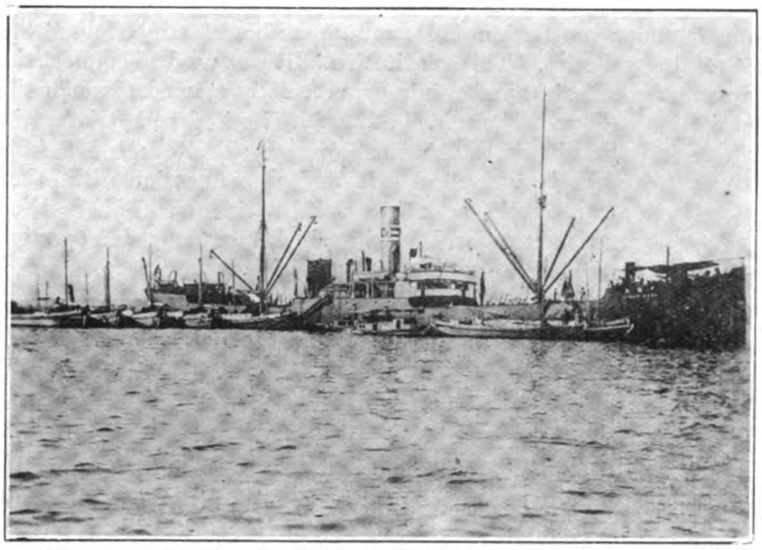

The Noborigawa Colliery


Coal Sorting and Screening Plant of the Futamizawa Pit of the Manji Mine


Coal Sorting at the Yubari Mine


Coal Sorting and Washing Plant of the Shin Yubari Mine

The Port of Muroran, Hokkaido, showing the Great Coal and Iron Ore Wharf



The "Yubari Maru," 6,200 tons, one of the Coal Fleet of the Hokkaido Tanko Kisen Kaisha

railway connection with the ports was completed and the mine thrown open to business.

The head of the coal seam appears at Shikorokabetsu, inclined from 15 to 20 degrees where it enters the mountains to the north-east of the field. The seam to the south is confused, and has three branches. The upper seam is four feet thick : the main seam is about 180 feet below the surface and is 24 feet thick ; while the lower seam is 500-ft. down and is 4-ft. thick. All three seams are being mined.

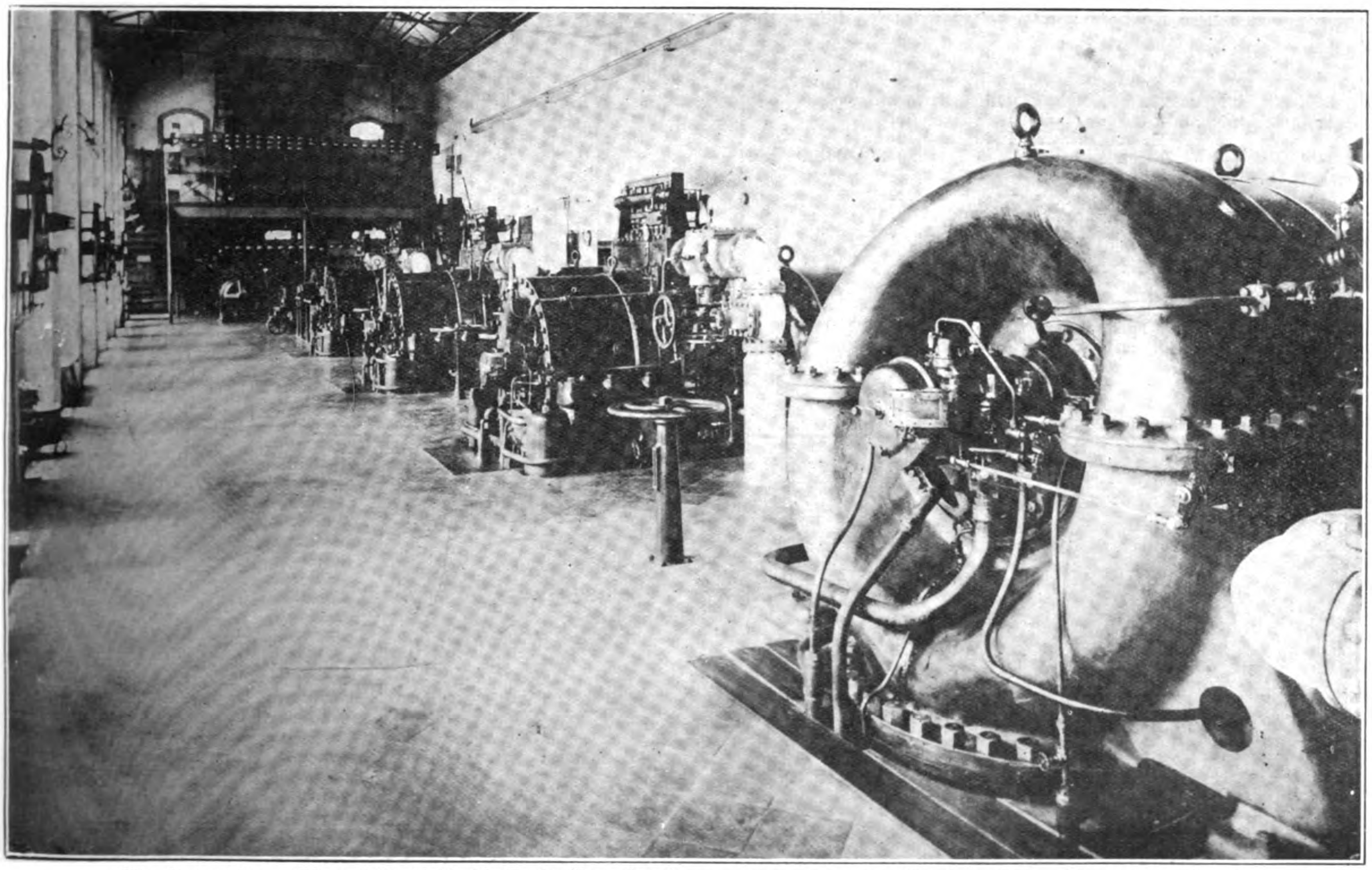
The analysis of the coal from the Yubari mine is as follows :

Water, 1.30 ; volatile matter, 46.47 ; fixed carbon, 48.17 ; ash, 4.06 ; nitrogen, 1.43 ; sulphur, 0.34 ; calories, 7,810. The ash is brown.

## Method of Mining

There are eight pit mouths to the Yubari mine, the Chitose, Kitagama, Mogami, Nagara, Daishin, Oi, and Jintsu. Where the pits are above the water level, galleries are opened directly into the seam from its outcrop, in pits under the water-level, either vertical or sloping galleries are opened.

Formerly, the method used was to open two adits on both sides of the seam at a distance of 500 feet from each other, at the same



The Central Power Plant of the Hokkaido Tanko Kisen Kaisha, supplying power to all mines of the Company, equipped with 12 B. & W. Boilers ; 4—1,000 k.w. General Electric-Curtis turbo-alternating sets of 3,300 volts, 3 phase, 3,000 r.p.m: and two 1,500 k.w. G. E., Curtis sets of 1,500 k.w.

time driving a ventilation adit, running at about 30 to 50 feet above the mining galleries. This ventilation adit was used to connect the two mining galleries, and mining was usually started through the ventilation gallery. The mined adits were limited to 1,000 feet in length and the circuit of the two adits was limited to 500 feet. Strong, heavy coal pillars were left, and all connection with other galleries was completely cut off to avoid accidents. This method was very unsatisfactory and has largely been superceded by more advanced methods.

In recent years the sand flushing system has been adopted and for the purposes of mining, two-step and three-step long walls are being used. The sand flushing equipment is erected at the pit mouths, and the sand dug in the neighborhood of the Kawabata station on the Yubari Railway line, and carried to the pit by that line.

The actual cutting of the coal is done by picks, or blasted by using soft powder. In order to open galleries rock-drills which are operated either by electricity or compressed-air are in use.

## Timbering

Parts of the galleries are built up with bricks, but on the whole the greater part is supported by timbering in the shape of *torii*. Where mining is being carried on, *torii* shape props are used.

## Drainage

Water which gushes into the galleries below the water-level is pumped out by electric power or compressed air ; while that in the galleries above water is let out by gravity ditches.

The pumping equipment of these mines is as follows :—

| Name of pit or gallery | Kind of pump | Capacity h.p. | Cu. ft. | Lift. | Number. |
|---|---|---|---|---|---|
| Kitakami North No. 2 | Electric turbine | 85 | 50 | 500-ft. | 1 |
| do. | do. | 70 | 50 | 400 | 1 |
| do. | Knowles special | 16-in., dia of steam pipe | | | 1 |
| | | 7-in., dia of water pipe | | | 1 |
| Kitakami South No. 6 | do. | | do. | | 1 |
| do. | Evans-Cornish | 18-in., and 12-in. | | | 1 |
| do. | Electric turbine | 85 | 50 | 500-ft. | 1 |
| Mogami No. 3 adit, bottom | do. | | do. | | 2 |
| Tenryu pit, East No. 1 | Evans-Cornish | 18-in. and 12-in. | | | 1 |
| Tenryu pit, East No. 3 | do. | | do. | | 2 |
| Oi pit | Electric turbine | 85 h.p. | 50 | 500 | 2 |
| do. | do. | 120 | 50 | 700 | 1 |
| do. | do. | 50 | 30 | 500 | 1 |
| do. | Electric three speed pump | 15 | 15 | 300 | 1 |
| Jintsu pit | Electric turbine | 50 | 30 | 400 | 1 |
| do. | do. | 35 | 25 | 400 | 2 |
| do. | do. | 35 | 25 | 300 | 1 |

## Ventilation

The galleries are ventilated throughout by fans operated by electricity or steam. The principal equipment is as follows :

| Location | Kind | Diameter | Width | Power | Horse Power |
|---|---|---|---|---|---|
| Chitose .. | Giebal | 20-ft. | 8-ft. | steam | 40 h.p. |
| " .. | Champion | 8 | 4 | electric | 50 h.p. |
| Mogami .. | Sirocco | 7-ft. 6-in. | 5-ft. 3-in. | " | 250 |
| Daishin .. | " | 10-ft. 6-in. | 6-ft. 4-in. | " | 500 |
| Tenryu .. | " | 7-ft. 6-in. | 5-ft. 3-in. | " | 250 |
| " .. | Giebal | 8-ft. | 8-ft. | steam | 40 |
| Sanban .. | Champion | 8 | 4 | electric | 50 |
| Jintsu .. | " | | do. | | |

## Underground Transportation

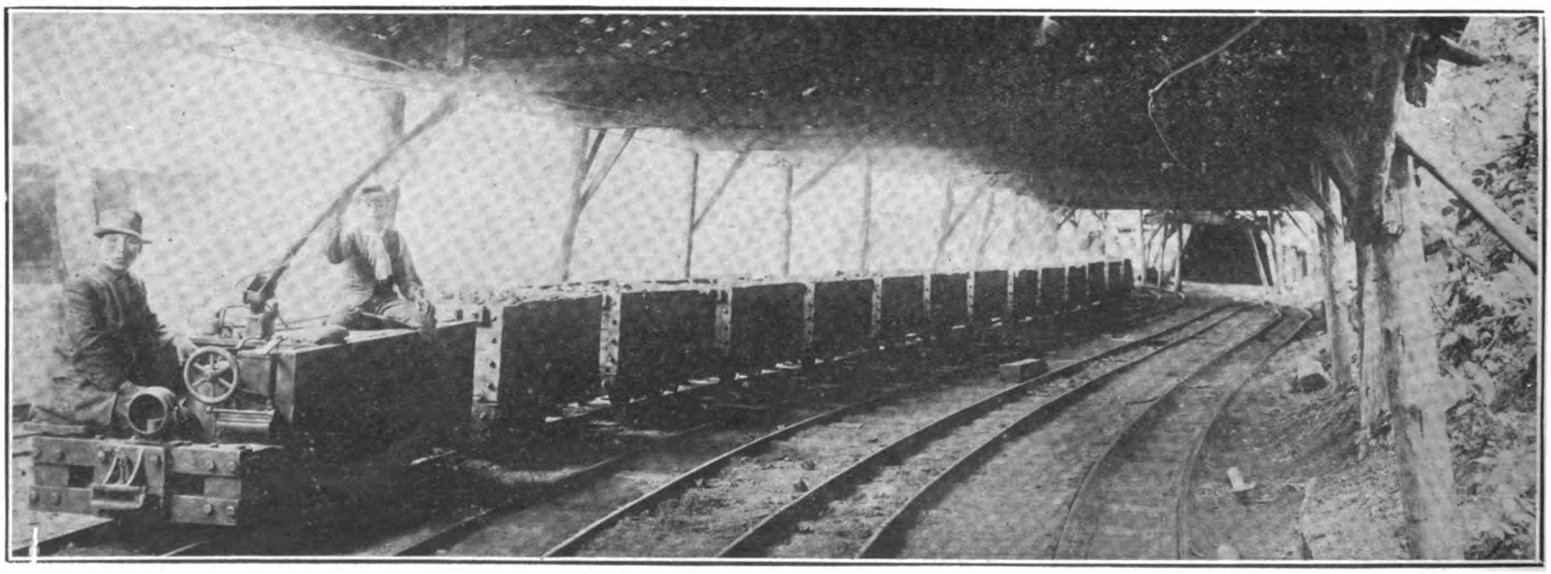
Most of the galleries are double tracked with rails of 12 to 18 pounds, gauge 50 centimetres. Each car has a capacity of 0.8 tons, and empty weighs 700 pounds. From the place where mining is going on to the mouth of the gallery transportation is done on bicycle roads, taking advantage of the slope or by " shute " or " face conveyors." Within the galleries hauling is done by horses, except in the Chitose pit where an air-driven locomotive is employed.

The Daishin vertical pit 18 feet diameter is built up with brick to a depth of 560 feet. At a point 193 feet below the pit mouth a tunnel is opened into the vertical pit making a connection with the outside. An electric railway is operated through this tunnel, connecting it with the coal grading plant at the main pit. The hoist of this pit operated by electricity is set up at the pit mouth on top of a mountain, and it hauls up four cars at one time.

Transportation outside the mines is carried on by electric locomotives or horses. The equipment is as follows :

| Location | Kind | Diameter or drum | H.P. | Diameter of cable | Length |
|---|---|---|---|---|---|
| Kitagami .. | steam cycle groved drum | 6-ft. | 200 h.p. | $1\frac{1}{4}$-in. | 4,800-ft. |
| Mogami .. | Electric cycle conical drum | 9 | 150 | $1\frac{1}{4}$ | 3,000 |
| Daishin .. | Electric winch double drum | 9 | 200 | $1\frac{1}{2}$ | 600 |
| do. .. | Electric cycle conical drum | 9 | 100 | $1\frac{1}{4}$ | 1,700 |
| Tenryu, East slope pit .. | do. | 9 | 150 | $1\frac{1}{4}$ | 1,500 |
| Tenryu, West slope pit .. | do. | 9 | 150 | $1\frac{1}{4}$ | 1,700 |
| Oi .. .. | Electric winch double drum | 6-ft. 6-in. | 150 | $1\frac{1}{4}$ | 400 |
| Jintsu .. | Electric cycle conical drum | 8 | 50 | $1\frac{1}{4}$ | 1,500 |
| Jintsu pit, outside .. | Electric winch double drum | 3-ft. 4-in. | 50 | $\frac{7}{8}$in. | 500 |
| Teimi pit, outside .. | Electric cycle conical drum | 6-ft. | 50 | $\frac{7}{8}$-in. | 2,500 |
| Main pit, outside .. | Electric cycle | 5-ft. | 50 | $\frac{7}{8}$-in. | 700 |

Several small hoists are installed for use at any time.

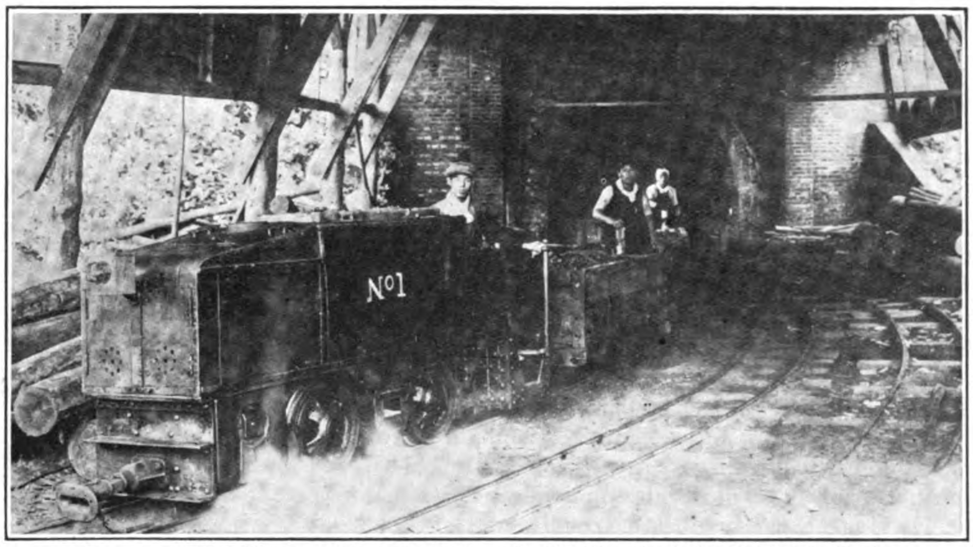


**Electric Locomotive Hauling out Loaded Coal Cars at Kumanosawa, the 7th Pit of the Shin Yubari Mine of the Hokkaido Tanko Kisen Kaisha**

## Method of Grading

Both the Teimi pit and the main pit are equipped with coal picking machines. The capacity of the machine at the main pit is 1,500 tons in ten hours. Three Gimmer (?) type screens sift the coal into large, small, and dust. The third grade coal is graded by picking out the large lumps, and small lumps are selected by hand. The storage bin for graded coal has a capacity of 2,000 tons. Another bin of 3,000 tons is now under construction.

The machine at the Teimi pit has the same capacity as that at the main pit, and the coal is sifted in the same way. Large lumps are sent to a Markas' picking table, smaller lumps are selected by the picking band, and the dust is sent directly into the bin.



Compressed Air Locomotive at the Wakanabe Pit Mouth of the Hokkaido Tanko Kisen Kaisha

Second grade coal is sifted into large, small and dust by one Gimmer's screen; the small lumps are again sifted into medium lump and small. The small lumps are then sent to a Brackett type coal washing machine where they are graded. The coal bin at this pit has a capacity of 1,900 tons.

## Air Compressors

In order to meet the need for compressed air for the gallery pumps, coal cutting machines, small type fans, and air locomotives, air compressors are installed in the following place :—

| Description of machine | Main Pit | Teimi Pit | | Daishin | |
|---|---|---|---|---|---|
| Diameter of steam cylinder ... ... | 24-in (1) | 20 (2) | 22 (3) | Elec. | Elec. |
| Diameter of air pipe | 24¼ | 22¼ | 16⅜ | 25-in. 15-in. | 25-in. 15¾-in. |
| Stroke ... ... ... | 42 | 42 | 24 | 20 | 18 |
| Rotations per second | 75 | 65 | 90 | 150 | 214 |
| Quantity of air compressed ... ... ... | 2,624 cu. ft. | 2,330 | 400 | 1,695 | 2,175 |
| Highest pressure ... | 100-lbs. | 80 | 800 | 80 | 100 |
| Horse power ... ... | 646 | 480 | 670 | 300 | 348 |
| Machines installed ... | 2 | 1 | 1 | 1 | 1 |

## Boiler Equipment

Power for the air compressors, winches and steam heaters the following boiler equipment has been installed as follows :

| Lancaster. | Main Pit. | Teimi Pit. |
|---|---|---|
| Diameter of boiler .. .. .. | 6-ft. 6-in. | 6-ft. 6-in. |
| Length of boiler .. .. .. | 24-ft. | 24-ft. |
| Length of flame tube .. .. | 2-ft. 6-in. | 2-ft. 6-in. |
| Heating area .. .. .. .. | 580 sq. ft. | 580 sq. ft. |
| Steam pressure.. .. .. .. | 80-lbs. | 80-lbs. |
| Number installed .. .. .. | 8 | 7 |

## Electric Equipment

Electricity is supplied to all the mines of the Hokkaido Tanko Kisen K.K. from a central power station erected in the neighborhood of the Teimi Coal Grading Station. This station is equipped with :—

1. Four Curtis steam turbines, 1,000 kilowatts, 150-lbs. pressure, 3,000 r.p.m.
2. Two Curtis steam turbines, 1,500 kilowatts, 150-lbs. pressure, 3,000 r.p.m.
3. Four G.E. alternating current generator, 3 phase, 3,300 volts, 1,000 kilowatts, 3,000 r.p.m.
4. One general electric ; same ; except 1,500 kilowatts.
5. Twelve Babcock & Wilcox water-tube boiler, heating area 3,441 sq. ft. grate area, 70 sq. ft. h.p. 400, steam pressure, 155-lbs.

In addition, rotary air pumps, centrifugal water pumps, switchboards of various kinds, hand cranes, water pumps, water heaters, coolers, etc., are installed. Electric power is chiefly used to operate the fans, hoists, coal grading machines, pumps and general construction work. The company uses 13,000 lights of 10 candle-power each, and supplies power and light to the towns in the district. Direct current of 550 volt is used in the electric cars. The power plant is furnished with two rotary transformers of 150 kilowatts.

## Machine Shop

The mines carry on their own repair work in a machine shop at the Yubari mine, divided into wood working, engineering, casting, tempering, lathe and finishing departments. Castings under 5

Relief Party at Work in the Yubari Mine

Futamizawa Pit of the Manji Mine

tons are made, and in the tempering a half-ton steam hammer is installed. The lathe section is equipped with lathes from 6 to 20 feet long, and turbo-blowers operated by 20, 30, 10 and 50 h.p. motors.

### The Manji Mine

This mine was opened to business in 1909 and in 1914 it was connected by railway with the imperial government lines at Shibun. There are three seams 4, 6 and 7 feet thick which outcrop at bed of the Poroporohoromui River.

The coal of this mine analyses; Water, 1.90; volatile matter, 41.04; fixed carbon, 51.75; ash, 5.31; nitrogen, 1.33; sulphur, 0.38; calories, 7,700; color of ash, reddish brown.

The principal shafts now being worked are the Fukuju, Botan, Sakura, Aoi, Momiji, all belonging to the main pit, and the Hinode and Hatsune, belonging to the Mirudo pit opened to business in February, 1918. All of the Manji pits use turbine pumps of 12 to 85 h.p., having a capacity of 10 to 50 cu. ft., and a lift of 300 to 500 feet of which fourteen are installed.

Ventilation is effected by electric fans having a diameter of 4 to 8 feet, with blades 2 to 4 feet wide, operated by motors of 15 to 50 h.p. All pits are equipped with the champion fan, except the Sakura, which uses the Sirroco.

Grading is carried on at the Manji and Mirudo pits, the machine at the Manji pit having a capacity of 1,500 tons in ten hours, and operates three screens. The coal bin here has a capacity of 1,500 tons. The capacity of the Mirudo grading machine is 600 tons in in ten hours, it operates two rotary screens, and dumps into a 1,000-ton bin.

This mine is equipped with 3-500 K.V.A. transformers of 3,300 volts each, to handle power transmitted from the main plant at $22,000 volts. Three 100 K.V.A. transformers are also installed to change the 3,300 volts to 550 volts. This power is chiefly used to operate the fans, winches, grading machines, pumps, etc. This station supplies over 4,000 ten candle-power lights.

### The Noborikawa Mine

The Noborikawa mine was acquired by the Hokkaido Tanko Kisen K.K., in November, 1919, after eight years of operation under the Mitsui Mining Co. The strata are rather confused with many faults. The seam under operation is comparatively regular, however running from south to north through a mountain chain more than 700 feet high, outcropping on the mountain side. There are several seam, only one of which is mined at present. It is 10 feet thick, and inclines from 40 to 60 degrees towards the east.

The coal mined is hard with fine black gloss. It is easy to burn, has a high thermal value, and is used for factories, railways, and steamers. One particular use of this coal is in pottery works, and is the favorite fuel of the pottery kilns in the Nagoya district. For many years the imperial government railways have been using this coal to produce gas. Its analyses follows:

Water, 3.37; volatile matter, 42.60; fixed carbon, 49.62; ash, 4.40; nitrogen, 1.47; sulphur, 0.24; calories, 7,480; color of ash, gray brown.

The slope of this mine being particularly steep, the coal mined is carried by chute to the funnel set up at the pit mouth, whence it is transferred to coal cars and hauled off either by horse or man power cars. Coal mined in the lower galleries is hauled up by winches, and transported by electric locomotives to the grading plants. The main gallery has three electric winches with single drums, having a diameter of 5, 5 and 2 feet, of 100, 60 and 30 horsepower. The diameter of the cable is 1 inch, and the length, 1,000, 1,000 and 1,500 feet. Methods of mining, timbering, etc., are the same as at the Yubari mine. This mine has two grading plants, with capacities of 500 tons, and 300 tons in 10 hours. Another plant of 300 tons is now under construction. Three electric air compressors with a capacity of 600 cu. ft. per second are used for rock drilling.

### The Shin Yubari Mine

The outcrop was discovered in 1888, and mining was begun in 1904. In January, 1920, the mine was acquired from the Ishikari Coal Co. The main seam of this mine 34 feet thick is a continuation of the Yubari seam. Above this are two other seams, three and four feet thick, separated by about 160 feet. The strata are rather confused, wave shape; the general direction being south-east and north-west.

The coal is similar to that of the Yubari mine. The Tokyo Gas Co. uses the product of this mine exclusively, its annual consumption being about 300,000 tons. The large quantity of gas produced, and the small sulphur content are characteristics of this coal.

Analysis: Water, 1.51; volatile matter, 43.19; fixed carbon, 49.57; ash, 5.73; nitrogen, 1.42; sulphur, 0.25; calories, 7,590; color of ash, light yellow brown.

The equipment of this mine is practically the same in all particulars as that of the Yubari and other mines owned by the company.

It owns and operates a saw mill in the neighborhood of Shikano Tani station, equipped with three band saws, one vertical saw, two medium size circular saws and one drag saw. Its capacity is something like 1,000,000 c.ft., per month.

### The Wakanabe Mine

The Wakanabe mine was opened to business in May, 1906, by the Ishikari Sekitan K.K., and transferred to the Hokkaido Tanko Kisen K.K. in January, 1920.

There are many large and small waves in the seam, and many faults make the seam rather confused. The seam now under operation runs from east to west with an average incline of 45 degrees in the direction of the north. It is divided into three parts, upper, middle and lower, with thicknesses of 6, 10 to 16, and 4 feet. The mining work has not penetrated to the lower seam so far. It is located about 400 feet below the middle seam.

The south pit of this mine opened in 1914 has four seams, the three upper seams being 4, 8 and 4 feet thick. The lowest or main seam, is 10 to 15 feet thick. Operations have not yet reached this seam, but sloping galleries are now being constructed to open this seam to mining work.

The coal has a high thermal value. It cracks but little, and is especially fit for all fuel purposes and the manufacture of coke and gas. It analyses:

Water, 1.26; volatile matter, 46.85; fixed carbon, 47.05; ash, 4.84; nitrogen, 1.28; sulphur, 0.27; calories, 7,590; color of ash, yellow brown.

Equipment is practically the same as that of the other mines.

## Mentoukou Coal Mines

M. Mamet, the well-known Belgian mining engineer of the Sino-British Coal Mining Company, has announced that an excellent seam of coal has been struck at Mentoukou, measuring on the average four Chinese feet. Mentoukou is about 40 *li* from Peking, at the base of the Western Hills, beyond the Hunho.

The Sino-British Coal Mining Company as its name indicates is a Chinese and British concern, in which McBains of Shanghai are largely interested.

The preliminary work has been carried on under exceptional difficulties. The arrival of pumping plant was delayed as a result of the war, and it was impossible for some time to cope with the flow of water. Then the neighboring electric plant proved unable to supply the necessary power, owing to the silt-laden condition of the rushing Hun river. The difficulties have been steadily overcome, and Peking, which has hitherto been largely dependent on Honan, will rejoice at last in having its own supply of valuable coal.

# The Chinese Eastern Railway

## Data from Last Annual Report

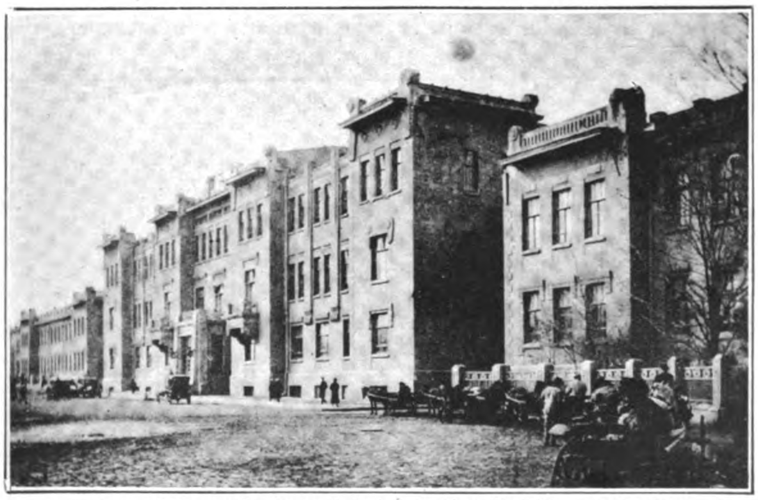
*Head Office*: Harbin. *Officers and Board of Directors*: President and Director-General, Chin-Chun Wang, C.E., Ph. D., LLD.; Chinese Directors: Yu Jen-feng, Ho Shou-jen, Yuan King-kai and Chen Tulow; Vice-President, Danilevsky; Russian Directors: Koushetzoff, Poushkareff, Richter and Dissenky; General Manager, Ostroumoff; Assistant General Manager, C. T. Shar. *Cable Address*: "C.E.R." (in English); "Pravlenie" (to the Company in Russian); "Opravlenie" (to the Railway Administration Office in Russian).

*History*: The history of the Chinese Eastern Railway began in 1896, when the Chinese government invested 5,000,000 taels in the Russo-Chinese Bank to join its partnership. One particular enterprise that both the Chinese government and the Russian government had then in view was the construction of the Chinese Eastern Railway.

To relate the story more accurately, however, it must be said that the Russian government was more anxious to have the line than the Chinese government. For up to this time, Russia had been seeking for an ice-free port for her navy; but many attempts were frustrated. So she began to cast her eye on Port Authur and Dairen—two ice-free ports. In the meanwhile, she had just been building the gigantic Siberian Railway. It would shorten the distance between the continents of Asia and Europe in a still more amazing degree, if another line passing through the Chinese territory could be built to connect it. Therefore with motives primarily political and military, the Russian government interested the Chinese government in the construction of this line, and in September 1896, an agreement was reached between the Chinese government and the Russo-Chinese Bank. It was agreed that the financing of the railway should be undertaken by the Russo-Chinese Bank. A railway company separate from the Bank, called the "Chinese Eastern Railway Company," was established with shares of 5 million roubles as the initial capital to be sold only to Chinese and Russians. The Chinese government shall have the right to appoint the president of the railway, whose duty is to look after China's interests both in the bank and in the railway.

**Dr. Chin Chun Wang, C.E., Ph. D., LLD.**
President and Director General of the Chinese Eastern Railway

Harbin Station



Chinese Eastern Railway Administration Building at Harbin

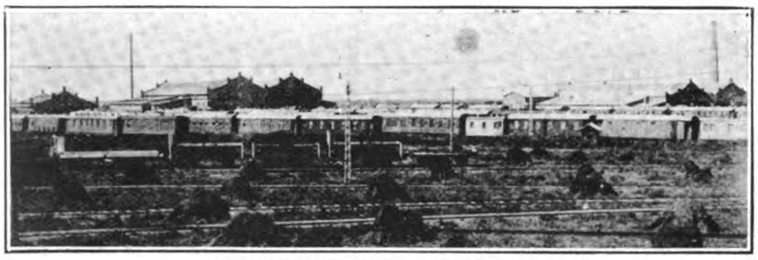
By this agreement, the company is given by China a vast quantity of public lands along the railway free of charge or at reduced prices. The company is exempted from all kinds of duties on materials used by the railway, and all taxes on the lands that are used by the railway.

To reciprocate the many fold privileges that the company receives from the Chinese government, the agreement requires that beginning from its first day of operation, the railway should pay to the Chinese government five million taels, which, however, have never been paid yet. It was further agreed that all profits of the railway, after that part which is distributable to the shareholders, shall be applied to the redemption of the railway in behalf of China. After eighty years, the railway, together with all its movable and immovable properties, shall be returned to the Chinese government without any cost, and with all its debt to the Russian government being cancelled. The Chinese government also reserves the right to redeem the whole line at cost after thirty-six years.

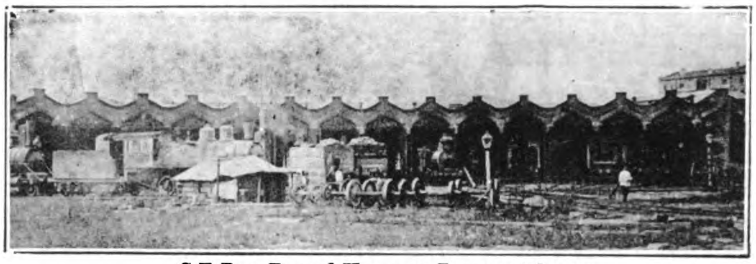
The whole line, as provided in the agreement, must be completed in six years. The construction of the branch line, called the South Manchuria line, giving Russia an access to ice-free ports, Port Authur and Dairen, started two years later. Thus this line enabled Russia to penetrate into the three eastern provinces and procure two strong naval bases. But this precipated the Japanese-Russo war, as a consequence of which the South Manchuria line was yielded to Japan.

It is important to note that the management of the railway was wholly in the hands of the Russians, who had a definite policy of colonization. For some time, a large army was kept on the line, contrary to the original agreement. Expenses, having nothing to do with the railway, were charged to the line, though actually paid by the Russian government. Curious to say that the Chinese government, though invested in the right of appointing a president, did not exercise this right except once at the beginning, and then until recently.

The outbreak of the world war, however, brought about

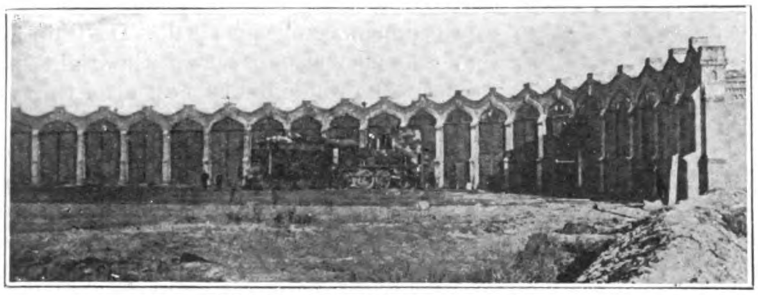


C.E.R. : Main Shops at Harbin



C.E.R. : Round House at Progranichnaya

great changes. The breakdown of the Russian government suddenly left the Chinese Eastern Railway in a most precarious position. In order to help the line financially and technically, the allies, as a temporary measure, formed the inter-allied technical board. At this critical juncture, China, having the sovereign rights over this territory wherein lies the railway and considerable financial interests in the railway as shown above, and being the sole partner of Russia in the enterprise, naturally stepped in to give help to the railway. An agreement was concluded between the Chinese government and the Russo-Chinese Bank, representing the shareholders, in 1920. By this agreement, the Chinese government is given the temporary responsibility of supervising the line. At present, the railway is being run under the provisions of the 1920 agreement. By this agreement, China only asserted some supervisory power, by adding four members into the board of directors, thus making the membership of this supervising body half Chinese and half Russian. As it requires seven votes to pass anything, neither the Chinese nor the Russians can decide anything without the approval of the other. As to the actual management, practically nothing is changed. The whole executive power still rests in the hands of the general manager, who is a Russian nominated by the Russo-Asiatic Bank. So all the change that has been made is that China has taken one-half of the supervising power into her hands, while leaving everything else still in the hands of the Russians.



C.E.R. : Round House at Hailar

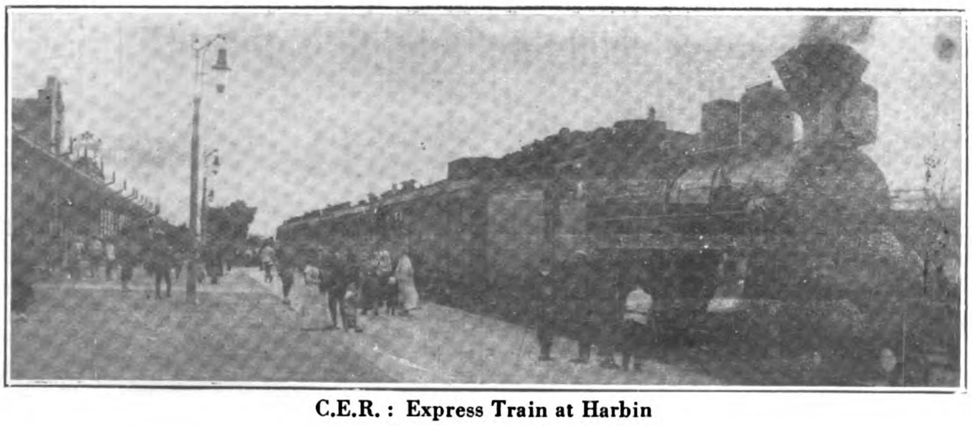
C.E.R. : Station and Yards at Manchuli

*Location and Extent* : This line lies in the heart of the three Manchurian provinces and links Asia and Europe together. At its northwest extreme, it connects the Siberian Railway at Manchuli, the last station in Chinese territory. At its east extreme, it connects Vladivostok. A branch, connecting the South Manchuria line, runs from Harbin to Changchun ; from there connection is made to Mukden, to Peking, to Dairen and to Korea. The length of the main line is 1726·83 kilometres, and that of its branch is 480·17 kilometres. The whole line is surrounded with fertile agricultural fields, grazing lands and rich mineral resources.

*Organization* : The whole organization broadly speaking consists of the president's office, the company, and the railway administration. At the head there is a director-general of Chinese nationality, appointed by the Chinese government to oversee the management of the railway, and look after China's interests in the enterprise. In the president's office, the work is divided into four sections and supervised by the chief secretary and the counseller.

The company is the law-making organ, consisting of the board of directors and board of audits. There are nine directors, four of whom are Chinese, appointed by the Chinese government. The other five are Russians. The Chinese director-general is the *ex-officio* president of the board of directors. The board decides the general policies of the railway. Measures of the board of directors cannot be legalised unless approved by seven votes. The detailed work of the board is performed by three departments : General administration, financial department, and technical department. Besides, there is a board of audits, which has five members, two of whom are Chinese appointed by the Chinese government, the other three members being Russian. The chairman of the board must be of Chinese nationality. This board examines and audits the financial records and transactions of the railway.

The railway administration has the special charge of the running and management of the railway. I is the most importans in that it has the whole management of this railway in hand. At the head, there is a general manager of Russian nationality who it the chief executive. His powers are ample and extensive. He practically runs the whole show. Besides, there are a Chinese assistant general manager and two Russian assistant general managers assisting him. This office has some twenty departments such as : General administration, legal department, accounting department, mechanical department, traffic department, business department, engineering department, materials department, navigation department, secretarial department, telegraph department, printing department, auditing department, pension department, land investment department, medical department, education department and veterinary department. The heads of these departments are Russians. But recently several important departments

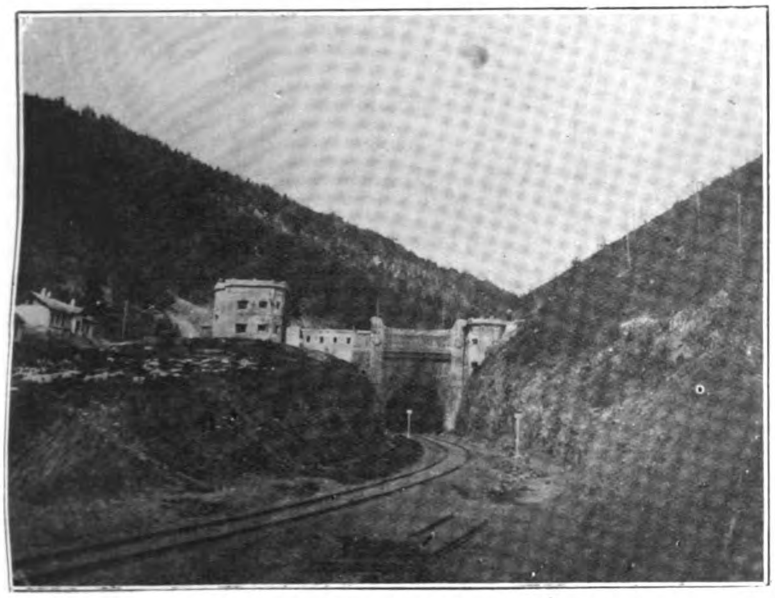


C.E.R. : Express Train at Harbin

such as accounting, operation, commercial, mechanical, engineering, materials and land departments have added Chinese assistant chiefs. All these chiefs and the subordinates are under the general manager, who practically has the power of appointment and discharge over them.

*Character of Traffic*: The transporation revenue for 1921 was 39,785,677.19 roubles. Of this sum, the freight receipts forms a greater part than the passenger receipts. The freight, broadly speaking, consists of agricultural products, livestock, lumber and minerals. The total amount actually transported on this line for 1921 was 126,149,527 poods (Russian standard of weight equal to 29 catties, or 40 pounds) Agricultural products usually furnish the largest part of the freight. For instance in 1920, of the freight, 58 per cent. was agricultural products; 32 per cent. lumber; 10 per cent. mineral; and 1 per cent. livestock. Agricultural products include wheat, grain, flour, bean, beanoil and bean cakes.

C.E.R.: The Spiral Climb over the Khingan Mountains



Fortified Tunnel at Hing An (Khingan Mountains)

The freight service handles, of course, goods exported as well as goods imported. Imported goods handled by this line consist chiefly of salt, iron wares, manufactured articles, petroleum, cement and sugar. For the year 1921, the figures are as follows:

| | | |
|---|---|---|
| Salt .. .. .. .. .. | 1,826,000 | Poods |
| Iron wares .. .. .. .. | 1,240,000 | ,, |
| Manufactured articles .. .. | 1,062,000 | ,, |
| Fruits .. .. .. .. | 764,000 | ,, |
| Petroleum .. .. .. .. | 415,000 | ,, |
| Cement .. .. .. .. | 492,000 | ,, |
| Sugar .. .. .. .. .. | 715,000 | ,, |

## EQUIPMENT

*Locomotives*: Locomotives 536..........434,867 horse power.

*8 Wheel Passenger Carriages*:

| | | | |
|---|---|---|---|
| Special carriages .. | 15 | 150 | passenger capacity |
| First-class carriages | 30 | 660 | ,, ,, |
| Mixed ,, ,, | 23 | 598 | ,, ,, |
| 2nd ,, ,, | 30 | 960 | ,, ,, |
| 3nd ,, ,, | 51 | 2,448 | ,, ,, |
| Mail ,, ,, | 11 | 66 | ,, ,, |
| Baggage ,, | 15 | 210 | ,, ,, |
| Dining car .. .. | 18 | 210 | ,, ,, |

*4 Wheel Passenger Carriages*:

| | | | |
|---|---|---|---|
| Special carriages .. | 79 | 395 | passenger capacity |
| Mixed .. .. | 23 | 460 | ,, ,, |
| 1st Class .. .. | 23 | 368 | ,, ,, |
| 2nd ,, .. .. | 72 | 2,160 | ,, ,, |
| 3rd ,, .. .. | 193 | 9,264 | ,, ,, |
| 4th ,, .. .. | 51 | 1,632 | ,, ,, |
| 3rd ,, mail carriage | 7 | 112 | ,, ,, |
| Baggage cars .. | 24 | 120 | ,, ,, |
| Prisoner carriages .. | 18 | 756 | ,, ,, |
| Health .. .. | 15 | 150 | ,, ,, |

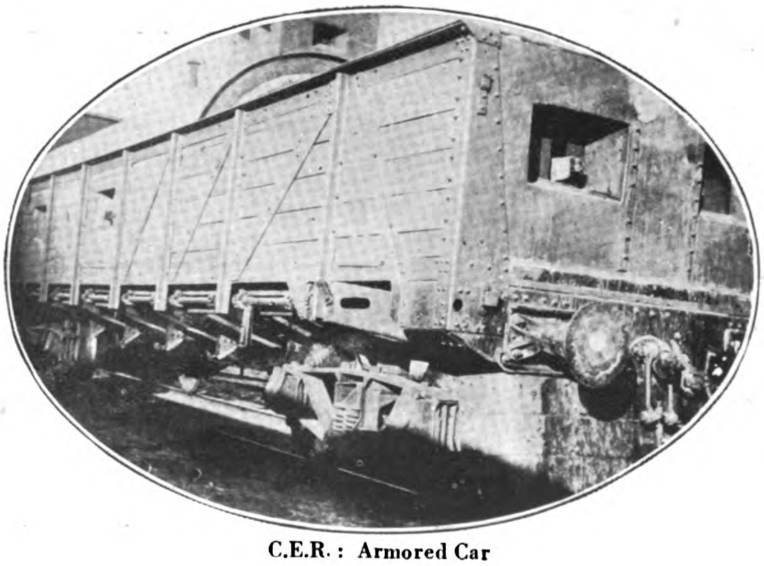
*Freight Cars*: 10,626 freight cars of 222,252 tons capacity including:

| | | | |
|---|---|---|---|
| Russian style wagons | 5,289 | 84,624 | Tons capacity |
| American ,, ,, | 860 | 16,770 | ,, ,, |
| Covered ,, | 418 | 18,183 | ,, ,, |
| Common ,, | 3,542 | 95,732 | ,, ,, |
| Ice ,, | 169 | 3,834 | ,, ,, |
| Oil ,, | 295 | 3,835 | ,, ,, |
| Special ,, | 53 | 742 | ,, ,, |

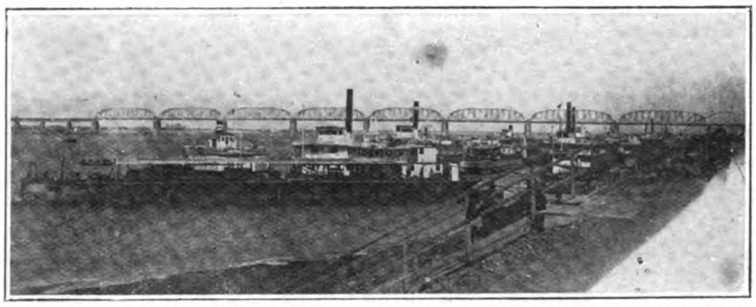
*Depôts*: Depôts containing back shop and roundhouse and doing car repairs and light and running locomotive repairs are as follows:

Harbin: Hengdaohotze: Pogranitchnaya: Tsitsikar: Pukedoo: Hailar.

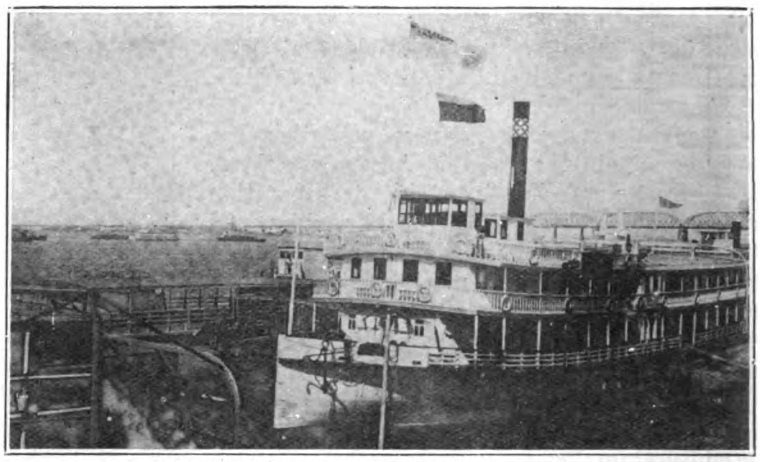
*Main Shops*: Harbin main shops consist of the following:—Old iron foundry: new iron and steel foundries: shops: black



C.E.R.: Armored Car



C.E.R. : Bridge over the Sungari River at Harbin

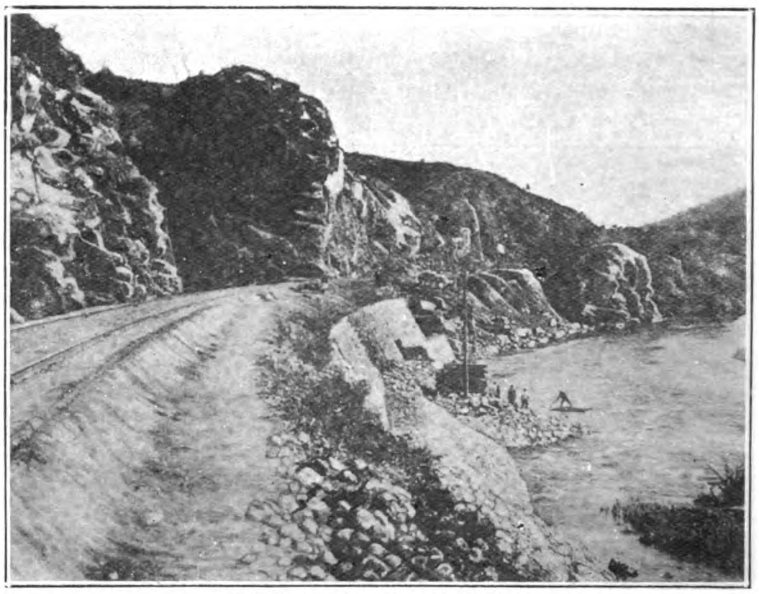


C.E.R. : Steamboats on the Sungari River

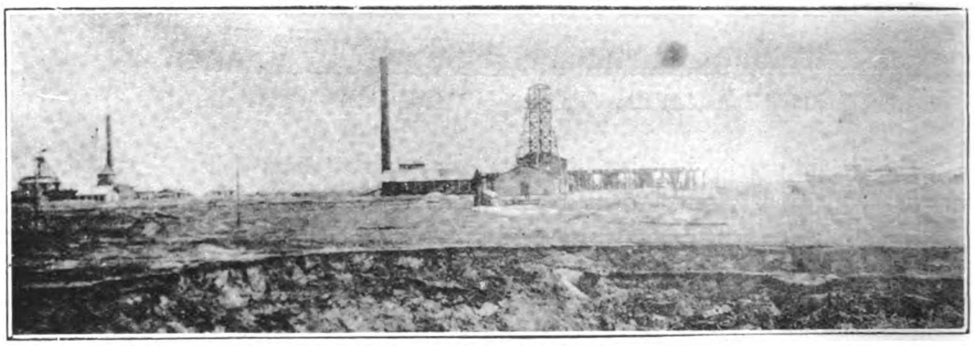
smith : machine : wheel : boiler : tube : erecting : tender : depôt : passenger car : freight : saw mill : power station : chemical testing laboratories.

INCOME AND EXPENSES OF THE CHINESE EASTERN RAILWAY FOR THE YEAR ENDING DECEMBER 31, 1921.

| | Roubles | Roubles |
|---|---|---|
| Transportation revenue .. .. | 39,785,677.19 | |
| Transportation expense .. .. | | 32,420,216.40 |
| Directorate .. .. .. | | 1,100,019.61 |
| General administration .. | | 6,285,080.61 |
| Maintenance of way and works | | 5,685,023.64 |
| Traffic and running .. .. | | 3,737,867.72 |
| Maintenance of equipment .. | | 12,234,005.87 |
| Interchange of rolling stock .. | | 30,349.98 |
| Emergencies .. .. .. | | 2,830,562.33 |
| Additions and betterments .. | | 544,306.64 |
| Special revenue (Per special budget) | 2,120,124.99 | |
| Special expense (Per special budget) .. | | 6,450.023.77 |
| | | *3,035,562.01 |
| | 41,905,802.18 | 41,905,802.18 |



C.E.R. : Near Progranichnaya



C.E.R. : Jalainor Coal Mines

*The Inter-Allied Technical Board* : The inter-allied technical board, represented by the United States, England, China, France, Italy, Japan and Russia, was organized in the winter of 1918. The reasons for organizing this board were various, among which one was to give the Czechoslovacs transportation facilities to join Russia to fight against Germany, and the other was to transport allies' troops to Siberia to maintain order there. At that time the allied nations were particularly anxious to protect the Siberian Railway and the Chinese Eastern Railway, in order to make the communication between Asia and Europe uninterrupted. During the course of the great war, many allied troops were actually transported on this line, and the board rendered some valuable services. But the board was originally intended for a war measure. And it is provided in the agreement that the board shall be dissolved as soon as allied troops should be withdrawn. Now their troops have been withdrawn except a part of the Japanese troops.

* Profit.

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The FAR EASTERN MOTORS
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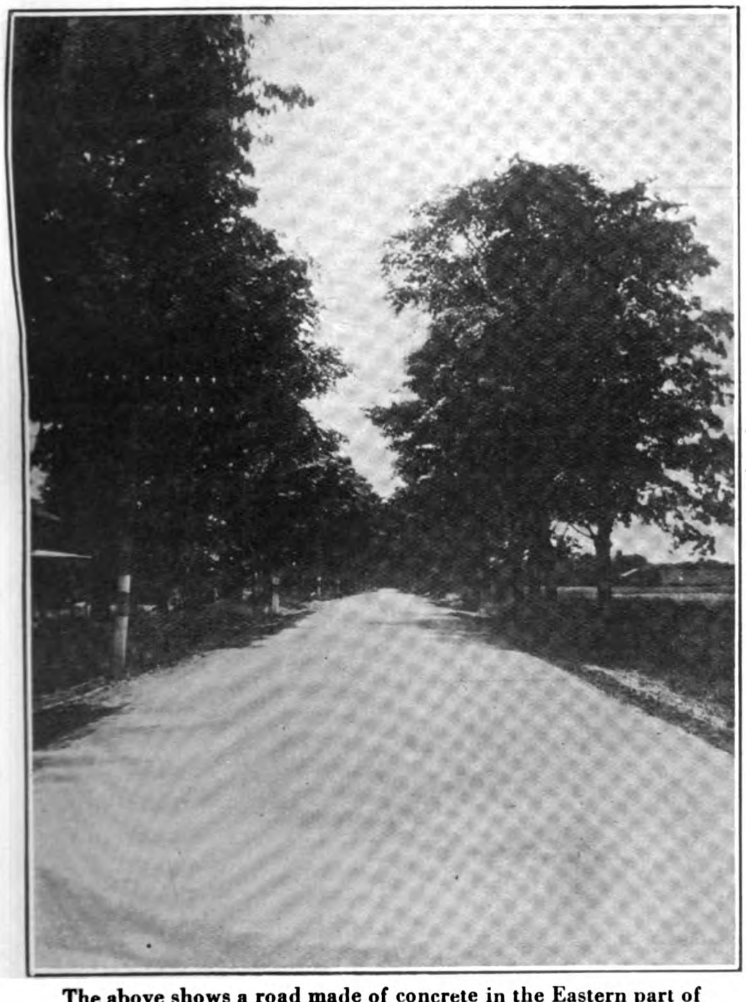
# The North American Road Situation

**How the Experiences of the United States in Providing Satisfactory Roads for Ten Million Motor Vehicles May Serve as an Example—in Some Instances as a Warning Example—to Road Builders and Organizers in other Countries.**

EXPENDITURES in the United States for road building during the year 1910 approximated $120,000,000. This sum included money spent by the U. S. government, by the various states, and by township, municipal and other local units.



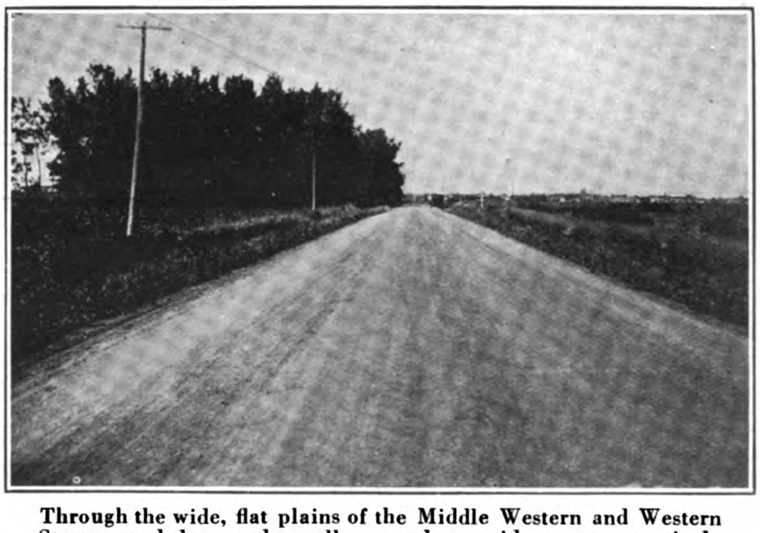
The above shows a road made of concrete in the Eastern part of the United States, where the population is comparatively thick and motor traffic is heavy

In the year 1921, on the contrary, the sum of $600,000,000 was expended for the same purpose and by the same authorities. This is an increase of 400 per cent. in highway expenditures in the United States in the comparatively brief period of eleven years.

Greater even than this discrepancy between the sums expended in 1910 and 1921 is the difference between the more or less unorganized efforts that characterized U. S. road-building campaigns eleven years ago, and the centralized, efficient method of constructing the nation's highways that is operative to-day.

When road-building was first taken up in a serious way in the United States, it was soon discovered that there was a great deal of confusion not only with respect to the proper types of surfacing to be employed, but also with respect to the correlation of federal, state and municipal efforts.

The century-old practice on the part of farmers of paying off their taxes in the form of road-building, led to a great deal of improperly directed and unsatisfactory road work that was really more harmful than beneficial. For example, road-drags were used by individuals who did not fully understand their proper employment, and the results in many cases were little short of catastrophic. A perfectly serviceable dirt road would be rendered useless by being



Through the wide, flat plains of the Middle Western and Western States, sand-clay roads, well-crowned, provide a comparatively cheap yet very serviceable form of highway construction

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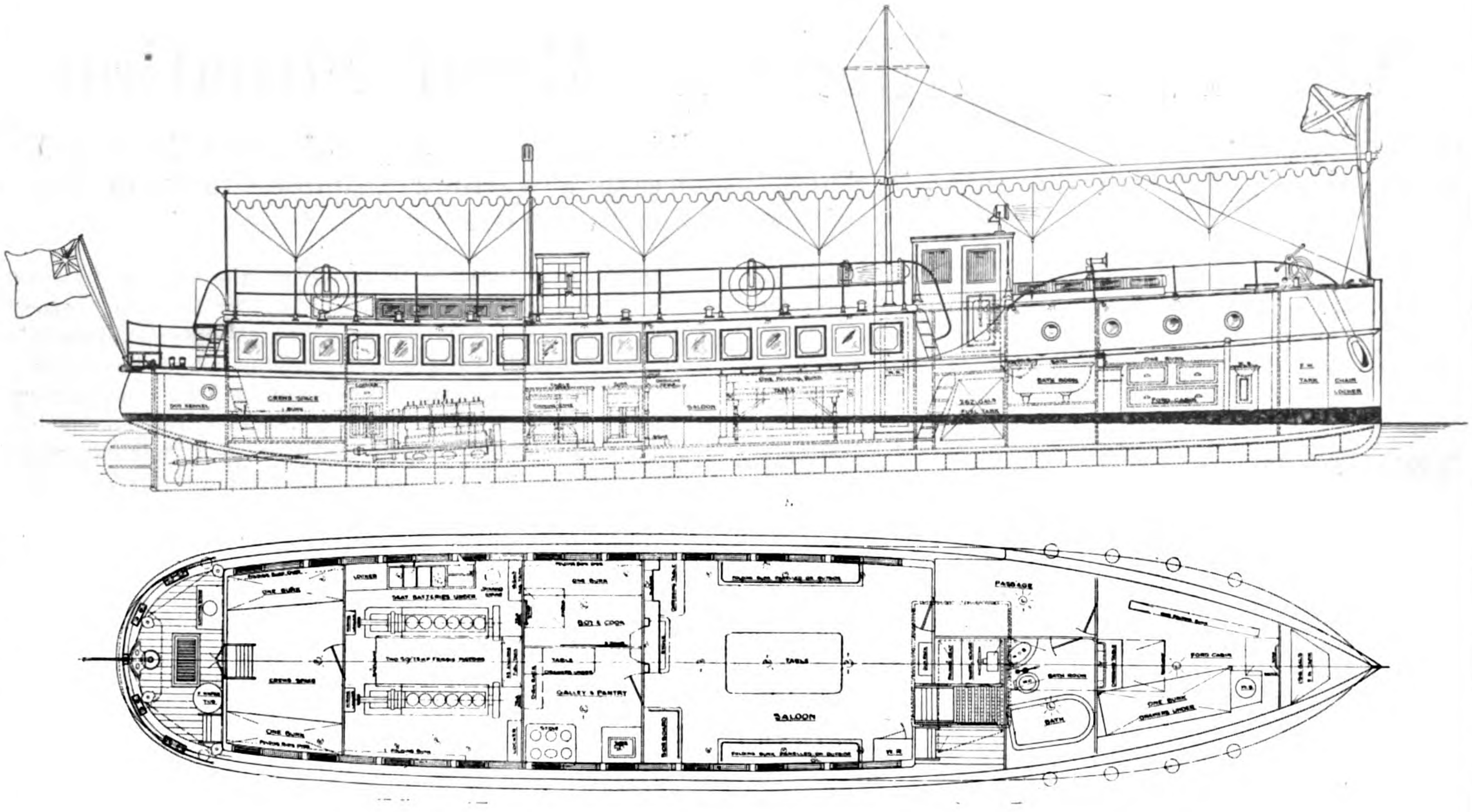

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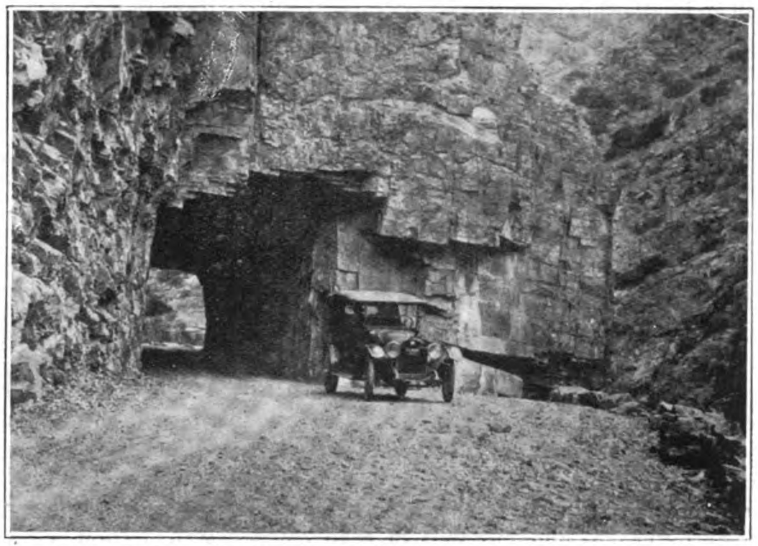
8A YUEN-MING-YUEN ROAD

SHANGHAI

Over the Continental Divide. A macadam road that serves to transport yearly many thousands of coast-to-coast motor tourists



A tunnel through solid rock in the mountain country of the West. Good mountain roads are costly to build, and are not constructed "over-night"

steeply crowned by loose dirt, masses of weeds, stones and other refuse that the drag had forced up from the sides of the road onto its centre.

Misunderstandings arose, moreover, between various authorities concerned in highway work—between state and county officials, between county and township, and so on—and in many instances there was a deplorable tendency to "let the other fellow do it," which could not but react unfavorably on what was one of the most vital and important problems of the day and age; the construction of well graded, smooth and permanently surfaced roads for use by the growing army of passenger and commercial motor vehicle users.

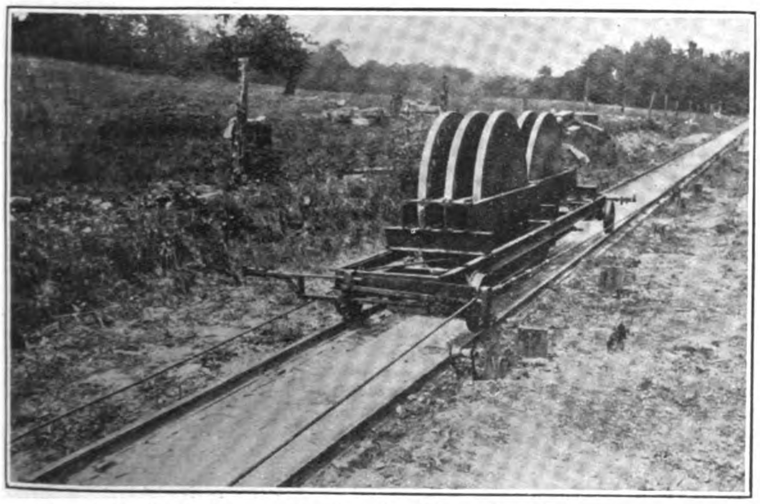
## Federal Aid Plan Formulated

This confusion and lack of systematic endeavor resulted in the formation of a plan for federal good-roads aid, that has formed the framework for practically all important highway progress in the United States during recent years. The principal feature of this centralized system of road-building control, is that the U. S. government and the various states share to an equal extent in the expense of a system of roads that are being built to connect county-seats of every state in the union. When this system of roads is completed, transportation everywhere in the United States will be rapid and easy, and all except the smaller outlying districts will be in permanent communication with one another. The system will comprise 180,000 to 190,000 miles of public highway, and will form a perfect gridiron of well-surfaced roads within the boundaries of the country.

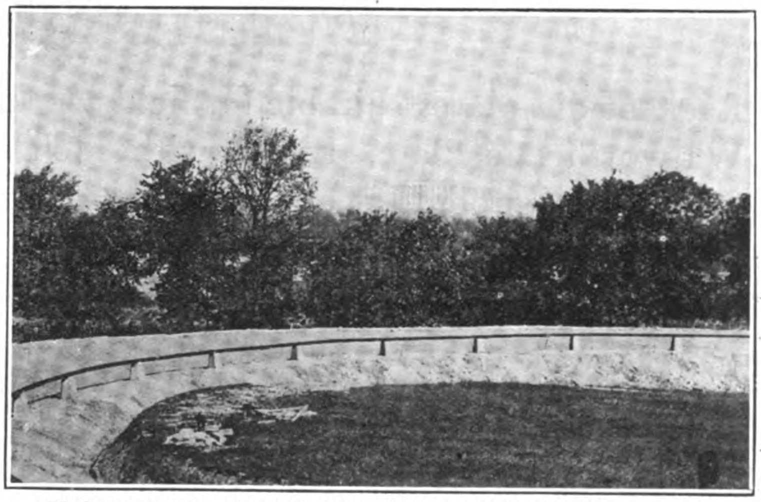
Since the roads comprised in this system are being built to the specifications of the federal government, they will be far more uniform in quality than would be the case if the type and standards of their construction were to be left up to the various state and local authorities. Maintenance is to be provided by the states, and periodic inspections of their condition will be made by district engineers who work under the supervision of the U. S. federal bureau of highways, and of which there are thirteen—one for each of the districts into which the country is divided for road purposes.

The real significance to an outsider of this federal aid system of good roads building in the United States, comes from the fact that from a motor car and motor lorry standpoint the United States is the most highly intensified country in the world. With a registration of close to ten million motor vehicles, it illustrates perfectly the conditions that will obtain in other countries several years hence when use of the motor car and motor lorry has become equally widespread.

In another respect, the United States is ideally suited to be a proving-ground for methods of road construction and road building organizations. Topographical conditions in the United States vary widely. Within its confines may be found practically every type of territory that obtains anywhere in the world. The east of the United States is practically European in contour and climate, with its rolling stretches of fertile land, its numerous streams, and its network of cities and towns. Throughout the middle west of the United States may be found immense stretches of prairie land that resemble those in the Argentine and in certain sections of Australia. In the far west are steep mountains. In the south there are stretches of arid desert land, other stretches of swampy



One of the U. S. Government's scientific road-testing appliances is shown above. This machine travels over different types of road surfaces to determine the amount of wear which each will stand



Within sight of the beautiful Lincoln Memorial at Washington, is the Government's circular track for investigating various forms of road-metalling. A motor lorry, heavily-loaded, is automatically guided around the track, and the wear on the different surfaces is noted and recorded

soil and still other localities where semi-tropical vegetation flourishes and conditions resemble those of the lands that border on the equator.

### Lessons to be Learned from U. S. Road-Building

From the immense task of providing adequate roads in all these various climates and locals of the United States, there may be learned definite lessons which will prove of considerable value to other countries who are now engaged in perfecting their road organizations.

The first of these lessons is the importance of centralized control. Without a systematic organization, a good-roads program is of very doubtful value. It is not possible to build and maintain a network of highways that will stand up year after year under heavy motorized traffic, without a carefully planned organization to unify and regulate the efforts of the various communities toward better highways.

The second lesson is the importance of scientific investigation of road surfaces and methods of road construction. Though the building of good roads is one of the most ancient of all arts—the Romans, and before them the Persians, knew how to build hard-surfaced roads, some of which have lasted up to the present day—modern highway building on a rapid and efficient scale is a development of the past few decades. The various tests and investigations made by the federal good roads authorities in the United States have proved of incalculable value in U. S. road-building work.

The third point is the matter of proper upkeep. It is not sufficient to build a good road, and then neglect it entirely under the impression that year after year it will continue to give the same efficient service as it did when first built, without a proper organization to inspect it at frequent intervals and to make any repairs that may prove necessary.

The fourth and last point is the advisability of not laying down any hard and fast rule for a single type of road to be used in varying types of countries. The kind of road that will prove amply satisfactory for use on level or rolling ground will not do at all over mountain grades, where heavy frosts and thawings, great extremes of temperature, occasional avalanches and other destructive natural phenomena occur. A road that may be ideal for use in swampy country, will not prove of any value at all in the desert. It is fully as criminal to build a wide concrete road in sparsely populated country districts where there is little or no traffic, as it is to build a narrow dirt road where traffic is heavy and commercial vehicles of large tonnage are frequent users of the highway.

### Value of Good Roads to Farmer

The benefits that centralized control of the good roads system of the United States have brought to the country, are especially noticeable in the case of the farmer. Because of good roads, the American farmer to-day is happier, more prosperous, and far more contented to stay on the farm, than he ever was in the days of rough dirt roads that were a cloud of dust in summer and a bog of mud in winter. The agriculturist in the United States to-day is within easy touch with the neighboring town or village, is able to travel swiftly and comfortably when on a pleasure trip, and he can visit his friends—no matter how distant their homes may be—in a fraction of the time formerly necessary for the journey.

Better roads in the United States have resulted, moreover, in the alloting to the railways of their proper function as long distance carriers, short hauls being taken care of by commercial and passenger motor vehicles. No better indication of the efficiency of motor transport service in the United States may be had than the fact that in practically every railroad labor crisis, the beginning of trouble finds a widespread motor organization ready to take the place of the steam carriers when a breakdown in rail transportation actually occurs.

The expansion of motor transportation and the extension and perfection of highways are interdependent. They have gone hand in hand in the United States, and both within the past decade have been nothing short of phenomena.


FIRST in the Field—

FIG. W4161. Nos. 0 to 1¾, without Leader Screw

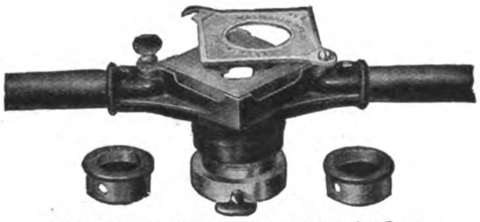


FIG. W4162. Nos. 2, 3, 4, with Leader Screw

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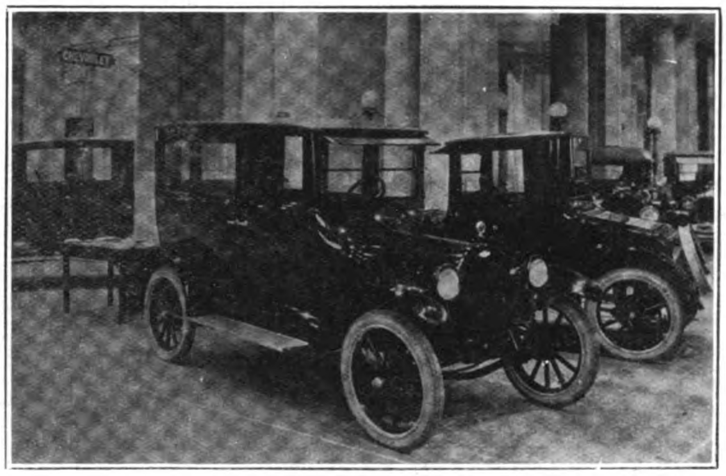
# The Closed Car Show in New York

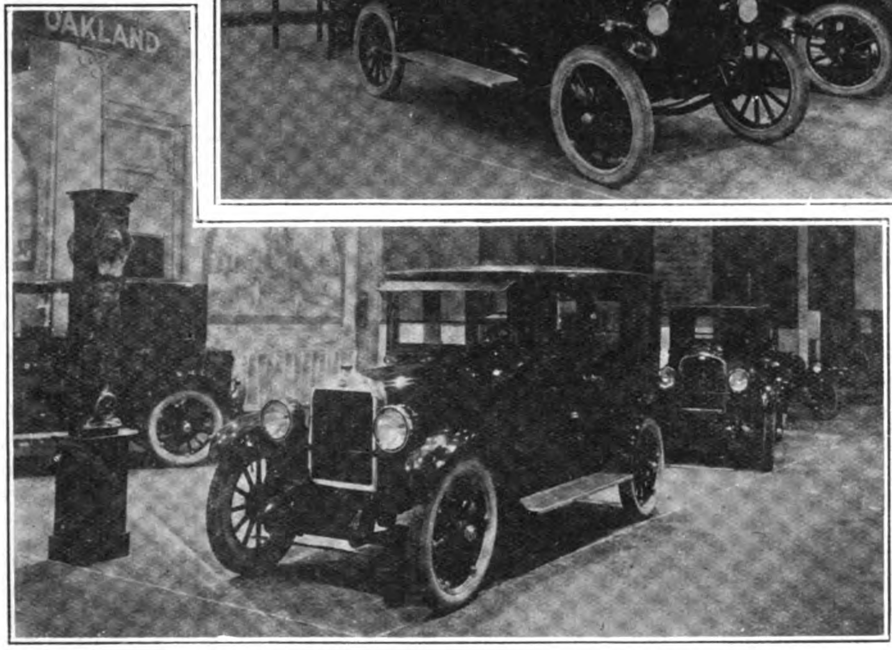
ITS advent timed to coincide with the beginning of the autumn and winter seasons when closed cars are most in demand, the New York closed car exhibit was held in the Grand Central Palace during the week of September 24.

Held under the auspices of the automobile merchants' association of New York city, and considered in many respects a forerunner of the big national automobile show in January, this exhibit was by all odds the best and largest closed car show ever seen in the United States. It was a most convincing object-lesson of the steadily increasing popularity of closed motor vehicles and their suitability for all-year-round use.

One of the features of the 1922 closed car show was the increased popularity of the five-passenger sedan, in place of the larger seven passenger sedans formerly built on the same or slightly longer chassis. Buick, for example, was exhibiting a five-passenger sedan—called a touring-sedan—on both the four and the six-cylinder chassis. These are new Buick models for 1923, and are designed to meet the demand for moderate-priced closed cars. A trunk rack and trunk, with nickel guard rails, is standard equipment on both the Buick touring-sedans, and makes them highly desirable for touring use.

Buick was also showing five other closed models—the standard five-passenger sedan, the seven-passenger sedan and the four-passenger coupé on the six-cylinder chassis; and the three-passenger coupé and standard five-passenger sedan on the four-cylinder chassis. A crowd was always gathered around these handsome models, which with their Fisher-built bodies and carefully chosen equipment made a strong appeal to the prospective buyer.






The popular five-passenger sedan was well represented at the New York closed car show. It formed one of the features of the Chevrolet exhibit (right) and of the Oakland display (below.)

The exhibit of Cadillac was notable for the inclusion of the new Victoria model, exhibited in New York city for the first time at any show. Changes have been made which gives the Victoria an appearance of greater length and less height. The seats have been widened and deepened, and the driver's seat placed directly behind the steering wheel. Another handsome Cadillac model which attracted great attention was the five-passenger coupé, a good-looking closed car of stylish, compact appearance and comfortable seating arrangement. Among other models, Cadillac showed a five-passenger sedan of the touring type, equipped with a trunk and trunk rack.

While the majority of the cars exhibited at the show were fitted with standard bodies, at the same time there were some very handsome custom-made bodies on display, representing the highest type of exclusive coach work. Rolls-Royce exhibited a very beautiful Cabriolet, seating five persons, the interior upholstered in cream-colored pig-skin. The rear of the top of this Cabriolet is collapsible, giving a landaulet effect when desired.

Going to the opposite price extreme, we find Chevrolet represented by two coupés—one a two, and one a four-passenger type—and a five-passenger sedan. With their handsome lines and careful finish, these Chevrolet closed cars made a profound impression on visitors. The amount of real, pound-for-pound and dollar-for-dollar value that is packed into the low-priced closed cars of to-day, is indeed remarkable.

A number of cars of the light six-cylinder variety were exhibiting closed models. Among these were the Barley six, a five-passenger sedan model, built by the company which constructs the Roamer car. Jordan showed a custom-made suburban sedan body, finished in maroon with upholstery of the same color. Oakland showed two entirely new closed models that have just been brought out, a five-passenger sedan and a five-passenger coupé. The latter takes the place of the former four-passenger coupé, and is built on the same chassis as the sedan. A platform in the rear is provided for carrying a trunk, and the body back is protected by trunk bars. The five-passenger Oakland sedan has a larger cushioned front seat, and four doors.

One of the most attractive exhibits at the show was that of the Oldsmobile. An entirely new model was the four-cylinder Brougham, seating five passengers and of two door construction. The fine coach work and striking lines of all the Oldsmobile closed models made a marked impression on visitors to the exhibit.

It would have seemed strange to a motorist of ten or five years ago, when the closed car had not yet come fully into its own to witness a show of this nature given up entirely to the exhibition of closed models. To-day, however, the comfort, cleanliness and all-year-round satisfaction of the closed car are appealing to more motor owners than ever before; and the great success of the closed car show in New York is a good indication of the increasing popularity of enclosed body types the world over.

# Automotive Japan

## Potentialities of the Market

### An Interview with William I. Irvine, U.S. Trade Commissioner

OPINIONS of the dealers as to the probable number of cars the market can absorb under normal conditions vary widely. The automobile does not enjoy general popularity and one is constantly reminded of this by the slowness with which pedestrians and vehicles respond to the vigorous hooting of the horn and sounding of siren. Although Japan has been a user of motor cars for more than a decade it is still young in the idea and this is one of the causes of the tardiness in road building. But it is a market well worth cultivating as is any which during a period of ten years averages approximately 1,500 cars a year.

How many cars will Japan take a year? With the clearing of stocks on hand, it is generally agreed that the market should be good for 2,500 cars per year with present road conditions. With a slight development of roads permitting touring, the market would absorb 3,500 cars a year. A conservative estimate of the number of cars the country can absorb in the next five years would be 15,000, of which, Americans should get at least 60 per cent. This figure allows for only a small number of new owners. Replacements will account for the great majority of orders, as operating conditions are so severe that the average life of a car is less than five years. This factor alone calls at least 10,000 replacements within five years. From this, it can be seen that although in the first stages of automotive use, the Japanese market is worth cultivating and deserves the careful attention of present and future exporters.

Part of Fleet of Six White 2-ton Dump Trucks sold to Osaka Municipality, by Sale and Frazar

### The Motor Truck Market

Japan is essentially a short haul country but realization of this has yet to dawn in force on shippers. The country is in need of many branch lines to serve interior sections and the question of the future is whether these lines will be developed as rail or highway routes. To some extent the answer is now being given by motor busses which are bringing rapid transit to thousands living off the main routes.

Railway building is very expensive owing to the mountainous condition of the country. Long grades and tunnelling are met in every journey of 100 miles or more. Japan is thickly populated and nearly every square yard under cultivation providing a basis for motor transportation. This development is retarded by road conditions which make the use of motor trucks impossible in many sections. But if the road plan of the government is carried through motor transportation will be introduced, for the cost of men and horse pulled carts is increasing. It is estimated that one out of every twenty-eight people in Japan are engaged as beasts of burden, drawing carts or engaged in other forms of manual transportation.

The use of the motor truck in Japan is quite recent. Before and during the first three years of the war less than 250 trucks were in use, and of these few were employed in commercial work. But with the increased demands of industry which became manifest in 1918, the need for quicker and better transportation was felt and as a result more than 600 were imported in that year. Of these more than 200 were used in a motor bus service in Tokyo which served as a stimulus generally to motor transportation for in the following year although no large purchases were made for city buss work, nearly 1,200 were imported to be followed in 1920 by approximately 1,250.

According to figures of the department of home affairs there were in Japan on December 31, 1921, a total of 2,070 registered trucks. To this number must be added fully 500 owned by transfer agents but not employed because of the business depression and which are not registered because they have not paid the yearly tax, and another 250 unsold.

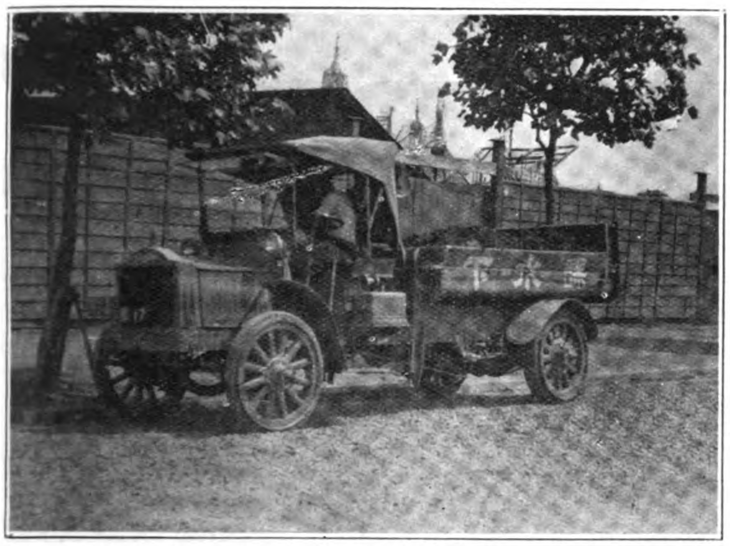
Very little road and street improvement is required to expand further the activity of the truck as is shown by the following figures. With the opening of the Tokyo-Yokohama and Kobe-Osaka roads will come a great impetus to truck transportation for merchants in these four cities are constantly harassed by the great cost of moving commodities between these points, and the loss of time, whether shipments come by rail or barges. This is a development that Japanese officials say will come within the next three years.

Significant of the change is seen in that the fact that three years ago practically all the imports were car chassis, while to-day about half are truck chassis. These light trucks are doing the missionary work for the larger motor trucks. It is significant that part of the first vehicles manufactured by the Jitsuyo Jidosha Seizo Company, Ltd., Japan's only active automobile manufacturers are being equipped with bodies suitable for carrying merchandise.

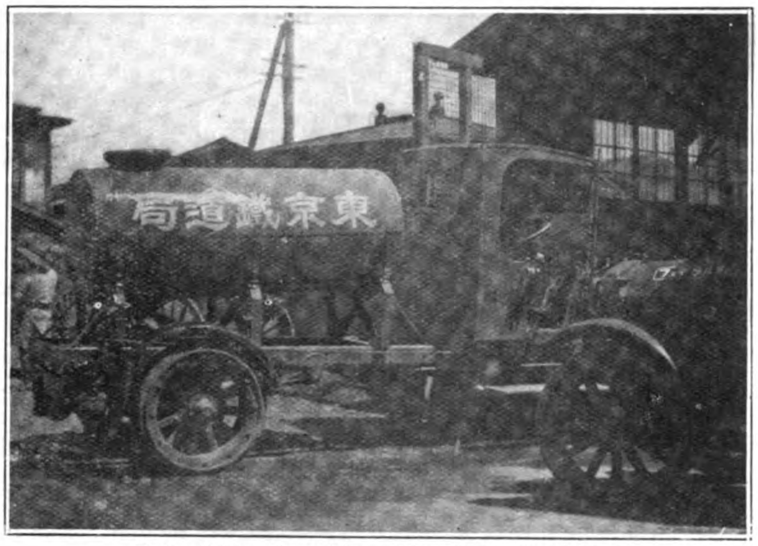
### Operating Field of Motor Trucks

At present nearly all trucks are employed within city limits. Although distances between villages and towns in Japan, especially near the rail lines are very short, there is little inter-city hauling. The field of activity within the cities is limited for reasons already given. Contractors, for instance, still depend upon carts for the delivery of materials, due largely to the fact that slowness in loading and the failure of dealers to keep sufficient supplies on hand to feed the trucks with. However, whenever loading was prompt the trucks proved more economical than carts.

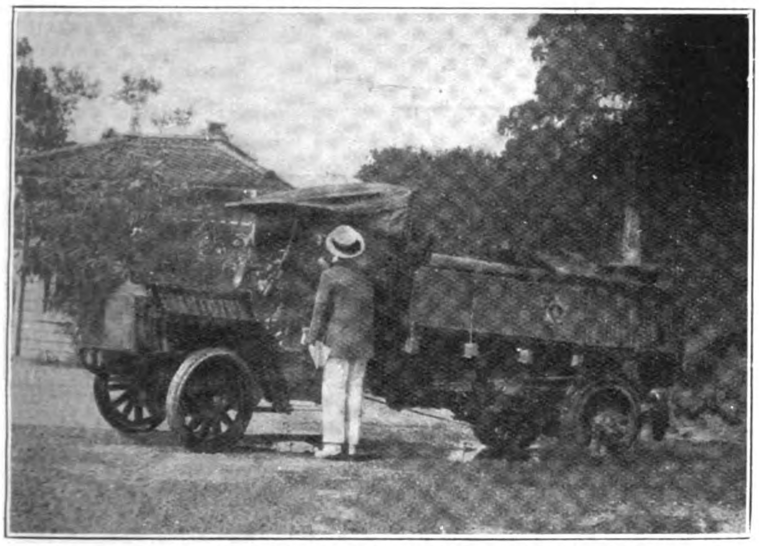
Contractors cannot use the heavy trucks which are a necessary part of the American contractor's equipment. The Japanese contractor is limited to the two-ton vehicle and his tax on that and the labor costs are as great as they would be on a five-ton truck. Under these conditions trucks cannot make the favorable showing as in America where the ton-mile costs is lowered by the use of heavy-duty trucks. An additional item of expense in the use of trucks is



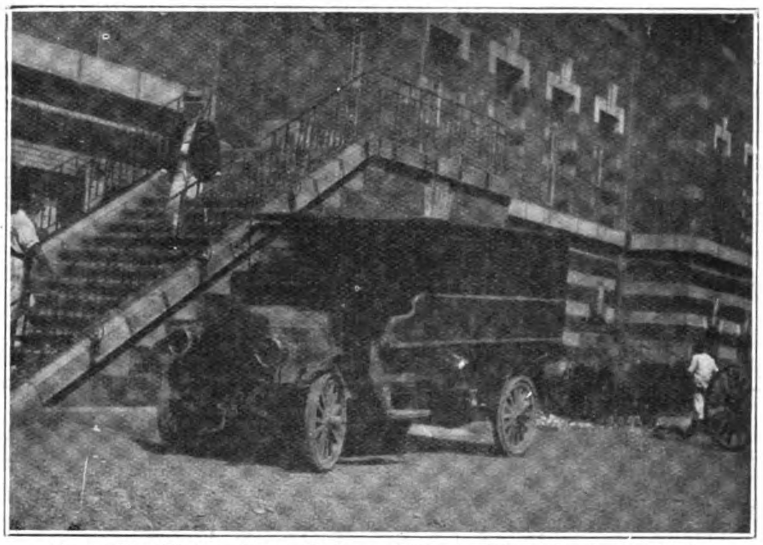
Two-ton Packard Trucks used by the Sewer Department, Tokyo Municipal Government



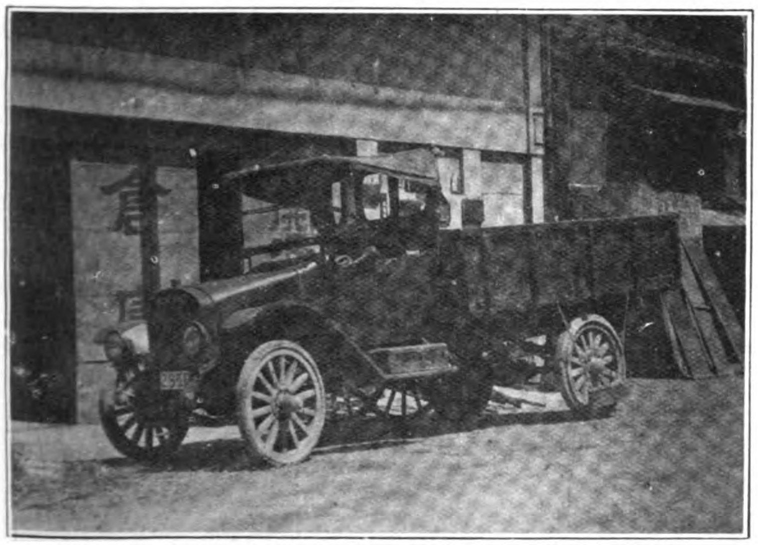

Federal 2-ton Sprinkler, Tokyo Tramway Bureau



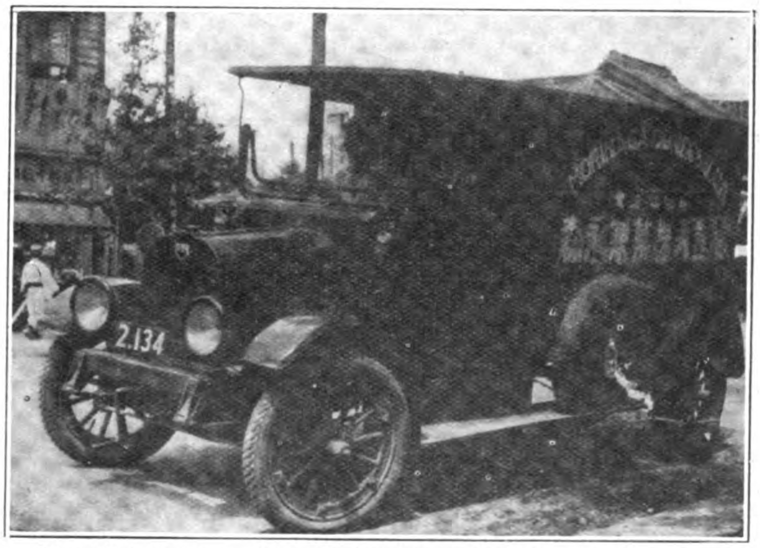
Packard 2½-ton Sprinkler used by the Tokyo City Road Bureau



1½-ton Day-Elder, Worm Drive: "Black Maria" of the Tokyo Metropolitan Police Bureau



Bethlehem Truck: Delivery Car used by the Kaitusha Transportation Company




¾-ton Vim Truck used by the Morinaga Confectionery Company, Tokyo

the fact that the Japanese truck driver will not load and unload and many trucks must carry a helper or depend for assistance at the loading and unloading points.

Manufacturers are slow to employ trucks as many of them enjoy the advantages of railway or waterside factory sites. In the islands of Kyushu and Hokkaido the mines in the former and the fisheries, canneries and lumber camps in the latter have the advantage of water sites. The use of trucks in these fields will be limited to general needs and not the movement of products.

## Trucks in Municipal and Government Work

Municipalities in all parts of Japan are using motor trucks. The major use is in public works and sewage disposal and a growing

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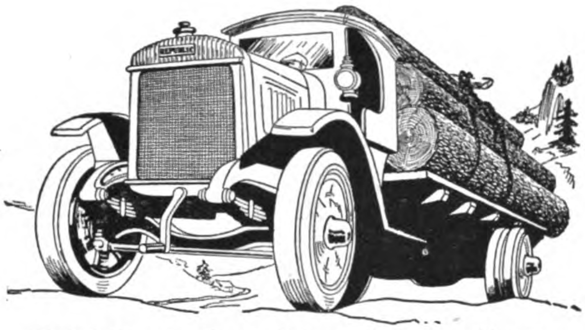

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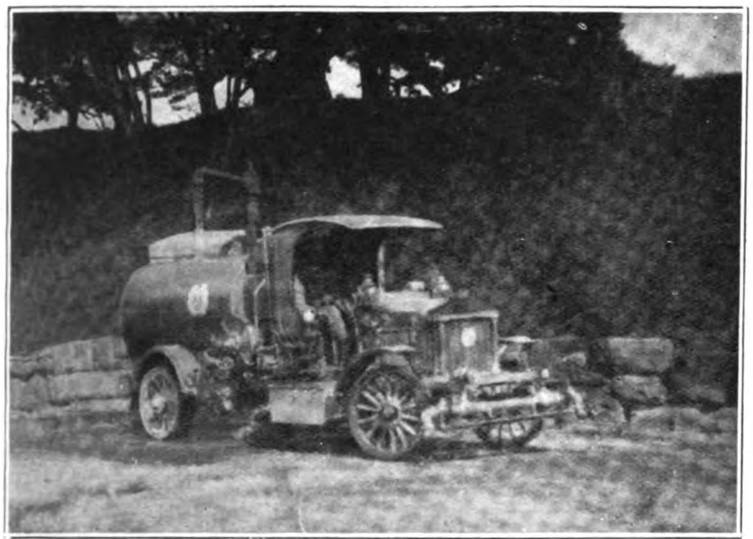
tendency for street sprinkling. The city of Tokyo is naturally taking the lead in this direction and during Mr. Irvine's stay in Tokyo the municipality purchased 35 light and twelve medium trucks for sewage disposal. The city of Osaka is anxious to purchase trucks but is restrained by the prefectural length restriction, its

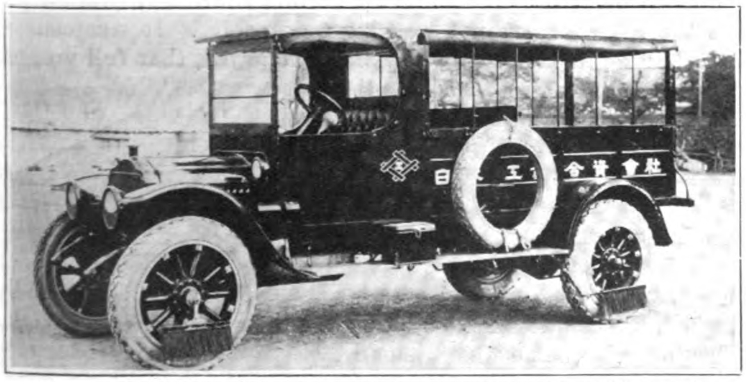


**3½-ton Pierce-Arrow Sprinkler used in the Imperial Palace Grounds, Tokyo**

requirements calling for trucks 18-ft. overall, while the allowable limit is 16-ft. 6-in. The opinion was expressed that the municipal and prefectural authorities would soon agree or the matter would be referred for settlement to the department of home affairs.

All the large cities in Japan are confronted with a very difficult problem in the disposing of sewage. Japanese cities have no underground sewage system and traps have to be regularly cleaned. Hand carts and oxen and horse teams have been used but there is a great deal of complaint especially at the stations where the barges are loaded. Because of the limited radius of operation of the carts and wagons these stations are located in various parts of the city, and this causes property values to decrease beside the public nuisance created. An effort is to be made to locate stations on the outskirts and to haul by truck. At the present time a commission of sanitary experts are sitting to find a solution to the problem other than installing underground sewage pipes.

Street sprinkling is an important function in every municipality for only by constant wetting can the dust be held down. From morning to night men can be seen drawing sprinkling carts and storekeepers and householders supplement their efforts with pail and dipper, water being drawn from the open sewers. The number of motor sprinklers is totally inadequate and certainly there is a splendid opening for the sale of many trucks for this purpose. Dealers contend that more are not used owing to the limited funds of the city. It is said that each year definite sums are set aside for the purchase of motor equipment and this must be divided among all branches of the municipality and only a small part can



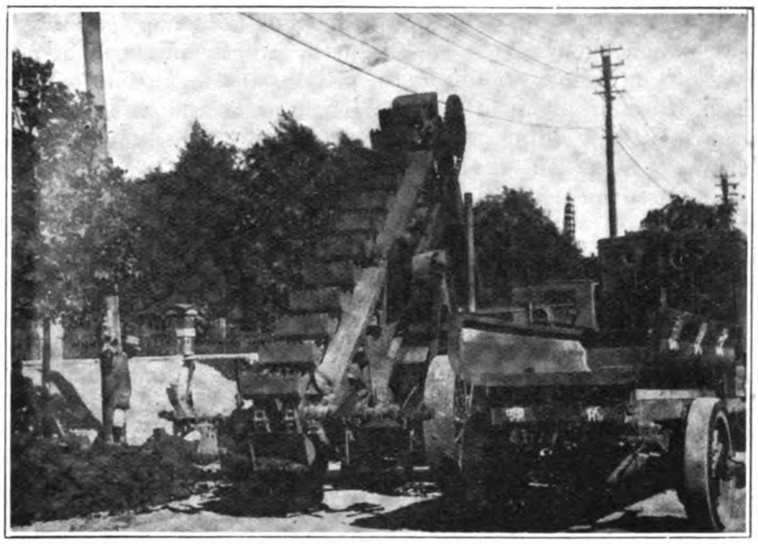
**Two-ton White Truck used for Engineering Inspection Trips and Instrument Transport by the Nippon Kogyo Goshi Kaisha**

be used for purchasing sprinklers. It appears that if a study were made of the waste resulting from the use of hand sprinkling carts it would show that the economy to be affected by the use of motor sprinklers would warrant special consideration being given to the subject. Flushing equipment cannot be used owing to the absence of hard surface streets and the failure to clean the streets.

The imperial government railways are using trucks in construction work and the engineers in charge of this activity are fully alive to the advantages of motor transportation, even to the possibility use of trucks as feeders to the main rail lines. Some interesting possibilities may develope from this source within a comparatively short time.

## Fire Apparatus

Fire departments throughout Japan are motorizing and there are few cities that have not at least one piece of apparatus mounted on a motor chassis. The equipment in the large cities such as Tokyo, Osaka, Yokohama, Kobe, Kyoto, Nagoya and Sapporo includes the most modern types of triple-combination engines of 500 gallons capacity, while a few 750 gallons type are used. The great majority of this equipment is American, the cities of Tokyo and Osaka being almost entirely equipped with American machines. A few British

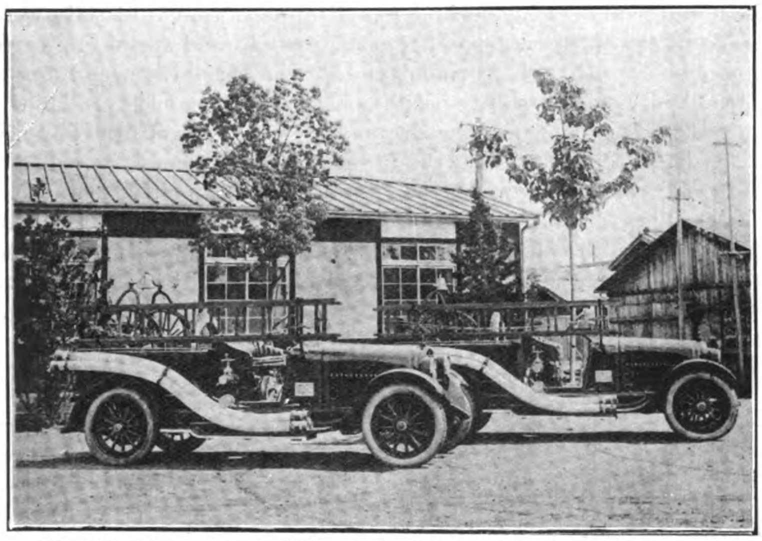


**Federal 2-ton Dump Car and L.nk Belt Material Conveyor used by the Tokyo City Road Bureau, repairing Road near new Parliament Buildings**

Merryweather and an occasional French and German machine have been imported but the dealers who have developed the fire business are of the opinion that American apparatus will continue to dominate the market for the reasons that American pieces are " in on the ground floor " and the apparatus is satisfactory.

In addition to the complete machines made by a single manufacturer there has developed for use in the smaller cities the practice of mounting equipment on passenger car chassis. This is especially true of hose carts, Tokyo having 26 and Osaka 22 while other cities have a few. These are mounted on American chassis, generally low price cars which sell in America for less than $1,000. Another practice is to mount a Japanese-built pumping apparatus on an American truck or even on a passenger chassis. The Monita Manufacturing Company and the Suzuki Manufacturing Company, of Osaka, are building such pumps, the former a 300 gallons while the latter manufactures a gear pump made for use with a separate motor. The Japan Automobile Company of Tokyo, which is the largest fire apparatus distributing agency, makes its own 200 and 300 gallons pumps which are run by separate gas or marine engines.

Japanese cities are perhaps the most inflammable in the world and when a fire occurs losses frequently run more than a hundred houses. This is due to the type of construction employed in dwellings. Houses which are never more than two stories high, are set very close together and are, with few exceptions, made of wood

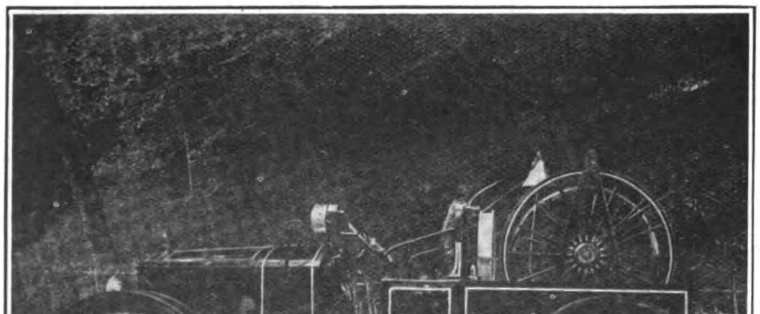


Fire Pumping Engine built at the Nakano Works of the Japan Automobile Company, on a Hudson Chassis

with paper partitions. The wood is very thin. All floors are laid with matting and there is an absence of protected electric wiring. There are no cellars and heating is done by oil stoves or *hibachi* which is a porcelain bowl, or wooden box with copper lining in which is built a small charcoal fire on a bedding of fine dry sand. Sparks from *hibachis* falling on the matting are responsible for many fires. In many houses the *hibachi* is set in the floor at night and over this the bedding quilts are laid so that the sleeper at least has warm feet. This arrangement leads to many fires. Bedsteads are not used nor is furniture generally, silk or cotton covered cushions serving as seats and are usually the sole objects of furniture. Cooking is done on the *hibachis* although kerosene and gas stoves are becoming popular for this purpose.

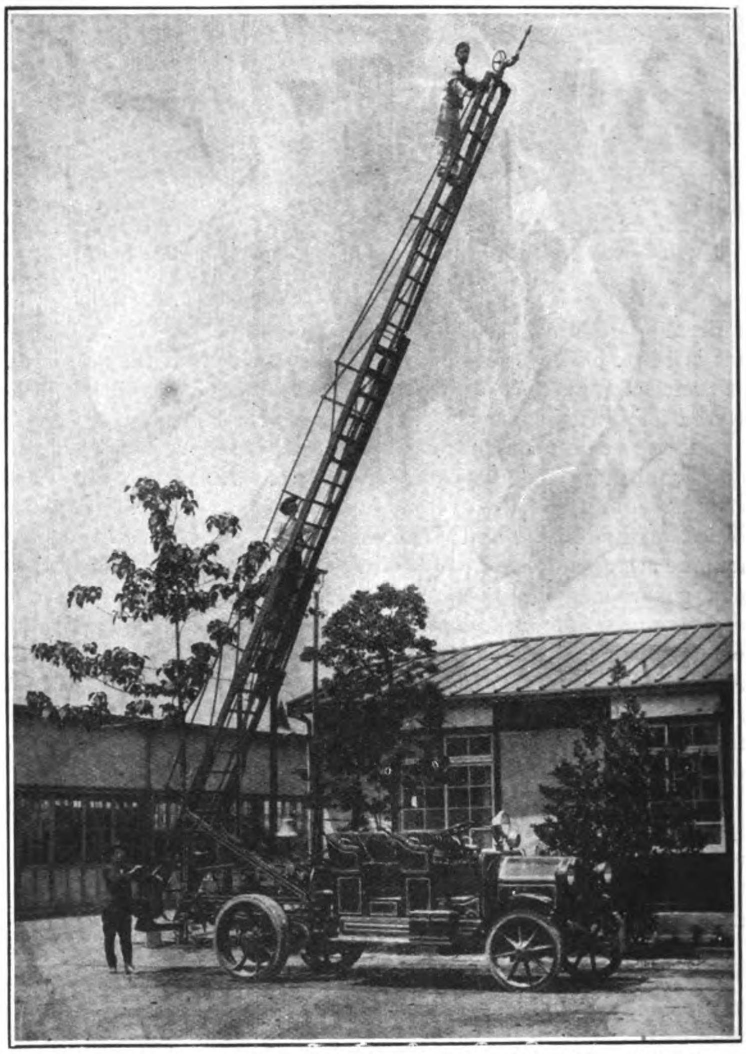
In the large cities fire watchmen are employed at night and they cover prescribed routes and about every twenty feet clap sticks of wood together signifying that all is well. In some cities the safety signal is a quaint song of a few notes, while in others bells are rung by the watchmen as they make their rounds. In the small cities towers are located at strategic points and from their heights of about 50-ft. men watch over the sleeping city and at the first sign of fire, ring great bells. In the large cities there are paid firemen but the small towns depend on volunteers.

Unless a fire is discovered at once the possibilities are that more than one house will be destroyed owing to the close proximity neighboring houses and the difficulty of getting in to them with fire apparatus because of the narrow streets. The cities of Tokyo, Osaka, Kyota, Yokohama, Nagoya and Kobe have water supply systems with hydrants for fire purposes. Other cities must depend upon the canals and open sewers. The latter are employed to supplement the water systems in the large cities whenever possible. There is no high-pressure service, the daily average pressure being from 30 to 50 pounds per square inch. Hydrant connections are 3¼-in. by 5 threads. Size of nozzles: ½-in. and ⅝-in. for hand pumps; ½-in. ⅝-in. and ¾-in. for steam and gasoline pumps under 200 gallons, and ¾-in. by 2, 7-ft. by 11⅛ by 1¼ for automobile pumps. the requirements for American fire engine makers are standard hose 2½-in. with hose connections of 3¼-in. diameter with 5 threads per inch, Whitworth standard thread.



Hose Cart on an Essex Chassis, built by the Japan Automobile Company at its Nakano Works

Hose of local manufacture is generally employed but observation shows it is not durable and not capable of meeting the requirements of high-pressure fire engines. During the visit of Mr. Irvine to Japan the largest hotel in Tokyo was gutted by fire. The hose leaked not only at the joints but along the line and from the size



Fire Ladder Car built at the Nakano Works of the Japan Automobile Company on a Fiat Chassis

of the streams projected against the burning hostelry, it was evident that the engines were not working to capacity. It was claimed after the fire, in the controversy which followed, that full pressure was not used for fear of bursting the hose.

The increasing use of fire-fighting apparatus in recent years is reflected in the decreasing total of the claims paid. For the year ended March, 1918, the total amount of claims paid was Y.10,-735,000; for 1919, the figure was Y.9,404,000 while at the end of March, 1920, it was Y.8,994,000.

The selling of fire apparatus is limited to a few dealers with more than 50 per cent. in the hands of one firm. The latter by reason of its organization outside of Tokyo has been very successful in selling equipment to the small cities, and it is reasonable to assume that if the other distributors were equally well organized, and pushed the business, they, too, could develope business without

crowding the field. Japan is a country of small towns and in all these at least one piece of fire apparatus is required. Japan will continue to offer an attractive field to the manufacturer of fire apparatus, for only in the large cities are any number of buildings of less inflamable type being constructed than brick or stone. In the business districts of the large cities steel and concrete buildings are beginning to make their appearance, but it will be many years before fire-proof buildings will be generally used.

## Army Truck

Definite figures as to the number of trucks owned by the army are not obtainable but dealers estimate that there are less then 200. These include not only the vehicles manufactured under the subsidy, but in the government arsenal and trucks purchased in the open market. There is a motor corps which has made a very thorough study of motor types both in America and Europe and as a result in one branch of the service an American truck has become standard equipment. There has been a tendency of the officers to build their own specifications which frequently eliminate makes, but this is diminishing and in the future selection will be based on performance as many different types have been purchased and their records are closely studied.

Each year a public test is held and all dealers enter cars and trucks and although no public verdicts are made the results of the test serve as a basis for future purchases. The test usually lasts two days, the first of which is devoted to a study of construction and design and the ability of the vehicles to run at different speeds in different gears and the proving of turning radius. The second day calls for a long test run ranging from 60 to 75 miles. Each truck carries its rated load and is accompanied by observation officers. During the run no repairs are allowed, all machines are loaded with fuel before starting and at the end of the run the balance of the fuel and oil remaining in the tanks is carefully measured. A total of 15 trucks participated in the test last year of which thirteen were American, one Italian and one French and two Japanese. The test is regarded by dealers as the most important event of the year and trucks are specially prepared for it. It also affords dealers the opportunity to use their literature effectively as each entrant is supposed to be supported with photographs and catalogs giving full details of his entry.

## Taxi-Cabs

Taxi-cabs are making successful headway against the ricksha mainly for the reason that they are faster and cheaper for any distance of more than two miles. Organized companies have been established in the principal cities but there is room for more as generally it is difficult to get cabs. The largest taxi-cab company is located in Tokyo and owns 250 cabs of which 150 are in constant operation without exception all the cabs are mounted on passenger chassis and the especially built taxi-chassis has yet to make its appearance in a market where sturdy vehicles designed for this hard service are required. Some of the cabs in operation in Tokyo and Kobe are make shifts, the owning companies having been organized to provide an outlet for overstocked dealers. These are not provided with regular taxi-bodies, open touring types being employed. One company operating this style in Tokyo are using a French chassis, a light job, which is totally unsuited to the work, an unusual proportion of the total number being always in the shop.

The rates charged are 90 sen (1 sen equals about ½ cent) for the first one-half mile and 10 sen for each additional quarter mile thereafter with a charge of 20 sen for each four minutes of waiting time.

The development of the taxi-business in Japan is retarded principally by the inadequate telephone facilities. Not only is the service poor but the number of phones is limited and private phones are confined principally to fair size business houses and the homes of the better classes. The securing of a telephone is a long and uncertain procedure. Each year the government, which operates the system, allots a certain number of new phones to a city. The number is insufficient to meet the demand and hence a lottery is held as a means of impartial distribution. For 1922 the assignment of new phones to Tokyo was 5,250 of which 502 were to be alloted to public bodies. There were applicants for more than 60,000 phones. Public booths are stationed at infrequent intervals on the street and these are the only pay stations and as it may take ten minutes or more to get a call through people resort to them only in cases of emergency. The scarcity of phones has led to the business of telephone brokers who buy and sell phone privilege and these were selling in Tokyo early last year for as much as Y.2,500. During the business boom Y.3,500 was not an uncommon price.

The most successful taxi company in Tokyo is fairly efficient. It had a complete cost keeping system. According to its records it operated from June 1 to November 30, 1921, 1,024,532 passenger miles against a total cab mileage of 1,785,468, netting a profit of Y.72,572 ($36,286). The company has paid an average dividend of 20 per cent. since it was organized. It maintains its own repair shops which are located at the headquarters garage where it also has houses which it rents to married employees and maintains a barracks for unmarried men. Chauffeurs are carefully instructed and occasional lectures are given on car mechanics and such topics as "safety first." Its cabs are rather small but they are built for the comparatively small Japanese who appear not to be uncomfortable when four or five are riding together. Cabs are stationed at the principal railroad stations and it is not an infrequent occurrence to see people waiting their turn for a cab, especially at the more distant stations. The company plans to add to its fleet. There is an affiliated company in Osaka which has been equally successful and is run on similar lines. The service in Kobe, Kyoto and in other cities is poor and there is great room for improvement.

## The Motor Buss Development

Within the past three years the use of motor busses has extended to all parts of Japan so that there are to-day approximately 759 lines operating about 2,300 busses over routes estimated at 8,400 miles. This is highly significant movement as it indicates the trend of passenger development for the great majority of these lines are serving as feeders to railroads, the services provided being from rail points back into the interior. While all these vehicles are not trucks, many passenger chassis being used, this development should prove conclusive evidence of the stability of Japan as market for trucks.

Up to the present time all the vehicles used are either bodies mounted on passenger chassis or a low priced one-ton truck chassis. It is reasonably certain that as these vehicles prove the profitableness of buss service larger jobs will be introduced with the coming of road improvements.

With the exception of one company all the lines are operated out of cities and towns and the greatest number and mileage is in those sections where rail transportation is limited.

The greatest number in any section is in the prefecture of Aichi in which Nagoya is located. Here more than 400 controlled by 35 individuals and companies are serving more than 820 miles. There are three prefectures: Fukuoka, Kumamoto and Nagasaki, in the island of Kyushu in which more than 100 busses are operated for a total distance of 1,600 miles. In the prefecture of Kochi in the island of Shikoku which is without any rail transportation, 130 are operated over more than 300 miles. More than 100 are in the prefecture of Hygoge and the adjacent section of Okayama. There is hardly a prefecture in the whole of Japan in which motor transportation is not to some extent provided by motor busses. An examination of the railroad map of Japan gives the answer to this universal use. Dealers say that the surface has only been scratched and that greater numbers will be used each year as the news of the success of the operating companies spreads. Road and weather conditions apparently are not a hindrance to these light busses for Mr. Irvine has seen them in operation in the city of Otaru in Hokkaido on streets covered with two feet of packed snow while most everything else

was moving on sleigh runners, including the ubiquitous rickshaw. Running on the same roads one frequently sees the most antiquated and ramshackled types of horse-drawn busses which are slowly giving way to the motor as the owners acquire sufficient funds and experience to run motor busses.

The movement of people continues to grow in Japan. Not many years ago a man who had traveled 50 miles from his native village stood out, but to-day everybody travels. Cheap railroad fares have made this possible and as a consequence trains, especially the second and third-class coaches, are always full. Street cars are congested at almost any hour of the day in all cities and the electric service between Yokohama and Tokyo in the rush hours is a fair reminder of the home rush on American elevated and subway systems. The western idea of quick travel has taken a firm hold on the people and as the public utility services are insufficient to meet the demand, motor transportation must be provided. In this fact lies the big future of motor transportation.

As yet but one large company is operating in a Japanese city. This is in Tokyo where service has been provided since the early part of 1918 by 160 trucks of which 150 are equipped with 18 passenger bodies. Unfortunately the company has not been well managed and is in financial difficulties at the present but plans are under way to reorganize and improve present routes and extend the service to sections in which there is an actual demand for transportation facilities.

The need for additional and better transportation service in Tokyo has been and still is very urgent. The city proper covers an area of 32 square miles and has a population of 2,159,308. Plans have been made for the inclusion within the corporate limits of the municipality of an area of 252 square miles, which will probably double the present population. This great number is badly served by a municipal electric railway which inadequately cares for limited sections, and by an elevated railroad which partly circles the city making possible rapid transit as the term is understood in America to those fortunate enough to be within its range. This is part of the Imperial Government Railways of Japan. Both of these mediums are badly congested practically at all times between 7 a.m. and 7 p.m. It was the recognition of this condition which brought about the organization of the buss company in Tokyo. Hastily organized it began operations without experienced transportation men and so it has deteriorated and its equipment is now in poor condition. There has been a lack of proper servicing and those necessary checks to prevent inefficiency and waste. Hope is now expressed that American capital will be interested in the company and under capable management the contemplated new equipment will put the company once again in the dividend-paying class. It is very important to the development of the motor buss idea that the Tokyo company succeed for upon its success probably rests the opening of other enterprises in Japan, as there are many fair sized cities which have no form of municipal transportation. In view of the street car congestion in other cities companies of a similar nature could be made profitable.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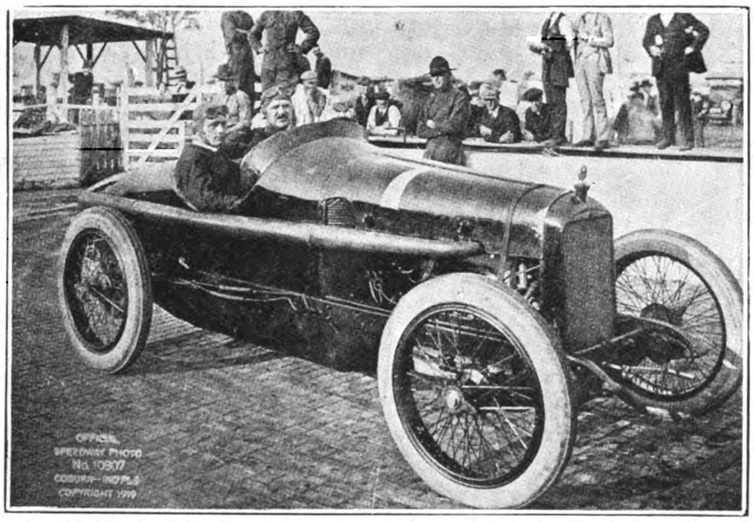

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### Provides for Dealer's Deposit, Insurance of Credit Risk and Co-operative Disposal of Rejections.

AUTOMOTIVE exports will increase three-fold if stimulated by financing facilities based on collateral value of motor vehicles, deposit by foreign dealer, insurance of credit risk, and provision for co-operative disposal by bank and manufacturer of any rejected shipments, according to G. F. Bauer, foreign trade secretary of the National Automobile Chamber of Commerce.

Motor vehicles represent definite collateral value, just as much as cotton, grain or securities. Recognition of this collateral value has been taken as far as domestic trade is concerned. A recent indication is the erection in Chicago of a warehouse, where motor vehicles may be stored by a dealer as collateral, on which loans are issued.

In export financing, however, the collaterial value of motor vehicles is seldom considered. A draft is discounted only as firm's standing warrants, regardless of the value that may be represented in the shipment.

This attitude is probably because of too little co-operation between the manufacturer and the bank and a lack of understanding as regards each other's problems. Any improvement is, therefore, possible only in a plan that proves satisfactory to both. To the manufacturer, it must offer protection from undue recourse; to the latter sufficient collateral and guarantee that the goods will not be thrown on the hands of the banker alone for disposal.

Negotiations are now on between the National Automobile Chamber of Commerce and certain bankers to devise a plan of this kind that will prove satisfactory all around. Based on co-operation between bank and manufacturer, it would provide this:

1. Dealer puts up as guarantee of good faith 25 per cent. of value of shipment.
2. Manufacturer discounts draft for 80 per cent. of face value, leaving other 20 per cent. standing until transaction is completed.
3. Bank insures itself against credit risk and charges premium of about 1 per cent. for six months to manufacturer.
4. Interest on credit extension is charged to foreign dealer.
5. Control of vehicles as collateral guarantee is retained by bank until payment is effected.
6. Disposal of vehicles, if rejected, is provided for in co-operative arrangement between bank and manufacturer, whereby latter contracts to give preference to returned goods in filling of any export orders on books.
7. Expenses of returning to U. S. of rejected vehicles are amply provided for in guarantee of 25 per cent. put up by dealer and forfeited in event of rejection of goods for invalid reasons.

The advantages from such a co-operative financing plan are manifold. The manufacturer is relieved of recourse. The bank avoids going into automobile merchandising, and if desired, could assume credit risk and collect premium for its own account. The dealer would have chance to sell vehicles before paying draft; but one-quarter of the present amount would be required to finance shipment from factory to destination; the credit with his local bank could be conserved for use in intensive sales development or in creating greater turn-over with resultant benefits to all from larger volume of business.

If then, co-operation will help us all in extending our foreign commerce, why not resort to it generally in advertising, selling, and servicing. It certainly ought to enable us to secure for all times 75 per cent. of the world's automotive export trade. The 75 per cent. would also then mean more than now, as the basis would represent a volume of business probably tripled what it is now.

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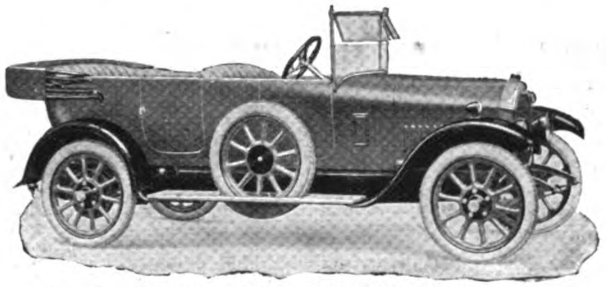
| 11.4 | H.P. All Weather | £650 |
| 15.9 | H.P. 5-Seater Tourer | £750 |
| 15.9 | Saloon de Luxe | £985 |
| 15.9 | Saloon Landaulette | £985 |



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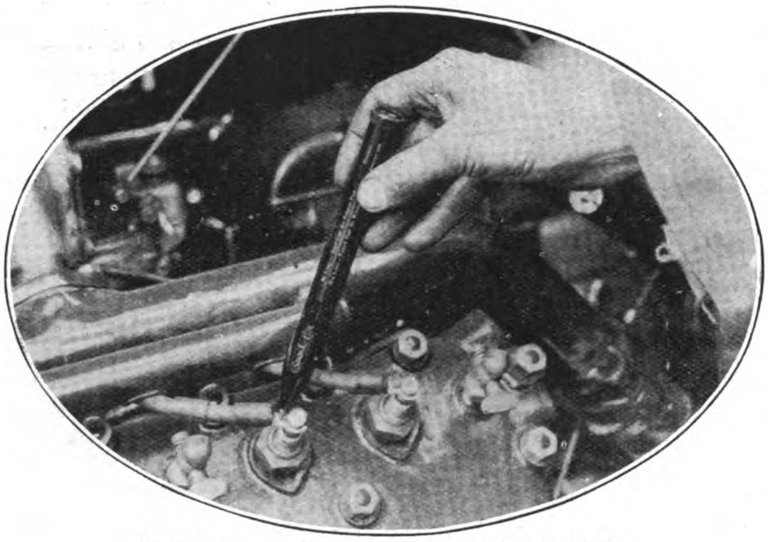
# New Automobile Spark Tester Makes Practical Use of Rare Gas

SPARK-C, a device recently placed on the market by the Westinghouse Lamp Company is an instrument for the location of electrical faults in the high-tension portion of automobile and similar ignition systems.

The essential part of Spark-C is a small Geissler tube, filled with Neon. Neon is one of the five inert gases contained in the atmosphere, of which it forms about one part in sixty thousand. The other inert atmospheric gases are Helium, Argon, Krypton and Xenon.

Neon is chosen, however, instead of the more easily obtained Helium or Argon, because of its striking appearance when passing a discharge. Most gases in a Geissler tube give off a bluish or whitish light, and the intensity of this light is quite small, except when a very powerful discharge passes. Neon, however, even when passing quite small currents, sends out a striking firey red light easily recognized even in the piesence of strong sunlight; the sunlight would make the pale blue discharge in Argon quite invisible.



Testing Automobile Spark Plug with Spark-C

In the Spark-C is a Geissler tube, about two inches long, and about one-quarter outside diameter. The central part of the tube is somewhat constricted so as to increase the brilliancy of the discharge, which takes place between two electrodes of nickle wire welded to lead-in wires having the same co-efficient of expansion as the glass of which the tube is made.

This bulb is mounted inside a protective casing of black hard rubber 11/16-in. outside diameter and 7¼-in. long. A window placed in the side of the casing opposite the narrow part of the Geissler tube, enables the discharge to be seen. This window is made narrow so that even in bright sunlight the discharge tube is somewhat shaded, making the red glow more striking. To avoid any danger of breakage the discharge tube is held in position inside the casing by thick washers of soft material. One lead of the tube is soldered to the brass tip at the pointed end of the casing. The other is attached to a lining of metal which is fitted into the rubber casing behind the discharge tube.

If now the brass tip is applied to any source of alternating or oscillating potential of sufficient magnitude, and the other end of the casing held in the hand, sufficient current will flow into and out of the condenser formed by the hand of the person holding the Spark-C as one plate, and the metal filler above mentioned as the other plate to cause the tube to show a red glow. This current will not, however, be felt by the person holding the Spark-C as the condenser formed as above mentioned has a very small capacity and so only passes a minute current at ordinary frequencies. Any high frequency components, to which the impedance of this condenser would be so much smaller than larger currents could pass, will be of frequencies so high as to cause no shock. Since the amount of light depends on the current and this depends in turn on voltage and frequency, the device may be regarded as a voltmeter.

It has been found that when the Spark-C is used to test the condition of the spark plugs in a gasoline motor, a cracked and shorted plug or one heavily coated with carbon will at best, cause a dull irregular flicker in the tube, while a perfect plug will cause a bright easily visible glow, pulsating regularly. If, however, the gap between the points of the plug is too wide the glow will be exceedingly bright and the bulb in the Spark-C will begin to glow before actual contact is made between the brass contact tip and the top of the plug, sometimes up to a half inch away while a plug whose gap is correct should only cause appreciable light in the Spark-C when actual contact is made.

If trouble is suspected with the high-tension insulation, tracing along the insulation with the Spark-C will often find weak spots or leaks. Missing due to a dirty distributor can also easily be found and the trouble correctly diagnosed by the aid of the Spark-C. It is of great service in repair or maintenance work on automobiles, airplanes, motorboats or any internal-combustion motor using high-tension ignition.

On the Spark-C itself and engraved in the hard rubber casing in bold orange colored type will be found the following information :—

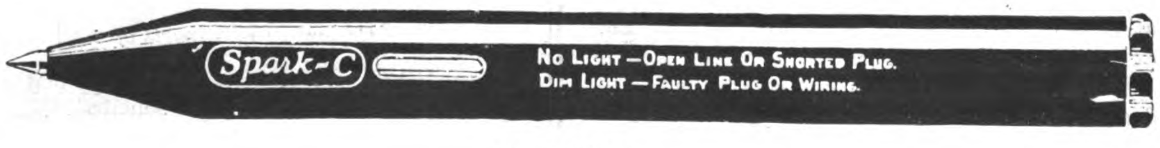
No light :—Open line or shorted plug.
Dim light :—Faulty plug or wiring.
Medium light :—Spark plug working properly.
Bright light :—Spark gap too large.

For instance :—No light-open line or shorted plug means that there is no voltage available to force the current into the Spark-C, and this may be the result of either of two causes :

First, the points of the plug may be so badly fouled that there is no longer any gap, in which case the current can flow across as rapidly as it is generated, allowing no chance for the voltage or pressure to build up.

Second, there may be no current flowing at all on account of a broken connection at some other point. This can be readily found by disconnecting the cable from the plug and testing it at various points back to the distributor or induction coil.

Dim light-faulty plug or wiring: This is the result of too low a voltage, which is generally att ributable to one of three causes:




Spark-C Tester

First, there may be an

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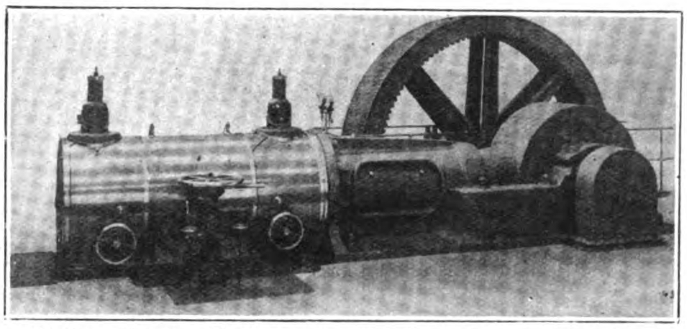

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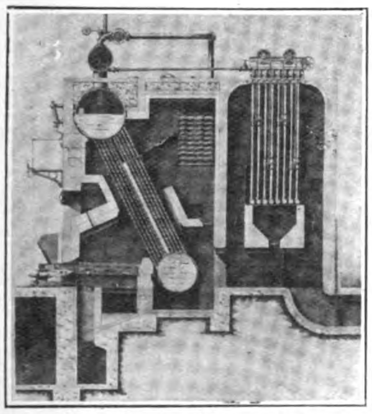

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accumulation of carbon on the points of the plug or on the porcelain insulation, which allows the current to pass without giving a good spark.

Second, the porcelain insulation of a plug may be cracked, allowing the current to cross at some other point. If, when the cable is disconnected from the plug and the Spark-C gives a bright glow when touched to the end of the cable, the trouble is definitely in the plug. If on the other hand, there is only a dim light on the end of the disconnected cable, then the third cause, that of faulty wiring, is indicated.

Medium light-spark plug working properly needs no explanation, as a spark plug which gives this indication may be assumed to be working properly.

Bright light-spark gap too wide : This is caused by the space between the points being too wide, which requires too high a voltage to force the spark across. The points of the plugs should be just far enough apart so that a worn dime will slide between them. If wider than that the spark becomes thin and weak or may not even jump at all.

Spark-C is considered of special value to ignition and battery service stations, garages, car sales rooms, automobile factories, car owners, etc., and should prove equally effective in the hands of those operating aeroplanes, automobile trucks, rural lighting outfits, tractors, motor boats, yachts and auxiliary power apparatus using explosion type engines.

It will not, however, give any indications on the low-tension circuits, as it requires a considerable voltage (500 to 800) to produce any discharge whatever.

There are many other uses for Spark-C that would take more time and space than is available now to explain, but it might not be amiss to mention the testing of the high-tension circuits of wireless plants, X-ray installations, etc. Amateur wireless operators surely can appreciate its value to them and its popular price brings a scientific and dependable instrument within the reach of even the most modest experimenter.

## Semi-Diesel Engines for Flying Invented

FOR a long time experiments have been in progress with a view to adapting the principle of the Diesel engine to aircraft and motor-cars, and there is reason to believe that complete success is near at hand, says a home paper. Whether England, France, or Germany will first be able to claim a really practicable result it is impossible to say, but whilst Professor Junkers in Germany has succeeded in making a six-cylinder high-speed semi-Diesel engine for aeroplanes, and a French engineer claims to have made a Diesel engine for motor-cars, experiments at the royal aircraft establishment at Franborough have, it is understood, reached a point which assures complete success. It is hardly necessary to point out that a great economy in running costs, besides reduction of fire risk, and the removal of one of the commonest causes of forced landings may be among the benefits, so far as aeronautics are concerned.

The Diesel principle does away with carburettor and magneto, and permits the use of heavy oils and high flash-point oils, obviating the necessity to use volatile spirit. Thus, besides the saving in the cost of fuel, the fire risk would be removed, which is a very important consideration as regards both aeroplanes and airships, and would, moreover, permit economical modifications in general design.

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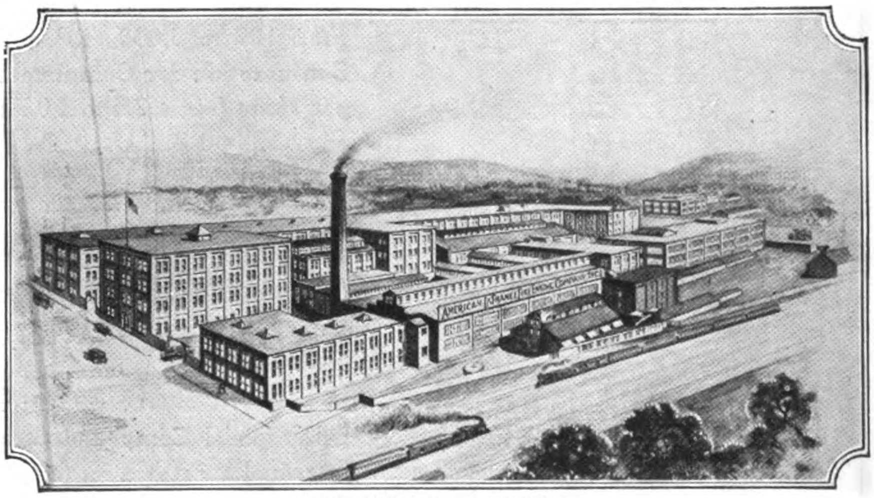

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ENGINEERING FINANCE COMMERCE

遠東時報

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Manufacturing in Manchuria

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Vol. XIX February, 1923 No. 2

SHANGHAI, PEKING, TOKYO AND MANILA

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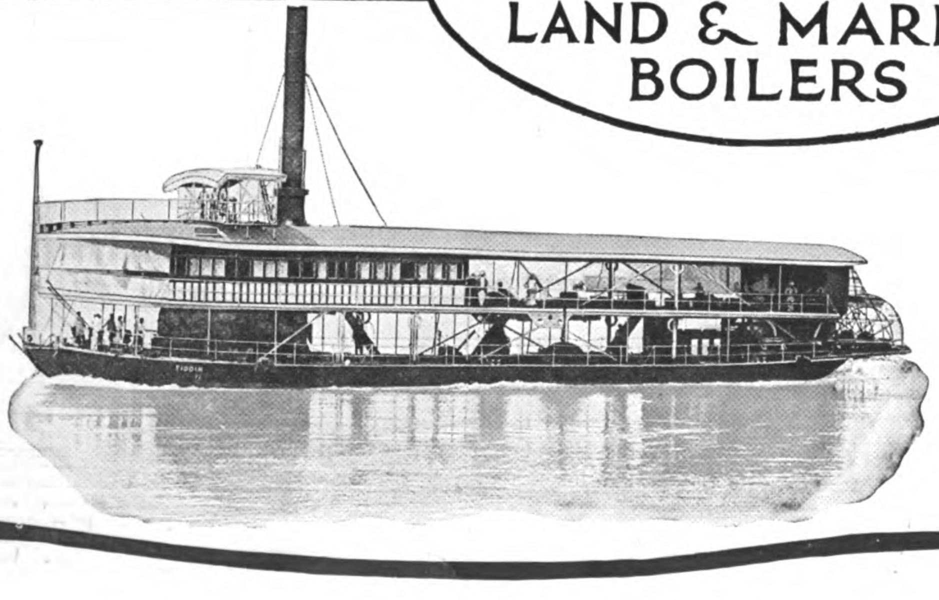

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, FEBRUARY, 1923 No. 2


# Chaos, Civil War, Insolvency and Ingratitude

## Dyer Sums Up The Facts

FOR the first time in many years a highly placed American official has discarded the language of diplomacy, dropped sentimental flub-dub and reported the facts as he found them in China to the American people. Congressman L. C. Dyer, the author of The China Trade Act, has been making a personal investigation into existing conditions in China in order to obtain first-hand information to enable him to secure legislation at Washington to support American business development in this country in connection with amendments considered advisable in the recently enacted bill providing for Federal incorporation for American business in China. Mr. Dyer is also the personal representative of President Harding commissioned to report directly to the head of the nation on general conditions in China.

Congressman Dyer represents a Missouri constituency. He insisted upon being shown and after having seen conditions at first hand and poring over contracts and other documents to be personally convinced of the truth of statements made to him, formed his conclusions without being coached by the usual propaganda committee directed by the Peking official intelligence bureau. In view of the seriousness of the present situation and in order that the facts should be made clear to President Harding and the American people, the American chamber of commerce at Shanghai most wisely determined that Congressman Dyer should be permitted to see things as they really exist. The result is seen in the following interview given out by Mr. Dyer in Peking on January 30:—

" In view of the importance of measures now under consideration in Washington, which are largely an outcome of the Washington conference, I will on my return to Washington, express my impressions and conclusions on present conditions in China. I refer amongst others to such outstanding questions as the commissions to be appointed to advise on customs increase and consideration of the judicial system of China with a view to possible future abolition of extraterritoriality.

" Information has also been sought from me touching the remission of the remaining Boxer indemnity funds aggregating between G. $12,000,000 and G. $13,000,000 in their application to purposes beneficial to the people of China.

" The broad desire of the American people is that in supporting these measures they shall produce benefits which will satisfy public opinion that the objects intended have been achieved in constructive results to China.

" The questions which I will be asked on my return to Washington are—

1.—What are conditions in China to-day ?

2.—Are they establishing a stable government ?

3.—Is the country now reasonably well administered and is progress being made in railroad construction and industrial development ?

4.—Can it be considered safe to extend to China financial assistance to help build up her communications and industrial development ?

5.—Are the Chinese sustaining their reputation for individual honesty in the management and administration of government public utilities ?

6.—Are they meeting government obligations ?

" I will for what I believe to be the good of China and America have to tell Washington that—

1.—I find China in a condition of chaos, with civil war south of the Yangtze ; Szechuan in the west reported in turmoil and armed camps dominating all parts of North China.

2.—In Peking I have met individually brilliant men and idealists but, possibly due to military interference, no real evidence of broad constructive endeavor to achieve in government affairs a unity of purpose to bind China together as a nation.

3.—In China's relations to American business I find a lack of the spirit of reciprocity to respond to the goodwill which America extends to China.

4.—On the Yangtze, steamers under the American flag have been repeatedly fired on by Chinese troops and hampered in their business operations because of Chinese official and military obstruction.

5.—In many parts of China the lives of foreigners are endangered by uncontrolled soldiery and those in the guise of brigands, culminating in the recent deplorable incident at Kalgan where Chinese soldiers under Chinese officers murdered an American citizen.

6.—I find China insolvent due largely to the squandering of government funds in military adventures and the maintenance of demoralizing military forces. There appears to be a complete disregard for the obligations of China to American merchants and bankers.

7.—I find in Peking numerous representatives of American commercial and financial interests, maintained here merely for the purpose of endeavoring to collect debts owed in many cases for years by the Chinese government.

8.—I find on examination of some of the contracts that they were awarded by the Chinese government as a result of public tenders specifying final payment within a definite time after completion, delivery and acceptance of goods. Such are examples of the obligations the Chinese government has failed to meet.

9.—Aside from unpaid bills for materials, China has borrowed money from important and influential American banking interests. Some of these loans are in default both as to principal and interest—and have been in default for some time. Americans cannot understand what China is thinking of to permit those defaults so continue unremedied.

10.—On the question of extraterritoriality I have not observed any convincing evidence of the existence of a judicial system which

would warrant me in supporting in Washington any movement to abolish extraterritoriality thereby entrusting the lives and interests of Americans in China to Chinese administration of justice.

"I have frankly stated my impressions of China as I see conditions to-day. China has the real sympathy and friendship of the American people. Without thought of infringement of China's sovereign rights she can obtain, against adequate pledges, financial assistance to pay off existing obligations and take in hand needed reforms to carry on her industrial development.

"To accomplish this there must be a united China with a government which will command and hold authority as representative of the will and interests of the people of this great country.

It is my purpose in Washington to do everything in my power to further the attainment of support to China so that the trade relations between America and China may be developed to the greatest possible extent.

* * *

## The Honor of the Flag

THE *liaison* between the waichiaopu and the American legation at Peking is a thing of the past. The wanton killing of an American citizen in the presence of an American consul at Kalgan awakened not only the government but public opinion at home to the danger involved in further pandering to a government which exists solely to conceal from and justify before the world the crimes of its real masters. In standing firmly for an apology, reparations and punishment to the guilty parties, the American government has recognized that unless such action is taken for the protection of American lives and properties, and proper respect for the flag and its representatives abroad, there is little hope of building up a foreign trade each year becoming more essential to the national prosperity. There was a time perhaps when the state department could pursue a policy of watchful waiting in the midst of a world upheaval while our citizens were massacred in Mexico; but times and conditions are different. Foreign markets are now important to our manufacturers, and unless our citizens have the fullest confidence that their government will stand by and protect them in the legitimate pursuit of business in foreign lands, the bottom will drop out of the campaign for foreign trade expansion and markets gained at the cost of much hard work handed over to competitors whose governments know how to protect them. The killing of Coltman at Kalgan and the insult to the representative of the American government by the rabble army of the *tuchun* of Charhar, automatically became a major case, upon whose outcome rested the future of American trade and respect for the flag in China. It is gratifying and inspiring to non-hyphenated Americans who have held aloof from entangling sentimental alliances to see how splendidly the legation and state department swung into action along those old traditional lines that marked American diplomacy for over a century, and which conveys to the world and to China in particular, that the leading strings which tied the waichiaopu to Washington have been cut. China stands upon her own bottom. She demanded this right at Paris and at Washington and it was conceded her. She has insulted and outraged the friend whose sympathy and support enabled her to attain her most cherished aspirations. The American attitude towards China now depends on the outcome of the Coltman case; either China complies in full with the American demands, or American policy towards this country will undergo a marked modification. Sentiment has gone by the board as far as America is concerned. For once our government is determined to insist upon the full acceptance of its demands.

These demands are listed under six heads: First, a general apology for the shooting of an American citizen in the presence of an American consul: (2) a full and complete apology from the *tuchun* of Chahar to be made formally to the American consul at Kalgan, embodying a letter dictated by the American legation; (3) dismissal of the three officers directly in command of the troops who fired the fatal shot (whose names are specifically pointed out in the American note) and who are to be prohibited from holding office in the future, and furthermore tried according to Chinese law and punished in proportion to the amount of authority and responsibility exercised by them; (4) indemnity to the Coltman family; (5) an assurance that there will be no further interference with the right of American citizens to transport silver specie for legitimate business purposes; (6) the right is reserved to exact a further indemnity unless all the above provisions are complied with.

The above points have all been more or less accepted by the Chinese with the exception of the third demand. The American authorities insist upon the Chinese punishing these men according to their own laws, and it is upon this point that the Chinese are hanging fire. If the foreign office as the representative of the recognized Chinese government cannot guarantee or refuses to have these men punished, then the whole question of who constitutes the actual government of the country will arise.

The Chinese government has presented certain counter-claims asking that the American consul at Kalgan apologize for his part in the incident which led to the shooting of Mr. Coltman by the Chinese sentries, and for the punishment of Mr. Wooden, the companion of Mr. Coltman who had passed the barrier of sentries but later returned when he heard that Mr. Coltman had been shot. This counter-claim only helped to stiffen the American attitude and Secretary Hughes announced that unless they were withdrawn in *toto* and the American demands complied with, the United States government would be compelled to alter its attitude towards China. This decision was communicated to the waichiaopu. At the date of writing the American demands have not been met, and faced with the responsibility of having to settle this vital issue, the foreign-trained diplomats, whose success has been largely attained by reason of American sympathy and support, are hastily seeking cover.

There have been many comments on the Coltman case in the Chinese and foreign press in which an effort has been made to divert attention from the real issue and throw the blame for the affair on to the murdered man. However, the main fact is overlooked. The shooting of Mr. Coltman, although serious enough in itself, is secondary to the larger issue involved. Coltman was in the company and under the protection of the American consul at Kalgan the representative of his country who he relied upon for advice and safe conduct. If any infraction of the Chinese law was committed, the American consul alone was culpable, and the Chinese military commander should at once have made his charges through the usual diplomatic channels to the American minister at Peking. Had the Chinese case been a just one, present conditions would be reversed and the United States government placed in the position where it would have been necessary to apologize and dismiss its representative from the consular service.

Opening fire on the occupants of an automobile which included the American consul, and in which the latter escaped with his life by a miracle, elevated the crime from a simple murder of an American citizen to a deliberate insult to the American government, one which in other days would have admitted of no parley: it would called for an immediate apology, reparations or—hostilities. The American government has, therefore, no option in this matter. The dignity and honor of the flag is at stake. Coltman's death might have been passed over with an expression of regret and the payment of a suitable indemnity to his family: the insult to the flag and its representative must be met by China complying with the full demands made by the state department. In this the American government will not cede an inch. China will comply or suffer the consequences, whatever they may be.

* * *

## The Death of Reinsch

### China's Ingratitude

THE collapse of the Sino-American "alliance" has been followed by the untimely death of the man whose influence and support made it possible. Dr. Paul S. Reinsch has passed away in Shanghai, following a long illness which sapped his vitality and

undermined his reason. Much of China's vaunted diplomatic successes at Paris, at Washington and in the conferences of the league are traceable directly to the guidance ond support of the former American minister to Peking. The victories that have come to China at the conference table of the nations are due more to American championship of their cause than to any extraordinary abilities on the part of her official representatives. Reinsch made China's cause his own. He felt that he had been double-crossed by secret diplomacy when he dragged China into the war and gave her assurances of support at the peace conference that could not be carried out owing to the existence of secret understandings between the powers as to Japan's position in Shantung. The failure of China at Paris turned him against diplomacy as it is practiced. He resigned the post of American minister to China and accepted the position of counselor to China at Washington in order that he might undo the wrong unintentionally done when, through his influence, she severed relations with Germany.

Dr. Reinsch was not a professional diplomatist, and although actuated by the highest motives, his distorted view of America's mission in the Far East led him to start many things that he could not carry out, and it is no reflection on his memory to add that it will take years to undo some of the work initiated under his tenure of office as American minister to Peking. From the first he was impatient to do things, to accomplish something big that would redound to American prestige in China, and to his lack of accurate knowledge of international policies in China is due largely the failure of the Siems-Carey contracts, and the closing of the Chinese field to further independent American activities. The consortium that was created as a result of his initial failures was the only way out of a delicate situation that would permit Americans to participate in the development of China. It is to be regretted that Dr. Reinsch camafloured the reasons which made this international financial combination necessary by throwing the blame upon Japan, for as noted elsewhere in this issue of THE FAR EASTERN REVIEW, there is no difference in principle between the much condemned Nishihara loans and the American loans to China made while he was representative of the American government at Peking.

Although he has been severely criticized for resigning the American diplomatic service to enter that of China, disregarding the recognized ethics of diplomacy in placing his knowledge at the disposition of another government at a time of intense international discord, yet he did his duty as he understood it. He felt that he got China into the mess by reason of his promises when she entered the war at his solicitation, and when his own chief at Paris surrendered to the other powers on the Shantung issue, he determined to contribute his efforts to undo the wrong he felt had been committed. It is superfluous to add that without the support and sympathy of Dr. Paul S. Reinsch the anti-Japanese movement in China could not have made headway. That other agitators and propagandists took advantage of the situation to push forward their schemes to incite hostilities between Japan and America was only natural, to the extent that even associate advisers to the Peking government drew up plans of campaign in preparation for hostilities.

The reputation of many champions of China have been built up and made possible simply because Dr. Reinsch with his great influence and power as the American minister made their propaganda work in America possible. He was the standard bearer, the leader whose advice and prestige with the American people enabled the rank and file of the anti-Japanese war element to operate and get their story over. Without Reinsch, China's case could never have been brought so forcibly home to the people of America, and without his support, the Chinese delegation to the Paris and Washington conferences would have had hard sledding. The laurels that have come to other champions of China's cause are theirs because they had at all times the inspiring counsel and aid of Dr. Paul S. Reinsch.

What was his reward? For over three years he carried the load for China in the United States. He became Chauvinistic in his dreams for her greatness. Books, magazine and newspaper articles from his pen and many speeches kept American interest centered upon China and her real or fancied wrongs. He came to China last autumn in order to contribute on the ground his advice towards national unification and financial reform. He also came to collect his much overdue salary of $20,000 gold a year. Reinsch was a poor man. When the Chinese failed to remit his salary, friends accepted his promissory notes in order to tide him over. He owed considerable sums to his intimates. He hoped to straighten out his financial difficulties in Peking. He failed. Discouraged and disheartened he left Peking facing financial dishonor. Never a strong man, be broke under the strain at Hankow on his way to Shanghai. Only after he was in the hospital and his life despired of, did the Chinese government remember him. They sent him $5,000 in cash, paid one of his notes for another $5,000 and renewed his contract for another year, but not before other Chinese had solicited Americans in Shanghai to contribute towards a fund for his financial relief and to send him home with.

So died Paul S. Reinsch, abandoned by those he sacrificed his career to assist. It broke his heart, undermined his reason and sent him to an untimely grave. Reinsch died the victim of Chinese ingratitude. His passing was a real tragedy.

While he lay dying in the hospital, his employers in Peking who could not raise the salary that wonld probabaly have saved the reason and life of this American adviser to the government of China, found no difficulty in raising $72,000 to finance a publicity and intelligence bureau directed by one British adviser to the president of China, and another $150,000 to start a new newspaper and propaganda service directed by another British adviser to the president of China. The success of both these British directors of China's publicity and propaganda work in influencing American opinion is traceable also to the fact that it was Reinsch, the American minister and adviser to the Chinese government, whose prestige at home made it possible. Americans will not forget.

* * *

# An Indiscreet Chronicle from the Pacific

***By Putnam Weale, Dodd, Mead & Company, New York***
***(Contributed)***

PROPAGANDA is the aim of this book, but after a careful reading of it, one is left in doubt as to whether the propaganda is directed toward a justification of the author, or toward furthering the interests of China. Mr. Simpson, who writes under the name of Putnam Weale, has frequently referred to himself as a publicist by which we suppose he means that he is a writer of topics of current or public interest. The only parts of this book which may be considered to be of current or public interest at the present time are those relating to Mr. Simpson and his connection with the Chinese government. On page 96 in his Memorandum to Lord Riddell, Mr. Simpson states in paragraph (1) "I have been sent to London by the Chinese government to make clear China's position, which does not seem to be at all understood in England." This view of his mission does not coincide with the statement made by the ministry of foreign affairs on July 18, 1921 in which it was said, "During this summer Mr. Simpson was entitled to a vacation, and taking advantage of this he proposed to visit both America and Europe, and asked what he could do for the Chinese government. He was therefore instructed to study and report on American and European opinion regarding China and its aspirations." To the ordinary mind there is a wide difference between reporting on American and European opinion regarding China, which were Mr. Simpson's official instructions, and making clear China's position, which was Mr. Simpson's self-appointed task. It thus turns out

that the present Chronicle is an apologia for the way in which Mr. Simpson attempted "to make clear China's position." As no official documents of the Chinese government are quoted, it is necessary further to note that the Chronicle is not a statement of "China's opinion," but rather an exposition of Mr. Simpson's personal views as to what China's position is. In estimating the value of this book one needs, therefore, to consider Mr. Simpson's point of view as to the duty of a writer on public topics to state the truth, the whole truth and nothing else but the truth.

At the outset we are met by a difficulty, for Mr. Simpson says on page 91 that "publication was what was needed—much publication—persistent publication." As to what should be published he also has a clear, though not convincing opinion on page 219. "Overstatement is good and refreshing in an atmosphere of compromise and indecision, presided over by the Golden Calf." Now it cannot be claimed on any score that overstatement is truth, and it is therefore probable that the term "indiscreet" used in the title of this book is synonomous with "overstated." The reliance of the author upon overstatement rather than upon truth is in marked contrast to Milton's dictum "whoever knew Truth put to the worse in a free and open encounter."

Propaganda and overstatement came to full fruition during the late European war. In England Lord Riddell was a brilliant example, and of him the author says that he made "such a remarkable success in Washington," that he "has Scottish sound common sense and can recognize new facts without being irremediably upset by them." There were also Northcliffe and Burnham, "that most genial of all men." In France there were Maurice Bunau-Varilla of the *Le Matin*, Arthur Meyer of the *Gaulois* and André Gêraud (Pertinax), of the *Echo de Paris*. The United States had George Creel with his committee on public information, and Ray Stannard Baker, director of the press bureau of the American commission to negotiate peace at Paris. Japan had the *Kokusai* agency. These were all worthy masters of overstatement and all of them had small use for truth when it stood in opposition to the objects toward which they pressed. Mr. Simpson had a long line of distinguished war writers as a model for his Indiscreet Chronicle; the only pity is that he has not yet come to learn that the sober public opinion of the countries represented by these writers has for some time classified them as undesirables. Overstatement of some facts and suppression of others had currency during the war, but as soon as it was over the public of all countries ceased to be fooled.

The narrative is concerned with the events of the imperial conference at London and with the limitation of armament conference at Washington. One might imagine from this Chronicle that the only question before either of these conferences was the Anglo-Japanese alliance. No one but a prejudiced observer could come to such a conclusion. Sir Robert Borden of Canada stated the problems of this country in the memorandum quoted on page 44 as the way in which the problem of "a group of free democracies enjoying complete powers of self-government in domestic affairs" should be able to act "in close association with the mother country." This was the fundamental problem of the London conference. Ireland was another urgent problem. The Anglo-Japanese alliance held an inferior place, for its continuance in some form or other had already been agreed to by Canada and Australia before the conference assembled. The main problem before the Washington conference was the lessening of the burden of taxation, and it was recognized that the first step toward this end was a limitation of naval armament. This question in its turn brought up the problems of China, the mandated islands of the Pacific, Shantung, Siberia and Yap. Incidentally these problems brought up the bilateral Anglo-Japanese alliance for which was substituted a quadrilateral agreement. It is overstatement, and overstatement for a purpose, which allowed the author to place the Anglo-Japanese alliance in the centre of the stage at both conferences. It was present at both conferences, it is true, but always behind the scenes. The place of undue importance assigned to it by the author is the mental afterglow of the strong defense of China's rights against Japanese aggression in which Mr. Simpson took a conspicuous and worthy part.

The Chronicle can lay no claim to dignity of thought or diction. "Indiscreet Letters" was a brilliant piece of writing; the Chronicle bears evidences of hasty dictation. Speaking of America on page 22 the metaphors of the author become hopelessly mixed when he says "She dreamed great *dreams* which ended in commonplace diplomatic *morasses* because she was never prepared to do more than throw out *ideas* which she allowed others to *stamp out* of existence." On page 137 is the phrase "in much the same mood she had been in July," and on page 138 "it gave British diplomacy a preponderance over France with Japan." These are not good specimens of an Englisd style in which the author had been "trained with a rod of iron" as claimed in the prefatory Note. The use of "we" on page 37 and again on page 52 is careless, not to mention its presumption.

It might have been expected that the author being an Englishman would speak courteously of things American, but we do not find this to have been his method. Lowell once wrote an essay on "A Certain Condescension in Foreigners." Mr. Simpson is condescending. These are a few examples—"American foreign policy always tending to use England as its starting point." "The state department was still as flabby as a wet pancake." "The price paid by Americans for the nominal acceptance of their schemes is nearly always the surrender of their ideals through the legerdemain of diplomats." He is even more severe upon certain individual Americans,—"President Harding had badly mixed up unrelated questions." "American statesmen should at least have understood, etc." In the elders gathered together as her representatives, there was no trace of the generosity or ardour of youth." "Secretary Hughes standing still with his arms hanging loosely beside him disclosed imperfect knees and small feet - two dangerous characteristics in a man. They mean a proneness to the influence of others; a tendency to accept formulas without proper inquiry; an absence of true conviction." On page 141 he regrets "that Mr. Hughes was not a more conscientious statesman," and on page 147 that "a unique situation arose which, had it been understood by Mr. Hughes, would have been dealt with." On another page he says "easily influenced by others and with a weak department behind him which had never known how to utilize the great stacks of information which had been accumulated throughout the years, Secretary Hughes needed support and plainly showed it." Is it not a pity that Mr. Hughes, an American amateur, under such circumstances did not turn to the author himself an experienced Englishman, for on the following page he assures us that the Monroe Doctrine had been prepared in England and that "there must always be a Canning before there can be a Monroe." These are all indiscreet sayings, but they are also amusing.

The memorandum which Mr. Simpson prepared for Premier Meighen of Canada refers to "the defense of the gulf of Pechili scheme which is under consideration and is designed to protect the approaches to the capital (Peking), pending American mobilization. This document, which is strictly confidential, is annexed hereto." A search at the end of the memorandum does not disclose this document. It would furnish interesting reading, but was it in reality an American mobilization that was planned? It would seem to be something even more surprising for on page 135 we read of a rigid blockade of Japanese coasts by an "Anglo-American fleet." If the terrible rains in Japan could not silence the discussion of disarmament, was it the dryness of the air in Peking which put an end to the American mobilization scheme? Or was there ever any such a scheme except the one prepared by the author himself, and, perchance, suggested by him to the Chinese government which suppressed it?

Is this book really an "Indiscreet Chronicle" in the same way as "The Indiscretions of Lady Susan" were in reality discreet parts in dramas great and small all the world over; or was the author romancing as he did in "The Human Cobweb," or "Wang the Ninth"? We are at least certain that it is autobiographical. Perhaps herein lies the indiscretion.

# Saving China

## The Price that Must be Paid

BACK in 1895, a famous American war-correspondent stood by General Oshima at the taking of Ping-Yang and afterwards rode into Port Arthur with the troops of General Yamaji, witnessing at first hand the horrible atrocities committed upon the Japanese who fell into the hands of the Chinese and the terrible price exacted by the victors when they stormed the stronghold. In concluding his story of this campaign, " Jim " Creelman said : " it is most important to remember that the most decisive elements in the struggle were the presence of a passionate national sentiment on the one side, and the almost complete absence of patriotism on the other side. The Chinese were well armed, and were fighting on their own soil behind great fortresses equipped with every death-dealing device of modern military science. But they were devoid of that pride of country, that fierce love of national glory, which thrilled the Japanese soldiery. So far as the Chinese were concerned their flag represented a mere abstraction, a distant, invisible, almost unthinkable authority, having no direct relationship to the individual, and manifesting itself in an endless system of squeezing, through the doddering old mandarins and their brutal retainers. To die for such a flag seemed as foolish as the tears of Mark Twain at the grave of Adam. The proclamation of the Chinese emperor, issued at the most critical stage of the struggle, called upon the inhabitants of Manchuria to resist the invaders—not because their manhood and honor would be stained by the conquest of their soil, not because their homes were threatened, not because they were to be enslaved by a foreign government, but for the reason that the tombs of the emperor's ancestors at Mukden were in danger of desecration.

" To the Japanese soldier, the flag of Japan stood for his own honor. His patriotism was simply an extension of his personal pride. Deep in his heart was the feeling that he who served Japan best, served God and world best. It was that sentiment, that conviction, which developed the soldier spirit . . . It may be that after the Chinese have learned to love China well enough to fight for her, they may love her enough to purge her of cruelty, and corruption, and idle scholastic vanity—love her well enough to want to see her honored among the nations for her humanity and usefullness.'

There was another outspoken British newspaper correspondent in China at the time, who wrote a book entitled " The Peoples and Politics of the Far East." Concluding a chapter on China, written after he had interviewed Li Hung-chang Mr. Henry Norman declared that

" The truth is that like everything else in China, her offensive and defensive power is a sham. The offspring of corruption and bombast is inefficiency . . . And even Captain Lang, declared that when under arms, one-half of the Chinese army is made up of savages. A force made up half of coolies, torn from their homes, afraid of their weapons, clamoring for their pay, driven forward by the lash, punished by the headman's knife ; and half of uncontrollable savages, defiers of their own officers, insulters of foreigners, plunderers of peasantry, torturers of prisoners, murderers of missionaries, outragers of women, mutilators of the dead, is not the kind of an army with which Englishmen should desire to stand shoulder to shoulder, and the sooner we learn to look for our Eastern alliance elsewhere than in China, the better."

With the exception that the emperor has been replaced by a puppet president, and the doddering old opium-smoking mandarins by the *tuchuns*, the picture painted by " Jim " Creelman and Henry Norman in 1895, remains same in 1923. A few foreign-educated students have come to the top, thrust into prominence by the old crew of officials as a sop to European opinion, a few foreign " advisers " have become attached to the system in order to manufacture a so-called public opinion, but at bottom the Chinese nation, the countless millions of uneducated workers, like the ocean, are agitated only on the surface by the winds and storms of politics ; underneath, the great depths remain unmoved. That great requisite to the growth of patriotism and public spirit is still lacking. Public opinion, as we understand it in the west, does not exist.

It is a far cry from " Jim " Creelman to Frederick W. Stevens, from 1895 to 1923, but after reading the remarkably able address delivered by the representative of the American group in the consortium before the Chinese social and political science association in Peking on December 8, last, on the subject of " Public Opinion as a Force in China," we are convinced that these careful observers have placed their finger on the real reason why China finds herself in her present unenviable position and why there is absolutely no hope for the nation, or the success of the republic, while such conditions continue to exist. A republic without a public opinion is a farce, a play on words intended solely to impress impressionable foreigners who look no further than the word itself. At the same time, the sober-minded criticism of the British writer on the conditions underlying the Chinese army and the *morale* of its troops, is as true to-day as when it was written. China has not changed, and to think that otherwise sensible Americans have been so blind to the facts as to seriously advocate standing shoulder to shoulder with the Chinese army as allies in a war with Japan, or have not resented the intrigues to bring this about, is enough to call for an examination into their sanity.

Mr. Stevens brought forcibly before his audience the urgent necessity for the creation of the means to being about a healthy public sentiment and arraigned the students for advocating an anti-Christian movement at a time when they should have been supporting Tung Kang in denouncing corruption in high office. In this Mr. Stevens, incidentally invites attention to that drift of so-called Chinese public opinion, which, under certain conditions, ignores the real root of their country's evils and attempts to throw dust in the eyes of the people by attacking the foreigner. Here was a typical example of the force and trend of public opinion in China. At a time when one of their highest officials, a man of education and character, with an excellent reputation as an honorable public servant, was courageously denouncing graft and corruption in high places, the students of Peking, instead of honestly trying to help their country by standing by this leader were organizing an anti-Christian movement !

Their country was faced with dissolution, foreign intervention, financial bankruptcy : there existed a thousand evils the students could have fought against, but they turned instead against the Christians ! who at the cost of many millions Mr. Stevens reminded them, " are the founders of great colleges and universities in China, eagerly availed of by thousands of young Chinese ; who are sending out to all the provinces well-educated Chinese physicians, surgeons, nurses, teachers and preachers ; who are teaching the Chinese how to save their cotton and silk industries from extinction ; how to develop agriculture ! They turned against *the Christians* who at the cost of many millions have founded and are operating great and small hospitals throughout China !

If, as Mr. Stevens points out, this reflects the general attitude of the student movement, a long time will elapse before China will be saved by righteous and aggressive public opinion. "Mass meetings of students," he continues, "are called to help drive good men out of office. Why should not mass meetings including more

mature men be called to help keep good men in ; to denounce the evils that have brought China low and are keeping her down "?

Concluding, he brings home to his hearers the essential point, in the creation of a patriotic public opinion, by advising them **"not to start in this patriotic business until you have enough patience, persistency, and COURAGE, moral and physical, to carry you a long way, for it is a hard and long road you must travel. The task is becoming harder all the time. It will involve some, perhaps much, self-sacrifice. It will try your souls . . .**

**"Until there be many Chinese who are willing to risk their offices, their positions, their freedom, indeed their lives, in this cause, not much can be expected. The English history of freedom and good government includes the story of brave men, all willing to be martyrs and some of whom became such. The signers of the American declaration of independence knew when they signed it that unless there should be success, it meant the death warrant of every one of them. The history of the world shows that personal risk by patriotic and courageous citizens has always been the price paid for freedom, justice and good government; and it must be paid in China before they will be achieved here.**

**"What shall it profit YOU if you gain personal safety and save your positions for a time,—and meantime your country rushes to the conditions of Taiping days?**

**"Nothing great comes without sacrifice commensurate with its greatness."**

Over the stretch of years the war-correspondent clasps hands with the practical lawyer and financier. Both come to the same conclusion. China will never be placed on her feet by any " Save the Nation and Weep Society," unless its members are prepared to change their tactics and substitute action for tears, unless they are willing to pay the price that all other nations of men have paid ungrudgingly for liberty, progress and good government. Love of country may be theatrically displayed in a popular boycott against foreign goods and this may be played up by the foreign publicity agents of the student movement as a sign of the awakening of a national spirt (there is little risk and much notoriety in such methods) but before China can shake off the shackles of mediaval feudalism, this movement must be turned inward; the leaders must be prepared to sacrifice their lives for their principles: they must pay the price that all other red-blooded men have paid for their liberties. Unless graft and corruption are uprooted as part of the national conception of life, business and government, China will never take her real place in the comity of nations. If the Chinese were real militarists, good fighting men, they might, like the Turks, prolong indefinitely their national existence under any old kind of a corrupt government, and impose their terms upon the world.

But unless there is a love of country, or a religious fanatacism to inspire the people to lay down their lives for the preservation of their liberties or their faith, the day will arrive sooner or later, when China will go the way of all passive-resisters. The yoke of the conqueror will slip quietly over their necks and the glory that was China blotted from the pages of history. As in the case of Turkey, the jealousy of the powers may prevent any actual partition of Chinese territory for many years, bnt the yoke will be fastened on through foreign control of her finances, and like Egypt, the independence of China will become ancient history.

China is inviting such a fate by her refusal to recognize the consortium or ask it for relief. Once this international guarantee of her integrity is withdrawn and she drifts into bankruptcy through further impossible loans, the Chinese will pay for their lack of patriotism.

* * *

It would appear that the Chinese general chamber of commerce of Shanghai is now initiating a popular movement to demand the disbandment of troops which will take the form of a nation-wide demonstration. It is proposed to hold processions in the chief cities sometime in March for the purpose of calling attention to the importance of the reform measures demanded, which include disbandment, unification, constitutional government and reform of national finances. As usual, however, this movement, like its predecessors, will rely largely on the students, as we are informed that the principals of all middle and higher schools are to be approached in an effort to secure their co-operation, while shopkeepers are to be invited to close their doors during the day as an evidence of their sympathetic support of the movement. The students will do the parading and the shopkeepers will support them by suspending business.

In commenting on this movement at least one foreign newspaper has voiced the opinions expressed in the above editorial, pointing out that the leaders, with all their good intentions and advantages, were " good Chinese " and so " have no taste for being martyrs." Although we are in receipt of a contributed article which insists that the Chinese have shown a capacity for martyrdom, it is admitted that " the deepest root of China's present trouble is the fact that the overwhelming majority of her men in official positions have been, and are, devoid of true patriotism."

The writer is optimistic and expects that in the present crisis, perhaps in some respects the darkest hour in the history of China, there will arise leaders of unselfish devotion whose great privilege it will be to go down in history as the men who really saved their country. It is to be hoped that this will be the case, and while we heartily approve of any campaign that will tend to arouse the masses of China to a sense of their obligations to their country, even by student and other passive expressions of popular disapproval of existing conditions, we hold with Creelman and Stevens that if China is to be saved it will involve much self-sacrifice on the part of real patriots. Student parades coupled with boycotts and newspaper propaganda brings considerable notoriety and little personal risk to the leaders of such movements. It makes for cheap political fame, but in the end it gets nowhere. The price that has been paid in all parts of the world through all the ages for freedom, justice and good government will have to be paid in China; otherwise all history is a lie.

* * *

# Chickens Come Home to Roost

THE Asiatic problem in the United States is shifting from the Pacific coast to the gulf states and reverting to its original anti-Chinese character. Although California still fulminates against the Japanese, the south and east are up in arms against the unlawful entrance of thousands of Chinese coolies smuggled into the country from nearby isles of the Caribbean. Attracted by the high wages offered by sugar planters, many thousands of Chinese have flocked to the island of Cuba, where after the crop season, confronted with six months of idleness and their pockets filled with money, they have naturally turned their eyes towards the Mecca of the Asiatic laborer and willingly paid the $500 " fare " for landing them on some safe and secluded beach of the American coast line. Over 25,000 Chinese coolies are now in Cuba, waiting for the opportunity to slip into the promised land. The island of Jamaica has developed into a central distributing depôt for Chinese coolies desirous of entering the forbidden land by the " undersea " route. The south has become alarmed and the revenue forces of the United States are now concentrating their energies in an effort to put a stop to this traffic.

In our younger days it was considered great sport to run the gauntlet of United States revenue cutters and outwit the secret service men specially assigned to stop filibustering expeditions destined for the shores of Cuba from leaving the United States ports. Time and again the Spanish government protested against our lack of vigilance which constituted a breach of neutrality. Expedition after expedition was fitted out, slipped past the cordon and reached the high seas and the shores of Cuba in safety. In those days the successful violators of the law were popular heroes.

A quarter of a century rolls by. The shoe is now on the other foot. Versed in all the intracacies of the filibustering game, knowing intimately every safe landing place along the Florida and gulf coasts, the Cubans are now engaged in the lucrative business of unloading their superfluous Chinese coolies on our shores at $500

per head. The old filibuster has simply reversed the game and provided the revenue service with an opportunity to prove that it is more efficient than it was in the early nineties. Confronted with a situation most difficult to deal with the American government has followed the lead of Spain and protested to the government of Cuba. As it was difficult to interfere with a most profitable and popular sport in 1897 when Americans were playing the game, so it may be difficult at this time when the tables are turned, and it comes to putting an end to a most profitable Cuban pastime. Chickens come home to roost, after all.

* * *

Some rather funny looking chicks are also chirping to climb on the perch of the Japanese hen-roost. The Chinese play no favorites when it comes to worming their way into lands where high wages are paid. Because of the great industrial prosperity of Japan and the continuance of war wages, and despite his propensity to boycott and belittle the Japanese, Ah Sin has no particular objection to having a try at fortune in the latter's country. So we find him quietly slipping into Japan in the guise of students and peddlers and taking up jobs as laborers and mechanics. In the face of this influx, the Japanese are non-plussed. They are up against a proposition which puts to the test their definition of racial equality.

Several Japanese newspapers have invited attention to the large number of Chinese peddlers and laborers in and around Tokyo, and some time ago the police authorities discovered that a group of laborers had entered the country in the guise of umbrella dealers. In accordance with the imperial ordinance of December 1899 the authorities decided to deport all who had entered under false pretences. This step aroused the ire of the Chinese students in Tokyo and called forth a protest from Peking. The Japanese authorities were up a tree. After full explanations and with a desire to meet the Chinese fairly, the Japanese agreed that *bonâ-fide* merchants would be permitted to remain, and that those laborers who had been ordered deported but lacked the means to pay their passage, would be permitted to remain until they had earned the necessary amount to defray their passage. The affair was smoothed over, but the fundamental question remains unsettled. The Japanese bantam which crowed so bravely at Versailles has come back to roost a full grown game cock shooed home by their fellow Asiatics from across the China sea.

# The Nishihara Loans

## Japan's Contribution to the Allied Cause

### By GEO. BRONSON REA

AS a result of the bitter anti-Japanese campaign of two years ago the world has been led to believe that all the so-called Nishihara loans to the Tuan Chi-jui cabinet are illegal, therefore to be repudiated. Constant harping on this subject by the official publicity agents of Peking has kept alive this erronious impression and regrettable to record, many otherwise sensible Japanese writers have accepted the reports at their face value, thereby encouraging the Chinese to penalize their own financiers for what on analysis turn out to be most legitimate transactions. Eliminating the minor Japanese loans of the period 1917-19 and confining our remarks to those advanced to China by the three banks (Bank of Chosen, Bank of Taiwan and the Industrial Bank of Japan) we find the major transactions are as follows :

| | | | |
|---|---|---|---|
| 1. | Jan. 20, 1917 : | loan for reorganization of the Bank of Communications ... ... ... ... ... | Y. 5,000,000 |
| 2. | Sept. 28, 1918 : | supplementary loan for same purpose ... | 20,000,000 |
| 3. | June 18, 1918 : | Kirin-Hueining Railway loan advance ... | 10,000,000 |
| 4. | Sept. 28, 1918 : | War Participation Loan ... ... ... | 20,000,000 |
| 5. | ,, ,, ,, | Manchurian and Mongolian Railway advance ... ... ... ... ... | 20,000,000 |
| 6. | ,, ,, ,, | Shantung Railway Loan advance ... | 20,000,000 |
| | | Total ... ... ... ... | Y. 95,000,000 |

In commenting on this series of loans and in order to mislead the public, the fact that they embraced several distinct transactions, is invariably overlooked or wilfully ignored, the lump sum being stated with no attempt to differentiate between them. From the mass of hostile criticism appearing in Far Eastern and home papers on the Nishihara loans, the following extract from an editorial in the *Peking Daily News* of November 25, last, the official organ of the Chinese government, is selected as the most typical.

"In no case is it truer that one reaps what he sows than in the case of Japanese loans to China. A few years ago, Japan lent money to China recklessly and she now realizes that reckless lending, like reckless borrowing, is not a profitable proposition.

"It may be recalled that in 1918 and 1919, when Marshal Tuan Chi-jui was at the helm of the state and when the country was in serious political chaos, Japan made a string of loans to Chinese politicians under various pretenses. These loans were approved and supported by the Japanese cabinet, of which Count Terauchi was then the presiding officer. They were negotiated either in Peking or in Tokyo, but mostly in Peking, by Mr. Nishihara, the representative of Premier Terauchi and a number of Japanese banks in which he had a controlling interest. The loans have henceforth been known as "Nishihara loans." Their exact total has never been known. According so the published contracts, the total amount of all the Nishihara loans is no less than Y.200,000,000. Though supported and approved by the Japanese government, the loans are all unsecured.

"Practically all the Nishihara loans were contracted at the time under the most plausible pretext of industrial development of one form or another. But, it is very curious to say, none of the industrial enterprises for which the loans were contracted have every been started. No one exactly knows what has become of the proceeds of the different loans. Some say that they went to finance the political struggle then raging ; others assert that much of the fund was wasted on soldiery ; and still a third group of people seem to think that the money—a large portion of it, if not the whole—was used to finance the military campaigns against the Canton government, which had been established under Dr. Sun Yat-sen's leadership after the dissolution of the parliament in Peking in August, 1918. The truth is that a fairly large portion of the proceeds of the Nishihara loans remains intact, in most of the foreign banks in China, not however, under the name of the Chinese government, but on the credit or deposit account of those who had a hand in the negotiation of these loans and in their dispensation. Speaking plainly, a large portion of the proceeds went into the pockets of those officials who had the courage of contracting these loans without, in many instances, the knowledge of the cabinet. It is, therefore, a comparatively easy question to answer ; what has become of the money from the Nishihara loans ? The answer is that the money is now safely deposited in foreign banks for interest.

"This is the Chinese side of the transaction in which the Chinese government is the loser, of course. The gainers are those who are now drawing monthly or yearly interests from their deposits."

In apologizing for China's repudiation of these loans, the official organ says :

"These Japanese banks, which had money to overflow four years ago, are now finding themselves in deep straits, due to the failure of the Chinese government to repay the principal or interest on the Nishihara loans. From this financial stringency, the Japanese banks and the Japanese government as well should learn a sound lesson, that it does not pay to fish in troubled waters and that it is a bad financial policy to lend money recklessly and without security. Practically all of the Nishihara loans, though made under pretext of industrial development, were political loans. They were

contracted by the Peking military clique then in power for political purpose, and they were agreed to by the Japanese banks also for political purpose. The Japanese will, therefore, have none but themselves to blame to have ever made these loans at all."

It is well to pause right here and digest the words of wisdom expounded by the official organ, as they apply with equal force to all foreign lenders of money to China. The warning is of special importance at this juncture owing (as pointed out in another article in this issue of the FAR EASTERN REVIEW) to the difference of opinion between the American commercial attache and the representative of the American group as to the necessity of adequate guarantees for any new loan. The Chinese official organ very gravely admonishes the Japnese that it is bad financial policy to lend money recklessly and without security. It is. The representative of the American banking group has apparently taken this wholesome advice to heart.

The *Peking Daily News* is correct when it says that the situation of the three Japanese banks is most painful. They are now reported to be crippled as the result of the failure of the Chinese government to meet its obligations. This seems to afford considerable enjoyment to the Chinese official mouthpiece, providing the opportunity to read the Japanese a curtain lecture on their carelessness in not exacting adequate guarantees for repayment. Although the Chinese government has paid neither principal or interest on these loans, the 7½ per cent. interest has been religiously paid to the bondholders on due dates by the three banks, which means, that in five years they have protected their clients and maintained the credit of a defaulting government by paying out of their own surplus something like Y.7,500,000 yearly, or to date, about Y.40,000,000, which, added to the principal, makes a total out-of-pocket loss of about Y.140,000,000. Contrast this faith in China's integrity with the attitude of other foreign banks which, on the first default of interest on much smaller loans, failed to protect their clients, and injured her credit. No matter how much the Japanese loans may be open to criticism, the fact that the three banks protected their clients and the credit of China until they were financially embarassed by carrying the load, will everlastingly redound to their prestige.

In order to raise the money for these loans, the Industrial Bank of Japan issued and placed on the market a series of "Industrial Bonds" to the extent of Y.100,000,000 guaranteed as to principal and interest by the Imperial government. Some of these bonds mature in May of this year and the balance in May of 1924, and the Japanese government is now confronted with the necessity of retiring the first issue by allocating funds from the treasury for this purpose, or of renewing the bonds for another term of years with government guarantees. The position of the three banks is such that another payment of the annual interest of Y.7,500,000 out of their reserve funds is a most serious matter, so the government is called upon to pay the next installment and include the sum in the annual or supplementary budget as an advance against the time when the Chinese government will consent to recognize and pay its obligations. The responsibility for repayment is thus squarely put up to the Japanese government and as the matter must go before the Diet for approval, it is certain to provoke considerable discussion, in which the government will be attacked by the opposition for forcing the official monetary organs under its control to take such risks.

In the midst of the bitter anti-Japanese campaign in China, it it was only natural that Japan's every move should be condemned. Privileges exercised by other powers in their relations with each other could not be extended to Japan in dealing with China. Japan could do no right. She was to have been pilloried before the world and public opinion turned against her as it was against Germany in order to pave the way for the war in which it was hoped she would be crushed and eliminated as a factor in world affairs. The Nishihara loans were seized upon at the height of the hysteria as irrefutable proof of Japan's sinister designs upon China. The transactions were characterized as iniquitous, a bare-faced attempt to corrupt and bring the Chinese government under the domination of Japan. To such an extent were these loans magnified and their objects distorted that they were used as justification for the organization of a new international consortium to save China from the clutches of Japan. China's parliament was not in session : the loans were concluded in secret (like all other Chinese loans) the money was not expended for any productive purpose, and altogether it was piously agreed by the smug hypocrites heading the anti-Japanese campaign, tney were so rotten that the new clique of grafters who followed Tuan Chi-jui into power, need not recognize them. Rupudiation, it was openly declared, was justifiable, and notwithstanding all honorable efforts on the part of the Japanese bankers to induce the Chinese government to meet its obligations, not one sen of interest has been paid to date. The three banks have carried the load of preserving China's credit in Japan. When pressed to meet the interest payments, the Chinese minister of foreign affairs very gravely wagged his head and declared that inasmuch as parliament had failed to sanction the loans, that the proceeds were not expended as provided for in the agreement, the present government of China could not possibly recognize them as legitimate obligations. They were repudiated.

Now the repudiator in this instance, happened to be the minister of foreign affairs who as Chinese minister to Washington signed on behalf of his government, the Lee, Higginson and Chicago Bank Loans, His Excellency Dr. V. K. Wellington Koo. These loans will bear a little scrutiny. The Lee, Higginson agreement of April 7, 1916 provided at the outset that the banking concern would be appointed fiscal agents of the Chinese government, that is, all future loans would be placed through their agency. After a year of negotiation, it was agreed that the fiscal agents would advance $5,000,000 to the Chinese government on six per cent. three-year treasury notes at 93. There was no security other than the good faith and general revenues of the Chinese government and the loan was not earmarked for any specific purpose. On its face it was an out and out administration loan, a present from American investors to the moribund Yuan Shih-kai government. It is a fact that only $1,000,000 was actually paid over, as before the expiration of the fortnight in which the balance ($4,000,000) was to have been paid, the revolution against Yuan's restoration of the monarchy became so wide-spread that Minister Reinsch became alarmed and stopped further payments. Had Yuan triumphed, there is little doubt that further installments would have been negotiated with the fiscal agents of the Chinese government on the same basis, that is, without security without sanction of parliament and for purely administrative purposes ; donations to the military clique then dominating the government.

When it became apparent that Lee, Higginson & Company could not live up to the financial expectations of the new group in power at Peking, Dr. Koo hunted around in the United States until he found another donor. In the Chicago bank loan signed by Dr. Koo on behalf of his government on November 16, 1916, the former paid over $5,000,000 as the first installment on $25,000,000, in exchange for six per cent. three-year treasury notes secured on the wine and tobacco taxes. The object of the loan, and this is most important, was industrial development, the strengthening of the reserves of the Bank of China and the Bank of Communications and other similar objects. The last is very indefinite. Now the question arises, was this loan expended for the above purposes ? It is only necessary to state that the governor of the Bank of China has officially gone on record that not one cent of the proceeds of this loan was paid into his bank. There is no record that any industrial enterprise was benefitted, nor was it ever sanctioned by parliament. It was, therefore, an out and out donation to the government of China without any guarantee that it would even be employed for the purposes specified in the agreement. In view of these facts, it would seem that Dr. V. K. Wellington Koo is the last official in China who has the right on behalf of his government to question the validity of the Japanese loans. If the latter are illegal, so is the Chicago loan. If the Chicago loan is legal and a just obligation of the Chinese people, then the Japanese three banks loan must also be liquidated.

In regard to the Pacific Development loan, we have not the agreement before us, but from all reliable accounts this also was an out and out donation of $5,000,000 to the military clique then in power at Peking, advanced without security and for no particular purpose. Neither was this loan sanctioned by parliament. In principle it stands on a par with the Chicago and some of the Japanese loans. Although this loan has also been defaulted as to payment of interest, we have never heard of its validity being placed in question. If, therefore, the Chinese people acknowledge this as a legitimate obligation, the Nishihara loans by comparison are gilt edged.

Let us now examine the more important Nishihara loans negotiated through the three banks. The first of the series signed on January 20, 1917 was for Y.5,000,000 at 7½ per cent. advanced for the express purpose of reorganizing the business of the Bank of Communications, a semi-official institution. The notes were secured by (1) $1,300,000 face value Lung-Hai Railway bonds (2) treasury bonds of the Chinese government to the face value of $4,000,000 and (3) loan bonds to the face value of $2,425,687 issued to the Bank of China. On September 28, 1917, a supplementary loan agreement was entered into for Y.20,000,000 at 7½ per cent. for the same purpose, the security being treasury certificates of the Republic of China to the face value of $25,000,000. Here we have two of the much condemned Nishihara loans to the value of Y.25,000,000 adequately secured and advanced for the idenuic purpose as the much lauded and strictly legitimate Chicago loan. If a loan by the latter intended to strengthen the reserves of the Bank of China is considered legitimate in the face of irrefutable evidence that the Bank of China failed to receive one cent of the proceeds, then the three banks loan for strengthening the Bank of Communications must also be legitimate.

Let us now turn to the preliminary Kirin-Hueining Railway loan agreement of June 18, 1918, in which the three banks agreed to provide the funds for construction after the cost had been determined by the Chinese government. Construction was to commence as soon as the final agreement was signed. The loan was to be secured upon the physical property and revenues of the line after construction and bear interest at five per cent. An advance of Y.10,000,000 was paid to the Chinese government on the signing of the preliminary contract which in turn was secured by treasury notes to that amount bearing interest at 7½ per cent. In the same category comes the other two railway loans signed on September 28, 1918.

It is around these three loans that the bitterest campaign has been waged, in which the three banks advanced a total of Y.50,000,000 to the Chinese government in order to consolidate Japan's strategic position in Manchuria *vis-à-vis* Russia and make certain of retaining the German rights to the two railway extensions in Shantung. In regard to the Manchurian lines, subsequent disclosures of secret diplomacy have fully justified Japan's anxiety to protect her strategic position in these regions and in paying any advance, no matter how large, in order to insure the construction of lines that sooner or later must become of supreme importance for the mutual defence of both China and Japan against the menace from the direction of Urga. Whether Japan was justified or not in paying over an advance of Y.30,000,000 to China to establish her right to build these lines, is purely a question that Japan alone is entitled to answer. Japan is the best judge of her own vital problems. In our opinion, at a time of great international stress and uncertainty as to the outcome of events in Russia, she could have well afforded to have advanced a still larger amount in order to obtain these guarantees for her national security. Japan dealt with the recognized government of China and paid its price without haggling. Although other nationals in China may not have approved of Japan's tactics, we submit they were every bit as honorable and much more commendable than methods employed at other times by other powers in obtaining railway rights in China, which in their opinion were also essential to their strategic security. It is needless to go futher into details to elucidate this question. All intelligent students of the Far Eastern problem will recognize the truth of this statement.

As to whether it is more honorable to pay an advance or bargain money to the Chinese government in exchange for certain railway rights or extract the latter under severe diplomatic pressure, through secret bargaining or an impossible contract that can never be executed, is a matter that would call for much unnecessary and acrimonious discussion, and a minute examination of the preliminary negotiations surrounding all of China's railway contracts. Our own experience inclines us to the belief that a sum of money paid over at the time of signing a preliminary railway agreement, the larger the better, is the surest sign of good faith that the lines will be speedily constructed and not kept in cold storage and the agreements dragged out every now and then to establish a prior right and block any one else from developing the country. The mere fact that the Japanese government through the three banks, advanced without hesitation the Y.10,000,000 on the Kirin-Hueining preliminary contract, Y.20,000,000 on the Taonan-Jehol and other short Manchurian lines and Y.20,000,000 on the Shantung extensions would indicate an intention to proceed immediately to the construction of these lines, which after all, would have been Chinese government railways, built from the proceeds of a Japanese loan and operated for the benefit of the people of China, no different from any of the other foreign railway concessions. As indicated further on, the exigencies of the military situation demanded that the Manchurian lines be built as rapidly as possible, and they would have been built by this time had not foreign propaganda and wilfull misrepresentation of Japan's intentions provoked the pooling of these highly necessary strategic lines in the consortium.

If it is honorable and legitimate to pay over bargain money to the Chinese government at the signing of a preliminary railway agreement as a sign of good faith and as an advance on the loan, to be employed for preliminary expenses, surveys, organization and salaries of head office staff, etc., then the difference between the three bank transactions and those of other foreign banks is merely one of the size of the advance. The principle remains the same. In the matter of the three banks advances on these railway agreements, however, it was distinctly understood that pending the signing of the formal or final working agreement, the advances would be secured by treasury notes bearing interest at 7½ per cent. In this respect the advance was in the nature of a loan without specific revenues allocated as security, in exactly the same category as the Lee, Higginson loan. The real security was the good faith and general revenues of the Chinese government. No critic has ever raised the question of the legality of the advance made by Mr. W. F. Carey on signing the preliminary railway agreement of May, 1916. It may have been expended in legitimate preliminary expenses or it may have gone into the pockets of certain officials. As far as Mr. Carey was concerned it was an advance on the main loan, and secured by treasury notes.

The legality of the Manchurian Railway loans to a large extent is determined by the legitimacy of the war participation pact and the subsequent loan for carrying into effect its provisions. The military and naval agreements signed on May 16, 1918 had for their specific object co-operation between the armed forces of China and Japan to combat the gradual extension of enemy influence towards the east jeopardizing the peace of the two countries and to drive out of the Amur and Trans-Baikal regions German and Austrian forces. Commenting on these agreements, McMurray says in his introductory note: **"It need scarcely be said that both agreements contain no such stipulations whatever as will go towards disturbing the peace of China or encroaching upon her sovereignty, as has been understood to be the case in a section of the Chinese public. It must be clear from the agreements that they have been made entirely for the purpose of Japan and China participating in the allied operations, of facilitating defensive measures against the enemy, and of taking the steps to meet the urgent exigencies of the situation."**

There is nothing clearer or more impartial than the evidence of this eminent authority.

That these military agreements were absolutely essential and bear testimony to the far-sighted grasp on the trend of the war by Japan's soldier-diplomat (Count Terauchi) is attested to by the fact that three months later (August, 1918) the American government announced its decision to send troops to Siberia to operate in conjunction with Japan for the identic reasons set forth in the war participation pact between China and Japan. There is furthermore sufficient evidence in published state documents (see Russian American Relations) that Japan's determination to defend herself and China against the spread of enemy activities in Siberia was fully endorsed by the American government and further, that the latter was quite satisfied to entrust the defense of allied interests in these regions to Japan alone. It was the incessant nagging and propaganda against Japan emanating from Peking and Petrograd which finally influenced Washington to participate in the adventure. In concluding his explanation to the Senate of the reasons why American troops had been sent to Siberia, President Wilson said "*this participation was obviously of incalculable value to the allied cause.*" If this be so, then the initiative of Japan and China in entering into a military pact for the same reasons three months before America moved, and which forced our hand, must also have been of incalculable value to the allied cause. If America was justified in sending her troops into Siberia, then the credit for this move of incalculable strategic valve belongs to the soldier-statesman who directed the Japanese government at the time. Of course, it was very wrong for Japan to have a military premier during a world war, when all her allies were ruled by a political party autocrat. It placed her in the same class with Germany, yet as we look back over the history of the war, we incline to the belief that it would been brought to a quicker end with less loss of life and expenditure of treasure, had some of the liberal governments been dominated by a military autocrat whose one idea was to win the war rather than by politicians more concerned in winning the next elections. The fact that Terauchi the military premier of Japan, initiated the move that caused all the allies to fall in line for the defense of theit interests in Asia is something we have to be thankful foι, according to President Wilson.

The so-called war participation loan of September 28, 1918, amounting to Y.20,000,000 was advanced to China by the three banks to provide funds to organize a defense army so as to be able to fulfill its co-operative duties and for the expenses of participation in the war. It was for the term of one year and bore interest at seven per cent. It was made payable to the chief of the treasury of the Chinese national defense army and the Chinese government pledged itself to reform its tax system in the future and the revenues derived therefrom reserved as the sources of a fund for the redemption of the loan. In other words, it was a loan made under the exigencies of the military situation to prepare China to fulfill her obligations as an ally, and at a time when the question of security could not be haggled over. It was for a definite purpose, in the same category as the many advances made by England to her allies and by the United States to her associates for the same purpose. Insistence upon adequate security or guarantees that the funds would be expended for the purposes they were lent at such a time of world stress was obviously out of the question, whether in transactions between England and her allies, the United States and her associates, or between Japan and her immediate ally. Guarantees and securities for military loans under such conditions would have defeated their object and permitted Germany to win the war. There were many American loans made to allied countries that could never be accounted for and there are instances on record where some of the advances were expended on objects that had no relation to the war. If reports are true, it would be difficult to account for one of the American loans to the Kerensky government expended largely in New York city along the Great White Way.

Once the necessity of this much condemned war participation pact is established and justified it follows without discussion that the loan advanced to China by Japan for carrying out its provisions was also justified and of incalculable benefit to the allied cause. In connection with this loan is the contract with the Tahei Gumei of January, 1918, in which the Chinese government was to purchase arms and munitions of war to the value of Y.30,000,000 and in which it was distinctly specified that the Chinese government should not use these arms for the purposes of civil strife. If the war participation pact was justified, the loan agreement and the arms contract to enable China to carry out her obligations were most legitimate and from the allied point of view of immense benefit to their cause.

In order to justify repudiation it is alleged that instead of being employed for the purposes of the pact the forces equipped through the loan were used in crushing the rebellion in the south. This may appear to be a most satisfactory argument for the southern element to advance, but it does not invalidate the transaction. It certainly lacks force when advanced by the Peking government. The Peking government was the one recognized by the powers. The Peking government had severed relations and declared war upon Germany over the protests of the southern leaders. As far as the allies were concerned (and that means Japan) the south was pro-German and for all intents and purposes an open enemy. The menace to China, to Japan and to allied interests was in the far north of China and aside altogether from the fact that the Peking government was one of the allies, it was the only constituted and recognized one which could equip an army and co-operate effectively with the allies for the protection of their mutual interests in Siberia and Manchuria.

All honorable Japanese will concede that it was most regrettable to find that the Peking government abused the confidence of the allies and violated its agreements with Japan by employing a portion of the funds to solidify its power fighting the rebellion in the south. But in any case, even admitting that any portion of the Japanese funds was so employed, the fact remains that the world was at war. China, through her recognized government at Peking, was one of the allies. China could not fulfill her war obligations without financial assistance or if one section of the country was in revolution and in sympathy with the common enemy. The internal political disturbances in China were of no concern to Japan or the other allies when larger questions menaced the success of their cause on her northern frontiers. They were in duty bound to stand by and support materially and morally that element in China which espoused their cause. That element was in the north, represented by the recognized government at Peking. It was not in the south.

Now against the flimsy argument put forward to justify repudiation of these loans because they were employed to finance military campaigns against the Canton government, let us revert to the testimony of the *Peking Daily News*, the official Chinese government organ. The chairman of the board of this publication who directs its policy is in close and constant touch with the waichiaopu, its confidential adviser on all publicity matters and an adviser to the president of China. The official organ of the Chinese government says:

> "The truth is that a fairly large portion of the proceeds of the Nishihara loans remains intact, in most of the foreign banks in China, not, however, under the name of the Chinese government, but on the credit or deposit account of those who had a hand in the negotiation of these loans and in their dispensation. Speaking plainly, a large portion of the proceeds went into the pockets of those officials who had the courage of contracting these loans without, in many instances, the knowledge of the Cabinet. It is, theretore, a comparitively easy question to answer; what has become of the money from the Nishihara loans? The answer is that the money is now safely deposited in foreign banks for interest."

Let us accept that statement. It takes the bottom out of the argument that the funds were used to fight the south with and places the responsibility for their repayment squarely up to the Chinese government and people. If that is true, why are these men not prosecuted and compelled to disgorge? Why have not steps been taken to convict these criminals? If this statement is true, then the governments under whose charter the foreign banks operate in China would certainly consent to having these stolen funds handed over to their rightful owner, the Chinese government. As it is difficult to imagine that these funds would be deposited in

a Japanese bank after the loans being repudiated, the facts as disclosed by the *Peking Daily News*, would seem to place this matter squarely up the other foreign banks operating in China, and their governments. The Chinese official organ says in effect that the foreign banks in China are receivers of stolen goods, a very grave accusation.

The names of these officials concerned in the Japanese loan negotiations are no secret, neither should it be difficult to trace the names under which the deposits are held in the foreign banks. It is a rather large sum of money to conceal effectively. Admittedly, the Chinese received the money and hastened to place it in safe places outside the jurisdiction of their government, secure from confiscation. The Japanese lenders, however, received nothing but a worthless piece of paper in return. They were simply fleeced at a time of great international stress by a gang of official confidence men who took their money for specific purposes, failed to live up to their agreements and their successors in office who were not in on the graft repudiated the transactions. And although the bulk of the money so stolen is still reposing quietly in foreign banks drawing interest (which is probably being divided with the new gang in power) the Japanese lenders have disbursed Y.40,000,000 to date to sustain the credit of China and protect their clients! If the Chinese have their way, they will repudiate altogether these loans most honorably contracted without any attempt to bring the corrupt officials to the bar of justice or take steps to have the sums recovered and returned to the treasury where at least a portion of the amounts can be returned to the Japanese donors.

On the part of Japan, these loans were eminently urgent and justified by the exigencies of the military situation. Terauchi acted wisely and well from the standpoint of a power called upon to protect itself by bolstering up an impecunious neighbor and ally whose weakness and unpreparedness constituted a menace to the very existence of the empire entrusted to his care to defend. The series of above mentioned three bank loans stand on a par with the obligations of other allied nations to America and Great Britain. Japan advanced the sums demanded by the Chinese for certain railway concessions. Through the jealousy of the powers, she was afterwards denied the right to enjoy these concessions and coerced into surrendering them to the consortium. In taking over the Manchurian, Mongolian and Shantung lines with their advances of Y.40,000,000 the powers are morally obligated to support Japan in demanding that the interest and principal on these advances be paid. Otherwise, after depriving her of the exclusive enjoyment of the concessions by forcing their inclusion into the consortium pool, they are simply aiding and abetting China in repudiating her just obligations.

If the Japanese loans are repudiated on the flimsy pretexts set forth by the present Peking government and no attempt made to compel the former corrupt officials to disgorge, while American and other loans which are in the same category as the Nishihara transactions are recognized and paid, a great wrong will be committed. The three Japanese official banks faithfully discharged their obligations to their government at its express invitation. They could not refuse any more than any patriotic American or British bank would have refused a similar invitation to assist its government during the progress of a great war. In supporting their government to finance the war participation pact and make Sino-Japanese military co-operation possible, they were rendering a great service to the allied cause, a service that all other nations shirked after China had been prodded into declaring war against Germany. Had enemy influence in Siberia spread and the peace of China and Japan menaced in Manchuria, the construction of the Taonan-Jehol, Kirin-Hueining and the other Manchuria lines would have automatically become an immediate strategical necessity. There was no time to lose, and the situation permitted of no haggling or long drawn out negotiations. When viewed from this angle, Terauchi demonstrated that his knowledge of the Asiatic military situation was on a par with Foch's grasp of the problem on the Western front. Because a few rabid anti-Japanese foreign diplomats and propagandists playing to the Chinese gallery started a violent campaign to discredit Japan, the world accepted their viewpoint and Field Marshal Count Terauchi was held up to scorn and his motives impugned because he had the foresight to see ahead and prepare against all emergencies in the part of the world entrusted by the allies to his defense.

It is not our intention to analyze all the Nishihara loans at this time. Our immediate purpose is to throw light on the legitimate transactions of the three banks which acted merely as the agents of their government to forward its plans for the successful prosecution of the war in territories of an ally utterly incompetent to defend its own interests, and by reason of its insolvency and military weakness a grave menace to the success of the allied cause. The transactions of the three banks in the matter of the Manchurian and Mongolian railways and the war participation loan are as much a part of world war finance for the good of the common allied cause as any of the American loans to Europe, obligations that although difficult perhaps to meet at the present moment, are held by all parties concerned as sacred. The obligations of China to Japan are of special importance from the fact that after practically forcing China to declare war against Germany, she was refused financial assistance by the United States in order to enable her to fulfill her part in the struggle. The time arrived when conditions in Siberia demanded prompt action, and when America declined to advance the funds, Japan stepped into the breach, and took over the burden. In lending money to China at a time when other powers could not or would not advance the funds, Japan acted in self-defense, and incidentally furthered the cause of the allies. The mere fact that Japan was lending money to China when all others could not, seemed to indicate an intention on her part to dominate the country. The others turned on her.

There may have been, as alleged, fifty thousand ulterior motives in the mind of Terauchi when he ordered the official Japanese banks to carry out his instructions, but the great fact will remain that his action was most praiseworthy and when viewed from a proper angle in relation to world events and Japan's duty in Asia, of incalculable value to the allied cause, and of supreme vital importance to the safety of Japan and China, which after all, was Terauchi's first concern.

Any formal announcement on the part of the Chinese government that these loans are illegal and are to be repudiated because of non-approval of parliament, failure to exact guarantees or to supervise the expenditures, must of a necessity strike at the legitimacy of all her foreign loans of the republican period, many of which, by comparison, are in the same category. The principle underlying the negotiation of the American and Japanese loans is identical. If one is legitimate so are the others. If one is repudiated, so must the others be. The interests of American and Japanese bankers are the same.

# Another Railway Loan

Another secret railway loan has been unearthed, according to Peking vernacular papers. Some time ago, the story runs, Mr. Kao En-hung concluded a loan with the Belgian-Netherlands Bank amounting to 30 million dollars on the security of the Sian-Kuanentang section on the Lung-Hai Railway, and received a sum of \$1,250,000 out of $1\frac{1}{2}$ million dollars to be advanced. Later, Mr. Kao changed the security, substituting the Chingsi-Paotou section on the Peking-Suiyuan line for the section above mentioned, on account of which the syndicate refuses to hand over the balance of the advance, amounting to \$250,000. Members of parliament headed by a certain Mr. Chien brought forth a questionnaire demanding that Mr. Kao En-hung reply within three days whether he concluded such a loan, it being taken for granted that Mr. Kao is guilty of the charge if no answer is forthcoming within the stipulated period.

# "Fed Up"

CHINA'S slipshod financial methods are rapidly precipitating a crisis, which may compel energetic action by her creditors to assure payment of their debts. China is now actually bankrupt, unable to meet her current expenses out of revenues and in many cases has not only defaulted but repudiated her just obligations. Sir Francis Aglen, the custodian of the customs revenue, has officially gone on record in order to to protect his own good name, to the effect that in violating the principle of priority and breaking down pledged securities China has ruined her national credit, adding that it will be impossible for him to further maintain this credit.

Perhaps no nation has suffered more from China's dishonesty than Japan, and in another article we quote the official Chinese government organ to the effect that the millions advanced by Japan for strictly legitimate and honorable war purposes are now safely deposited in the foreign banks drawing interest for the corrupt officials who pocketed the advances and repudiated their obligations. We emphasize this point, which plainly intimates that the Japanese millions loaned to the Chinese government were stolen and deposited to the credit of the thieves in banks outside the jurisdiction of their government. The Chinese authorities have made no attempt to prosecute the dishonest officials and obtain possession of these funds, but have coldly repudiated their debts to Japan, saying in so many words " you have been very foolish to make advances to the recognized government of China, you deserve no sympathy and you can now whistle for your money." We invite attention to this because in attempting to protect themselves against further unethical financial methods, the Yokohama Specie Bank has temporarily withheld a portion of the salt surplus deposited in its care for the service of the reorganization loan, for what it considers sufficient reasons. In commenting on this incident, *The North-China Daily News* alleges that this is a breach of banking honor which British banks although pressed to similar action in other instances, have steadily refused to countenance. We must agree with our contemporary in principle, but it would seem that banking honor works both ways, and although it is true that no bank has the right to question the source of moneys deposited by any individual or divulge the names of its depositors, yet in view of the numerous defalcations and wholesale plundering of the Chinese treasury during recent years, it should not be a difficult task for the foreign banks who have received these stolen funds on deposit to further the ends of justice by assisting a Chinese investigating committee to ascertain the names of the culprits. The honor of a bank like that of Cæsar's wife, should be above suspicion. The financial integrity of a nation should be on the same level. The honor of a bank very often depends upon that of a government, and we find that certain Japanese banks associated in Chinese business with the Yokohama Specie Bank, confiding in the good faith and integrity of the Chinese government have honored its obligations for five years to the tune of Y.40,000,000 and are now seriously crippled as a result of this over confidence in China's intentions to play fair. Not only have their advances been repudiated, but insult has been added to injury, a fair sample of what other creditors may expect when their claims are pressed. The Japanese banks it would seem are in no frame of mind to continue the farce and be further mulcted out of legitimate disbursements.

The present situation arises out of the fact that certain duplicate bonds belonging to the Russian participation in the 1913 Reorganization loan have been placed on the market by the Soviet government. The official explanation is that in 1913 the Chinese government authorized the Russo-Asiatic Bank to issue " advance bonds " pending the printing of the formal certificates. The war broke before the Russian bank could withdraw and exchange all the advance bonds and such as remained were kept in the safe deposit vaults of the Russian Treasury at Petrograd where they were subsequently seized by the Soviet. Some of these were apparently marketed abroad or wherever they could be sold, and from all indications most of them went to New York. Here, some of them were presented to the Yokohama Specie Bank who paid the interest on the coupons.

In refusing now to pay this interest, the Chinese assert that ample notice was given by them that such bonds would not be honored, while the Yokohama Specie Bank declares that it was not warned in time to prevent the payment of these coupons. As a sidelight on this dispute we reproduce from the *New York Journal of Commerce* of January 4, the following letter to the financial editor from a correspondent who found himself in the same position as the Yokohama Specie Bank, and whose testimony would tend to corroborate the Japanese statement as to the time when the Chinese announced they would not honor these bonds :—

" BOUND BROOK, N. J., December 26, 1922.—The Chinese government under date of December 4 last, announced that the so-called Russian issue bonds of the Chinese reorganization 5 per cent. loan of 1913 are to be exchanged for new bonds, on the grounds that some of the bonds were seized by the Soviet government illegally, and therefore when this exchange takes place the Chinese government should be satisfied beforehand that the bonds offered for exchange are not those seized by the Soviet. I bought from some New York bond brokers during 1921 those Russian issue bonds (as Russian issue or as Chinese reorganization bonds in general) without any knowledge of such complication. I also understand that New York bond brokers are at any time to exchange the bonds they have sold and delivered to their customers if the bonds are found to be lost or stolen property. Can I request my brokers to make good my loss if they fail to produce sufficient proofs that the bonds they delivered are bonds without such complication ? "

In replying to this communication the financial editor says that

" The Chinese government is replacing the 1913 loan bonds with a new issue on account of the seizure of the bonds of that issue which had been deposited in a Petrograd (Russia) bank, some of which have since appeared on the market. A recently issued circular states that exchanges will be made by the Russo-Asiatic Bank, 9 Rue Boudreau, Paris, France, and advises sending bonds of the original issue to that bank at an early date, together with documents evidencing rightful ownership, giving satisfactory proof of the origin of the bonds forwarded. Such bonds which are to be exchanged must not be of those seized in Russia. Coupons from No. 19 to those due January 1, 1923, should be included. If our correspondent's bonds were not from the lot seized in Russia they will be exchanged. Since his purchase was made in 1921 it is probable that they are not included in the number seized. In the event that they are repudiated by the bank making the exchange there is little hope for obtaining restitution from the vendors. The securities were those of a government,and authorities hold that issues of a municipality, as distinguished from private issues, are open to investigation, and the laws under which they have been issued are accessible to the public, so that investors may make any investigation necessary on their own account, which is not always possible in the case of private issues. In the event of an express warranty by the vendors restitution may be compelled. It has been held in United States courts that unless there has been an express warranty by a broker who has sold bonds he cannot, if a bonâ fide holder of the bonds, be held liable to a purchaser if the bonds turn out to be part of issues fraudulently placed on the market. If a buyer desires special protection he must take a guaranty (92 U. S., 447 ; 46 Fed. Rep., 727). If a bond is invalid because of non-compliance with statutory requirements it has been held that a purchaser cannot allege failure of consideration as a ground of recovery. The rule that the buyer must beware prevails (96 Cai., 160), and in a sale of government securities there is no implied warranty by a vendor except that they belong to him and are not forgeries ; there is no implied warranty that they were legally issued."

The point made clear in the above correspondence is that the American investor very clearly states the date of the Chinese government notice as that of *December 4 last*, while the financial editor refers to a " *recently issued circular*," all of which would seem to bear out the contention of the Yokohama Specie Bank, that it was not informed officially in time to stop these interest payments. This correspondence would also seem to disprove the statement made by a Chinese official organ that the Japanese Bank purchased the bonds from the Soviet at 30 per cent. discount, and indicate that many such bonds were placed on the American market through bondbrokers having no relation to the Yokohama Specie Bank, corroborating the latter in its final statement that it also bought some of these bonds in New York.

In reference to the price alleged to have been paid by the Yokohama Specie Bank for these bonds, which the bank qualifies as a lie, it is merely interesting to recall that this discount is just about what the Chinese government now estimates its credit at, if the recent loan agreement to tide over the New Year can be taken as a standard. This loan for $12,000,000 as reported by *Reuter* is to be issued at 82, with six per cent. commission to the bankers and at six per cent. interest which means that the government will receive 76, and by the time the bonds are peddled out to subscribers they will be selling around 70, which we can take as the Chinese estimate of their credit at the present time.

In explaining its side of the case, the Yokohama Specie Bank makes its position clear in a memorandum, the translation of which we take from the *North China Standard*.

"Under date of January 22, the Yokohama Specie Bank, through its Peking branch, sent a note to the Chinese government demanding the settlement of the account relative to the payment of the coupons of the Chinese government reorganization loan of twenty-five million pounds, issued in 1913, and announcing the seizure by the bank of the portion of the salt gabelle placed in its custody in case China should fail to settle the account. The Chinese government sent a reply to the bank under date of January 27, refuting in full the points as put forth by the bank and proposing a postponement of the settlement of the account. The bank refuses to accept the Chinese proposal and is determined to take suitable steps, although it has not as yet taken any action.

"The controversy between the Specie Bank and the Chinese government has afforded to the Chinese press, the opportunity to launch an attack on Japan, and some of them are already giving circulation to many preposterous reports regarding the matter. The bank has apparently found it necessary to vindicate itself, and has issued a statement giving a detailed explanation of the circumstances that led to the controversy. A full translation of the text is unavoidably held over, but the salient points as contained therein are as follows :—

(1) In accordance with the provisions as agreed upon, the Yokohama Specie Bank has been cashing the coupons of the 1913 reorganization loan issued by the Chinese government, receiving repayment of the money thus advanced through the Central Clearance House in London.

(2) In December 1921, the bank received a proposal from the Russo-Asiatic Bank asking for the postponement of repayment amounting to 53,-86J.10 pounds, on the ground that the loan bonds kept in custody at the bank in Petrograd had been confiscated by the Soviet government which made the possession of the coupons insecure. The bank refused to accept the proposal, and eventually got the repayment.

(3) Under date of January 24. coupons relative to the said loan bonds after January 1, 1922, and received repayment up to January 10 of the same year.

(This appears to be mutilated).

(4) Under date of January 24, 1922, the Chinese legation in Tokyo, sent a note to the head office of the bank, communicating the instruction from the home government that the Specie Bank should be asked to cash such coupons of the said loan bonds only, as the possessors thereof could prove legal possession before the Soviet government nationalized all the Russian banks, that is to say, before December 27, 1917, Russian calendar, while the Bank would be responsible for the redemption of the same, in case it was later ascertained that the bonds relative to the coupons had been converted into the property of the Soviet government.

(5) Between January 11 and January 24, on which date the Specie Bank received the above mentioned communication, the bank cashed coupons to the amount of £107,476. The bank asked for repayment of the same of the Russo-Asiatic Bank through the Central Clearance House in London, when it was replied that repayment could only be made on special instruction from the Chinese government.

(6) The bank protested, on the one hand, to the Russo-Asiatic Bank, and on the other to the Chinese government and succeeded in inducing Mr. Tung Kang, the minister of finance, with whom Mr. Odagri, the director of the bank, had negotiated anent the question, to declare that the account relative to the coupons in question, amounting to 107,476 pounds, should be settled.

(7) Before the account was settled, however, Mr. Tung Kang resigned, and his successor failed to act up to his declaration.

(8) Under date of January 22, the Specie Bank sent a note to the ministry of finance asking it to take suitable measures to see the account in question settled, before the Chinese government would approach the banking consortium for the release of the salt surplus for December, and by the 27th at the latest, announcing at the same time the bank's intention to seize the portion of the salt surplus placed in its custody. In the reply, which was issued under date of January 27, the ministry of finance reiterated its own points, disagreeing with the bank's request, and proposed that the question should be left as it was for the time being.

(9) The Specie Bank is, it is true, in possession of a certain amount of the reorganization loan bonds. These were bought in New York, before the question arose, through suitable proceedings and at a suitable price. The report, indulged in by some yellow Chinese papers, that the Specie Bank purchased the bonds before warning had been given is a lie, pure and simple."

Here we have a repitition of the German Hukwang bond incident, where in order to justify their position, the Chinese have no hesitation in impugning the honor and integrity of the bankers. In the matter of the German Hukwang bonds, the Chinese deliberately accused J. P. Morgan & Company, the greatest financial house in the world, of sharp practice and prevarication, alleging that the bonds came into their possession after China had declared war against Germany and thereby justifying their repudiation. In the matter of the duplicate Russian bonds, the same aspersions are cast on the integrity of the Yokohama Specie Bank, asserting that it bought the Russian bonds after China had declared them invalid. There would seem to be a limit to such tactics in attempting to escape the payment of just liabilities. The honor of the Yokohama Specie Bank is certainly far above that of the Chinese ministry of finance as it has been conducted in recent years, and if the Japanese bank has taken drastic action to protect itself against the loose financial methods of Peking, it is probably because it is "fed up" dealing with officials who employ the reprehensible methods that have brought China's credit to its present deplorable condition.

# Watch Belgium!

OUR correspondent in Brussels informs us that one of the most important financial transactions of December was the signing of a £3,300,000 sterling loan to the Chinese government negotiated through the Societe d'Entreprises en Chine, a Belgian corporation closely allied with the Banque de Bruxelles. The object of the loan is the joint construction of a railway between Paotow on the Yellow river and Ninghsia, a prolongation of the existing Peking-Suiyuan line along the great bend of the Yellow river that will ultimately connect with Lanchow. The contract provides that the Chinese government will construct the road bed and the Belgian society furnish the equipment, which, most naturally, will be Belgian. The Societe d'Entreprises en Chine is permitted to issue the bonds in lots for the above amount or for an equivalent sum in Belgian francs at the rate of 60 francs to the pound sterling. The first installment of the loan, amounting to £800,000 or francs 48,000,000, has been issued by the Banque of Bruxelles, and taken up immediately.

The Belgians have again succeeded where America has failed, and the chances are that the bulk of the above-mentioned bonds will be bought by American investors. On two occasions, American capital had the opportunity to build this line. In 1912, during the revolution, Yuan Shih-kai requested an independent American banking house to advance $5,000,000 secured on the physical properties and earnings of the Peking-Kalgan line and the right to finance future extensions, and solemnly declared that owing to the great political significance attached by the Chinese government to this line, which commanded the approach to Peking from Monglia, under no considerations would they ever permit it to be hypothecated to a European power, for fear of its falling under the influence of Russia. The independent American group headed by Salomon & Company, were quite prepared to advance the funds, but the state department, living up to its agreement with the other powers to lend no money to China during the internal struggle, and supporting the monopoly to the official group, declined to extend support. Convinced that

nothing could be done with the United States, the Chinese in their desperate straits for funds reversed their declared policy and entered into a secret transaction with the new Belgian group, in reality the instrument of Russia, and concluded a loan for $5,000,000 secured on the Peking-Kalgan line five days after the president and premier had signed an agreement with the new consortium giving the latter an option on all new loans. The breach of faith cost Tang Shao-yi his position as premier. To make good this act of sacrifice the Belgians shortly afterwards signed the Lung-Hai loan with Tang's henchman, Alfred Sze, who held the postion of minister of communications in the first republican cabinet long enough to put through this deal, and tie up the Lung-Hai construction work under the director generalship of his brother. Belgium, acting as the agent of Russia, brought the latter to a port on the Yangtze throwing a bomb into the British camp.

One of the lines specified in the original Siems-Carey railway contract of 1916 was from Fengchen (at that time the terminus of the present Peking-Suiyuan line) to Ninghsia. Mr. Carey was on the job within a month, with engineering headquarters at Kalgan and a complete staff ready to proceed with surveys, but when the final agreement was made public Russia was the first to enter an emphatic protest. It is well to recall that Russia considered Mongolia as a buffer state in order to keep the yellow man from becoming a menace on her Siberian borders, and any railway that might open this territory to Chinese colonization would be considered by Russia as a direct challenge to her vital policy. Whether it was Russia's protest or whether Mr. Carey finally determined that the line could not pay, that induced him to shift his activities to the Hunan-Kwangsi line is a matter of conjecture, but on the face of the contract, the line along the great bend of the Yellow river passing through Nanghsia and terminating at Lanchow, is or was an American right, which, we understand, was subsequently pooled in the consortium.

At any rate, here we have the Belgians returning to their old railway program, monopolizing the lines that converge at Lanchow and which some day will stretch further westwards towards Russian Central Asia. Joffe, the Soviet representative at Peking, has been at great pains to elucidate Russia's policy in Mongolia, which in no way differs from the flat declaration of the old Czarist government: Mongolia is not to be opened up to Chinese colonization. We hear no emphatic protests from the Soviet or denunciations from Joffe against the conclusion of the new Belgian loan which will carry out and construct the identical railway which which Russia declared could not be built when the contract was awarded to an American concern. When the Peking-Suiyuan line is extended to Ninghsia, its further extension to Lanchow will follow as a matter of course. Here it will hook up with the great Lung-Hai line, and proceed westwards. There is always the possibility of the Chenting-Taiyuan line being extended westward by the same means, also the revival of the Tatung-Sianfu line, in which case the entire system of lines in the northwest will come under Belgian influence, and unless politics in Europe take an entirely different trend, the day may well arrive when we will again witness a Russo-Franceo-Belgo combination dominating a section of China which will serve as the entering wedge of ultimate Muscovite control.

The world has been so occupied with watching Japan's moves against this very menace, that it has lost sight of the real problems involved. What value is a consortium which in order to eliminate other spheres of influence, leaves the door open for the free operation of other interests whose designs upon China originated the scramble for strategic railway concessions and made the spheres of influence possible? The day will come when interest will again be diverted from the moves of Japan and once more centered upon more important intrigues which will nullify the pacts of Washington and expose China to dangers that no round table conference will save her from. Russia's aims and aspirations in Asia never change.

It is of special interest to Americans to learn that simultaneously with the floating of the Chinese loan by the Societe d'Entreprises en Chine in Brussels, another loan of $15,000,000 is being negotiated between the Belgian minister of the colonies and American bankers, the proceeds to be employed in railway and other improvement work in the Belgian Congo in the province of Katanga, one of the richest mineral regions in the world. The company which controls the mining interests in this district, The Union Miniere du Haut Katanga, is the largest producer of copper in in the world, last year clearing a profit of nine million francs. The Kantanga and Chinese interests are closely allied. The profits of the Katanga districts in ways known to financiers may well be made to serve as security for otherwise dubious Chinese bonds, and through this interlacing of interests, American bankers may find themselves financing a railway in China through Belgian banks that they declined to undertake direct.

We present these facts with a purpose. We are satisfied that whatever may have been Belgium's connection with Russia in the past, the war has modified these relations and to-day Belgian financiers are working for the exclusive advancement of their national industrial welfare. On the other hand, if Japan was to now re-open negotiations for the construction of the Kirin-Hueining and other Manchurian lines to which she holds preliminary agreements and on which she has paid considerable advances to the Chinese government, she would at once be accused of carrying out her pre-war political policy in Manchuria. Japan's railway program in these regions was forced on her by the Russian policy of conquest by railways in which both France and Belgium acted as her partners. If Belgium is now to take up the old Russian program where it left off and it is accepted as a strictly legitimate business transaction, we must not be surprised if Japan also insists upon the execution of strictly legitimate railway contracts without others raising the question of her good faith. For on this will depend to a large extent her ability to raise loans in the United States for Manchurian construction work. If Belgium is exempted from criticism and the way facilitated for the raising of loans on the American market to enable her to carry out the old Russian railway program in China, which Americans were not allowed to interfere with, then fair play demands similar treatment for Japan, whose vital interests depend upon carefully scrutinizing any new move in Chinese railway construction by groups outside the consortium. The new Ninghsia railway contract may be above criticism, but under the circumstances, it is needless to say that Japan will carefully watch Belgium.

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# Labor Unrest in China

THOSE who are interested in the industrial development of the Far East will find a most illuminating commentary on labour conditions in the recent strike movement promulgated by the employees of the British Cigarette Company in Hankow.

There have been various strikes on the part of foreign employed labour in the Hankow area during the last year or so, but this one is particularly worthy of attention both from the number of those affected and from the fact that the British Cigarette Company, which is affiliated to the better known British-American Tobacco Company, has always treated its employees reasonably, and afforded them good working conditions in so far as such are possible in a tobacco factory, in a climate such as that of Hankow.

To enable the reader to appreciate the situation one cannot do better than reproduce the letter received by the management of the factory from the labor union concerned, together with a copy of the agreement finally reached, and an analysis of the conditions as reported by the manager of the Company and by independant observers.

The first strike occurred in the month of October, 1922, and shortly after its settlement agitation amongst the workers was again begun, this culminating in the strike of January 3, 1923, which was followed by a lock-out on the part of the Company on January 10.

On January 15 the following letter was received by the management, a letter which may be considered typical of the attitude of Chinese labor under present conditions :—

B. C. C. Factory.

Dear Sir,—The workers of your factory raised the demand for better treatment after the previous agreement was signed, and nevertheless your officers, assuming the manner of despising the workers, do not keep the agreement, but indulge themselves in treating them cruelly.

Apparently you bribe public opinion and fool the workers in the hope of making real facts confused and to reach your aim of fooling the workers.

At that time this union gave you some loyal advice in the spirit of doing justice, but unexpectedly your actions are so clear that all the workmen's clubs of this union have been irritated by your ill-treating the workers, and all our countrymen have been enraged too, thus causing the second strike of the workers of your factory.

If the people of your factory have a little sense you should accept the workers' reasonable demands at once, this being the way to protect your wealth.

On the contrary you employ such cunning methods as can never escape public notice, as in threatening to close the factory.

You must bear in mind that our workers are born with the ability to work, and they cannot be starved to death.

From this our countrymen will learn a great lesson which will forever last in our memory.

As this union still considers the friendship between the two nations, we therefore give you this final faithful advice : that is, do not use those deceptive methods which are so apparent, but accept the workers' demands at once, or else we will take the antagonistic position and call upon our countrymen to sever commercial relations with you and prohibit the cigarettes of your factory.

Do not say we have not notified you beforehand ! This is the warning !

Yours faithfully,

Hupeh Workmen Clubs Union.

Hankow, January 15, 1923.

It will be observed from the foregoing that the union accused the B. C. C. management of deceiving the members of the union by failing to observe its written obligations, and threatened a complete boycott if its demands were not complied with.

Let us now look at the situation from another point of view. During the month of October last the employees of the factory called a general strike, upon which the management made a most careful and painstaking enquiry into the alleged grievances of the workers, and at their request received representatives of the Hupeh labour union in order to obtain their view of the position and to show that they were in no way opposed to the union so long as it was conducted fairly and with a sense of responsibility.

On that occasion the union representatives acted as mediators in a spirit of helpfulness, and in the interests of industry in general, and as a mark of their appreciation of this the Company sent a complimentary scroll to the union on the satisfactory termination of the strike.

On January 3, when the workers again went on strike, they left the factory without any notice, thus causing great damage to the goods of the company, which were abandoned in a condition causing quick deterioration.

The Company itself took no action until the factory had become paralysed by lack of labour, when it published its notice of January 10 calling on all workers to collect their wages, and officially stating that the factory was closed.

The management of the Company states that all the terms of the agreement signed last October have been adhered to on their part, and in evidence of that there is the fact that on November 14 there was a voluntary increase in wages of some 14 per cent., while the representatives of the Hupeh labor union who inspected the factory expressed themselves well pleased with the conditions they found there.

The minimum wages in the factory are $10.50 per month for the men employed there, and a rice allowance is also given, while there is extra pay for overtime.

In spite of these favourable conditions, constant agitation was carried on by people representing themselves as delegates of a B. C. C. labor union, although they held no position of responsibility in the factory, and as a result of their interference the standard of goods produced reached such a low grade that a quantity was deemed unfit for sale and had to be destroyed.

Various anonymous statements appeared in the vernacular press and elsewhere as to the various points of the agreement made in October which were alleged to have been broken, and to these the Company issued a categorical denial, asserting that it had nothing to conceal in regard to its work or the strike, and inviting the fullest publicity.

In pursuance of this idea a committee of conciliation was co-opted, and succeeded in drawing up an agreement which was more or less satisfactory to both parties.

Demands of Workers Presented January 18, 1923.

1. (*a*) Restore the rights of the union representatives to have direct appeal to the management.

*Agreed.* Representatives of the workers' club will have the right of appeal to the management.

(*b*) Reinstate the men and women workers who have been dismissed.

*Agreed.* The club will submit to the Company a list of workers dismissed since the first strike, whose future good conduct is guaranteed by the club, and on these conitions they will be reinstated.

(*c*) Strike pay for all, and reimbursement for all workers who have been dismissed.

*Agreed.* The Company will make a compassionate grant of $9,000 for its old workers.

2. New workers should be engaged on the recommendation of the B.C.C. union, and dismissal of workmen should be approved by them.

*Agreed.* The manager of the factory will engage new workers according to custom, but will be willing to receive recommendations from the club. Workers will be dismissed for infringements of the factory regulations.

3. The regulations in the factory should be announced and agreed upon with the union.

*Agreed.* Regulations in regard to dismissals and fines will be drawn up by the Company and communicated to the union.

4. Odd amounts in wage settlements should be paid in big money and not carried forward.

*Agreed.* All wages will be paid in big money.

5. At the end of each year an extra month's wages should be paid.

*Agreed.* All bonuses will be abolished, and at China New Year the Company will pay half a month's wages to those who have been in the factory for more than six months.

6. During the sickness of a worker his wages should be paid as usual when he is on recognized sick leave.

*Agreed.* On the certificate of the doctor at the Catholic hospital sick leave will be granted with pay.

7. For night workers, one shift shall be paid as 1½ shift. Sunday and regular holidays should be paid wages as usual.

*Agreed.* An addition of 30 per cent. will be made for night work. Wages will be paid by the month, and deductions will not be made for Sundays.

8. No fine to be imposed exceeding half a day's pay. Sums cruelly fined should be refunded.

*Agreed.* This will be dealt with in the regulations to be drafted under Article 3.

9. Those workers holding checks must be given work. They should not be turned down on account of there being no work for them.

*Agreed.* Holders of regular checks have first right to seats, and the holders of extra checks will then be accommodated.

10. Monthly wages to be paid, and no deductions to be made.

*Agreed.* Wages will be paid by the month except to piece workers.

11. Time should be given to all workers to wash their hands, and otherwise no fine should be imposed for cigarettes which are spoiled.

*Agreed.* The facilities for washing will be improved.

12. At 7 a.m. and at 1 p.m. the machinery should be set to work.

*Agreed.* Machinery will start at 7 a m and 1 p m.

13. In addition to this second agreement the former agreement shall remain in force.

*Agreel.* The agreement made subsequent to the first strike will remain in force except where it conflicts with this agreement.

CLAUSES AS TO CLOSING THE WORKS.

1. In case the B.C.C. factory closes down the factory shall indemnify the workers by three years pay.

*Agreed.* Article 5 of the old agreement recognizes that workers shall not be dismissed in consequence of the strike.

2. Should the factory be closed down it shall never be re-opened. If this is violated and the factory is re-opened, the time of unemployment shall be refunded to original workers up to three years.

*Agreed.* Articles of the old agreement which remain in force (under 13 above) are not re-copied into this agreement.

Business men and students of economic conditions will have little difficulty in analysing this agreement, and recognizing the dangers which underly some of the clauses, and which, though they were temporarily shelved by the adroit diplomacy of the negotiating committee, will doubtless recur after a short period has elapsed.

But after reading the agreement a second time the reader may not unreasonably begin to wonder whether there is not something more than ordinary strike purposes concealed behind its apparent intention.

Most of the clauses are so ordinary as not to call for consideration, one or two of them, indeed, being already covered by the customs of the factory work or included in the previous agreement.

Clause 8, however, would be a bone of contention in any discussion between masters and men, for it is difficult to see what protection is afforded to any Company under such an agreement if, for instance, their valuable machinery or other vital processes should be injured or even destroyed by a negligent or vindictive employé.

Clause 2 is even more direct in its menace to any friendly understanding between organized Labor and Capital, for the power of approval or rejection thereby placed in the hands of the factory union would render the authority of the management practically nil, and on the other hand would afford unlimited opportunities for "squeeze" on the part of the union committee, to whom all would-be labor must first apply before obtaining the privilege of admission to the works.

But it is possible, nay, even probable, that the union, in signing the terms of agreement, did not expect to obtain a full victory in their demands, and indeed, did not desire it, from the point of view of leaving a loophole for further agitation to enter in the not far distant future.

As for the final clauses, dealing with the problematical closing of the factory, and demanding guarantees against such an eventuality, such admissions would be almost impossible of concession, and both the workers and the management appear to have recognized the fact.

A similar demand for indemnity was made in Japan a few months ago in the case of the governmental dockyards and arsenals, and it proved to be one of such intensity as to gravely endanger the position of the politicians then in power.

It has been recognized by most students of economic conditions that the theory of pensions for a continued period of good work was a sound one, though many argue that such ameliorative measures are the duty of the state rather than that of the private employer; but this development of the argument to cover all employees of more than six months service, irrespective of the quality of their labor, cannot but be destructive to any friendly co-operation between the two parties concerned.

But it is an interesting speculation as to whether this idea was adopted *en bloc* from Japanese labor demands, whether it was propagated by Japanese labor leaders actually in Hankow, or whether it was an independant growth in the minds of the Chinese agitators themselves.

There was a strong rumor current that the Company had in their minds the possibility of a transferral of the entire factory to another site, where labor might prove more amenable to reason, and it is therefore reasonable to consider whether these demands were not drafted by the union leaders expressly to tie the hands of the management and force them to a surrender or a show down.

With regard to this point of view, it should be recognized that the factory pays every month a very large sum in wages to their 2,000 odd employees for goods which are largely sold abroad, and which therefore bring foreign money into the country, while the circulation of this credit is of the greatest benefit to the merchants of Hankow and to those producers in the interior who ship the tobacco to the factory.

There are not wanting those critics who declare that no consideration of this nature will be allowed weight for a moment, because the whole agitation is only part of a larger scheme of disruption put forward by Bolshevik agents, with the object of enlisting the youth of the Chinese labor movement in their struggle with the commercial and political relations of the rest of the world.

On the other hand, it will be discovered that practically all the strikes of any importance during the past two years have taken place in or affected British interests, and it is more than possible that some political influence, which is antagonistic on account of real or supposed injuries or opposition received, is stirring up this labor unrest as an easy point of attack, and a means of obtaining revenge.

Considering the very recent development of labor unions in China it would certainly seem more probable that the recent succession of strikes should have a political foundation rather than a social one, though we must admit that the Chinese methods of opposition and argument which are very akin to passive resistance, render them particularly susceptible to strike conditions as a means of dispute.

It cannot but be a matter of great regret to all independant students of labor movements that the Chinese, who are only just commencing their industrial development, should not have learnt from the sufferings of industrialism in the west, and realized that labor unions were created in the past to combat a sudden and unexpected evil, and that it has since became more and more apparent that only the wisest co-operation on the part of capital and labor can ensure the safety of the state and the welfare of its citizens.

*(Contributed).*

# American Policy in China

## A Question of Leadership

IF Americans are to succeed in China they must follow the example of their chief commercial rivals and pull together under an efficient organization, and above all, a recognized leader.

These thoughts come to us after reading the remarks of Commercial Attaché Arnold before the San Francisco chamber of commerce in which he follows up his previous criticisms of the representative of the American group at Peking for his conservative loan policy towards China. The *San Francisco Journal of Commerce* of November 23, presents Mr. Arnold's speech as follows:

"American trade development in China is being held back by American bankers, who persist in looking at loans in China from a narrow banking point of view, declared Julean Arnold, representative at Peking of the United States department of commerce, speaking yesterday at the weekly forum of the San Francisco chamber of commerce in the Palace Hotel.

"Trade follows the loan," said Mr. Arnold. "When the British banks make loans in China they stipulate that all material or equipment purchased through this loan must come from Great Britain. Thus the British and the other foreign banks help their own industries while helping themselves But American bankers are demanding that China be unified and on its feet before they advance money. Instead of helping China with loans to unify itself, our bankers are standing off, while our foreign competitors are strengthening their financial bonds with China."

"Mr. Arnold spoke of the international consortium of bankers as a great movement forward, as it prevented concession scrambling and consequent heart-burnings among the different nations. But the American element is now hanging off, demanding guarantees."

**Frederick W. Stevens**

By reason of his position as representative in Peking of the American group in the consortium, and unofficial agent of the state department in carrying out the most important American policy in China, Mr. Stevens is unquestionably the leader of American business interests in China. His success will create immense markets for American and foreign products; his defeat means a complete break-down of American policy and a return to the days of international competition in the scramble for concessions.

Mr. Arnold's statements clearly indicate the existence of a disagreement amongst Americans as to the wisdom of the present policy of the consortium, and by reason of the fact that the head of the American group is the chairman of the consortium, his criticisms fall on his own government and its agents. In plain words, we are brought face to face with the question of American leadership in China, one that must be settled if Americans are to succeed in this highly competitive field.

It is not our purpose to question the established position of Mr. Julean Arnold as the leader of American commercial interests in China. He is by far the most efficient of all the American commercial attachés and officials of the department of commerce; as widely known as Secretary Hoover himself. In commercial circles in America the name of China is synonymous with Julean Arnold: he put China on the American commercial map. There is hardly a chamber of commerce in the United States which has not extended an invitation to him to address its members on trade opportunities in China; there are few such invitations that he has declined. No other commercial attaché, trade adviser, diplomatic or consular official has been so frequently quoted or so highly honored. The American commercial attaché in China is a national figure.

Very little has been accomplished during the past ten years in this country that was not originated by Mr. Arnold or in which he was not in some way concerned with its success. American manufacturers and their representatives in China have contributed their part towards national trade expansion in this country but in nearly every instance where a big deal has been put through, the business has been brought to them through the enterprise of the American commercial attaché. The records of the department of commerce bear full and eloquent testimony to his commendable initiative and fertility of resource in "bringing home the bacon." Mr. Arnold is a typical "go-getter."

When informed that Judge Elbert Gary, the head of the great steel corporation, Mr. Thomas Lamont and other captains of American finance and industry intimated that it would be best for higher American trade interests to find some harmonious and friendly solution to our difficulties with Japan so that American and Japanese bankers could co-operate through the consortium for the financial rehabilitation and industrial development of China, the American commercial attaché very quietly remarked "well, pressure must be brought to bear to compel them to modify their viewpoint."

An American official so sure of his ground as to challenge the policy of the real captains of American industry and finance for the advance of higher national trade interests in eastern Asia, wields a power that automatically elevates him above all others and gives him the undoubted right to express his opinions upon any matter which concerns our commercial success in China. We are not surprised, therefore, to read that Mr. Arnold has thrown down the gauntlet to the representative of the American group in Peking and indirectly to the powerful financial leaders at home.

If the views of the commercial attaché are to prevail, then the representation of the American group at Peking and leadership in the consortium may just as well be handed over to one of Mr. Morgan's young bank clerks and the present high salaried financial

expert dispensed with. Or the work of the American group for the advancement of American interests in China might be handed over to a special government financial commissioner, ranking with the trade commissioner, and placed under the direction of the commercial attaché. An ideal solution that would solve for all time the question of American leadership in China. If, however, we are mistaken in this, and the great financiers and heads of American industries insist upon retaining their right to leadership and to form their own policies for what they deem best for the advancement and protection of their interests, then American leadership in China must rest with their accredited representative, and the commercial attaché should refrain from making his position more difficult than it is.

It is quite clear that the views of the commercial attaché on the questions of loans to China are diametrically opposed to those of the American group and its representative, which implies on analysis, that the commerce and state department are not working in complete accord on this important matter. The American group is as much an organ of the state department as the bureau of foreign and domestic commerce is of the department of commerce, with this difference, that while the group is composed of the most important banks of the country carrying out the policy of the government at its express invitation, the commercial attaché's office is simply an adjunct to the department of commerce, whose duty is to further in every way possible the success of a national program laid down by the department having direction over our foreign relations. If the representative of the department of commerce is to use his influence and position to destroy or make difficult the carrying out of the state department program, there can be no co-ordination or harmony, and in the end, national prestige will suffer by the defeat of our policies.

Organized British, French and Japanese business in China is directed by one supreme head. In every case it goes straight up the line to the representative of the most important financial institution operating in this country. America's competitors also have their chambers of commerce, their secretaries and commercial attachés. There are also many prominent *taipans* of trading concerns, but high above them all stands their chief financial representative. The British recognize the head of the Hongkong and Shanghai Banking Corporation as their leader. At present this position is held by Mr. A. G. Stephen. His lieutenant in Peking is the active head of the British group in the consortium and in matters connected with the financing and development of railways, the expert representative of the British and Chinese corporation speaks for him. What Mr. Stephen has to say, either direct or through his lieutenants, is listened to with respectful attention. It goes. No British firm or official understrapper would dispute his leadership or too openly condemn his policies.

It is the same with the French : the agent of the Banque de l'Indo-Chine at Peking and representative of the French group in the consortium speaks for French interests with authority. With Japan, the leadership rests with the capable managing director of the Yokohama Specie Bank in charge of Chinese business and representative of the Japanese group. There was a time, perhaps, when current criticism about the qualifications of the representative of the American group held good. Up to the formation of the present consortium, when China was split into spheres of interest and every European and Japanese loan had its political significance, there was good reason to insist that the American representative be fully acquainted with international policies and politics in China; a man who knew his Peking and its intrigues.

Every other power interested in China carefully selected the men to represent their official financial groups in Peking, and in each and every case they were promoted from the diplomatic service. Policies came first, finance afterwards. The British selected Mr. Sidney Mayers from their diplomatic service to head the British and Chinese Corporation at Peking. The French, at first had M. Casenave, one of their ablest diplomats as representative of the French group. The Germans took Herr Cordes from the consular service to represent the German group ; the Japanese elevated Mr. Odagiri from the grade of consul-general to a similar position ; the Belgians took Mr. de Vos, their consul-general at Tientsin, and made him the head of the Belgian group, while the Russian group has always had the experienced banker and diplomat, M. de Hoyer, to watch over its interests. This sextet of specially educated and trained experts in Chinese affairs with the addition of one or two men in London, Paris and Tokyo know more about China than their own foreign offices, the only men in the world really competent to sit around a table and intelligently discuss Chinese problems. When the United States first entered the Chinese field we had the good sense to select a man of the same type, and in the late Willard Straight our national interests in the operations of the American group were ably protected and advanced. Straight sat around the table with the others and talked their language. When they made a move on the chessboard, he understood the play. He had been in China many years. He had lived in Peking and like his colleagues, was elevated from the consular service to the post of financial representative. When he died, there was no one to take his place. No attempt was ever made to train another man for this highly important and specialized task. Those who did succeed in doing something which might in any way fit them to carry on, were discouraged, and sat upon. Had the consortium not been formed, American financial representation in Peking would have been entrusted to men utterly unequipped to understand the moves of their competitors, and unable to converse intelligently on matters of international political importance. Fortunately, not only for China, but for America, those days are passed.

With the signing of the consortium pact and the treaties of Washington, pooling all outstanding concessions and rights and abolishing spheres of interest and special privilege, the necessity of having an American financial representative steeped in the intricacies of Chinese and international political intrigue in Peking, disappeared. Once Chinese loans and railway concessions were dissociated from international politics, they automatically became purely business propositions, to be dealt with on a purely business basis. From the American banker's viewpoint this reduced itself to adequate security and the necessary safeguards that the funds would be expended for the specific purposes of the loan. The American group, headed by the most expert financiers of the nation, therefore selected the man who in their opinion was best qualified to carry out their ideas of what constituted a bond that could be readily sold on the American market. They sent to China the best bond lawyer and expert they could find, Mr. Frederick W. Stevens.

Mr. Stevens is not only the representative of the American group in the consortium, but by reason of its official connection with the state department, the agent entrusted with the carrying out of the most important state policy our government has to date devised for advancing American interests in China. In the same manner that Mr. A. G. Stephen is the recognized leader of British commercial interests in China, as Mr. Odagiri speaks for Japan and M. Mazot for France, so Frederick W. Stevens is unquestionably the leader of American interests in China. Unless that leadership is recognized and Americans work in harmony with and contribute to his success, American policy in China will suffer another break-down.

It is necessary to emphasize this matter. Americans have suffered from an over-dose of " expert " trade advice these past few years. The time has arrived when they must face the situation fairly. The national prestige hinges on the success of the consortium. The financial initiative and leadership rests with the duly accredited representative of the American group and by reason of this position the unofficial agent of the state department. Is he to be supported or is he to be assailed by petty criticism until his position becomes unbearable and his resignation forced to make way for some new and untried griffin ? The state department recently cabled the legation at Peking instructing it to support the consortium, which means, to stand by the representative of the American group, the leader who is carrying the load of bringing success to the one policy that will enable American capital to participate on equal terms with other nations in the development of China.

# Sir Ronald Macleay

TRUE to its traditions, the British government sends as its new minister to China one of the dozen men in the world entitled to sit around a conference table and discuss Far Eastern problems with intelligence and in the same language as the other eleven experts. In Sir Ronald Macleay, British interests will be represented in Peking by a diplomat with a firm grasp on the larger and more delicate questions embraced in the greater political and strategical problems which at no distant date may again become acute and menace the peace of Asia. As head of the Far Eastern bureau of the foreign office and as Far Eastern expert to the British delegation at Paris, Sir Ronald developed an insight into these deeper problems which easily elevated him above the experts of other nations whose viewpoint was influenced by sentiment rather than by the facts. He represents that type of European diplomat specialized in questions which have so materially contributed to the prestige and success of their various governments whenever international conferences have been called to settle the fate of nations or whenever expert knowledge has been essential to the maintenance of a national policy in certain world centres.

(*Shanghai Times*)

**Sir Ronald Macleay**

The New British Minister to China

Sir Ronald entered the British diplomatic service in 1895, serving with conspicuous success in various capacities in Washington, Copenhagen, Brussels, Madrid, Peking and the Argentine. In addition to his Far Eastern experience and special knowledge of its problems he comes to Peking at this time ripe with experience gained in other important diplomatic centres. British interests in China are to be congratulated on his selection for this post, where he will prove a worthy successor to a long line of other highly specialized diplomats who have carried them to success in this country.

# Jubilee Exhibition at Gothenburg

(*Concluded from page 142*)

Of special interest will be the exhibition showing in historical aspect up to the organization of to-day the municipal government of Gothenburg. Here will be found such interesting exhibits as city planning, harbor building, financial government, health service, care of the poor and of orphants, educational organization and housing problem. These exhibits will include a large number of models and plans.

Further exhibitions will be found covering handicraft—and industrial art, to include interior decoration, textiles, pottery, glass, gold and jewelry, books and printing and also a scandinavian art exhibition.

A special exhibition will cover Swedish activities now and in the past in foreign countries.

## II. Industrial Exhibition of Export Goods

The most interesting part of the Gothenburg Jubilee Exhibition will, however, undoubtly be the exhibition of Swedish export goods. It is expected that this exhibition will cover the entire field of Swedens export industries. The following are the main departments of this exhibition.

Mining of ore, iron—steel—and metal works and factories for finished metal products, macninery, electric and instrument industries, stone industry and pottery, cement, chinaware—and glass industries, forestry, wood goods, woodpulp—and paper industries, textile, leather and rubber goods industries, foodstuff industries, chemical industry.

The exhibition will comprise not only the manufactured products but also the manufacturing processes.

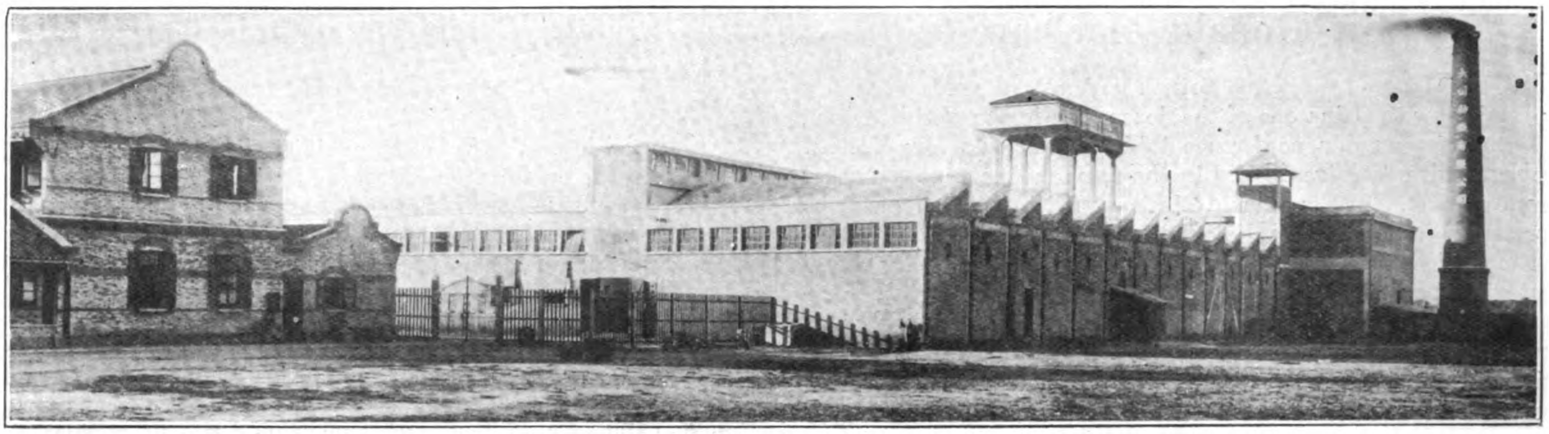
It is the intention to give as complete picture as possible of the present development of Sweden's export goods industries and also to convey to the visitor an idea of Sweden's future possibilities as an industrial country. The Swedes have since oldest times been famous for their engineering ability, which has given Swedish industrial products an important place on the world markets. The export exhibition should be of great interest to foreign visitors. The buildings for this exhibition cover a floor area of about 27,000 square metres.

In order to make these exhibitions as interesting as possible they will be arranged collectively so that a complete picture will be gained of each industrial group. Through special arrangements it will be possible to show the high quality and workmanship of the industrial products. To take the iron—and steel industry a visitor shall be able to follow the total manufacturing process, beginning with the mining of the iron-ore, manufacturing of pig-iron, of steel and of the finished product. Further the use of different products will be demonstrated.

In addition to what now has been mentioned their will be a specia lagricultural exhibition in combination with an all-Swedish agricultural convention, an international air traffic exhibition and a scandinavian horticultural exhibition.

The city of Gothenburg will during the time of the Jubilee Exhibition be the meeting place for many Swedish, scandinavian and international conventions and finally there will be held a great international sport meeting which will be almost as extensive as the Olympic games.

Foreign visitors to the exhibition will be able to take advantage of the wonderful opportunities which Sweden offers to the tourist. Gothenburg is connected with all important places in the scandinavian countries and on the European continent with first-class railways and with ports in Europe and trans-oceanic countries through direct steamshiplines.

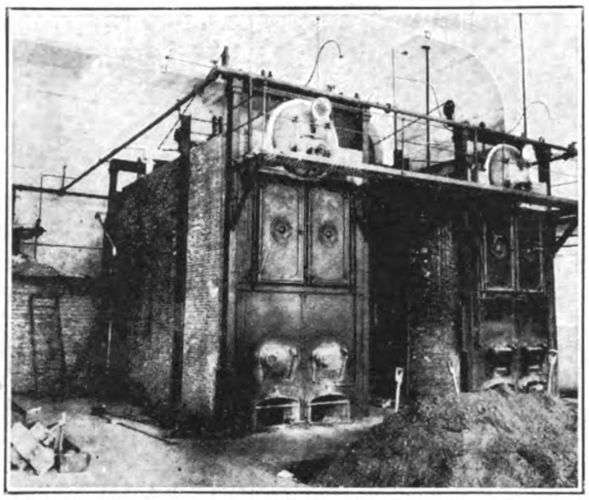


Dah Tung Cotton Mill

# British Textile Machinery in China

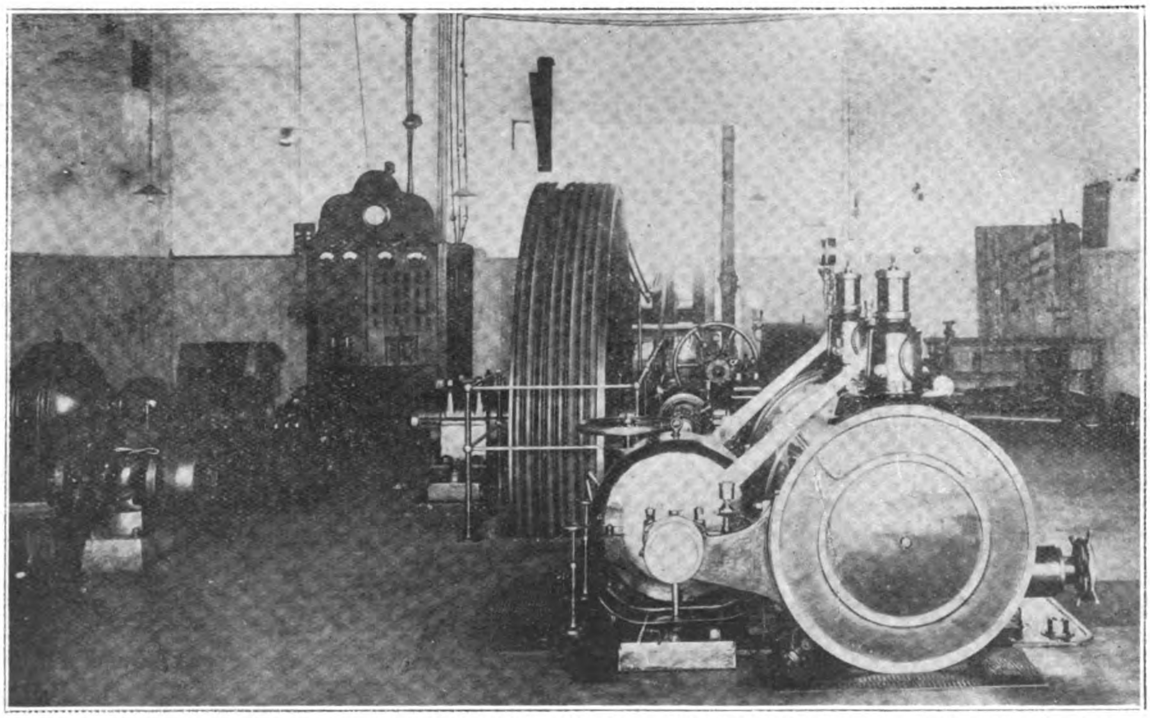
## The Dah Tung Cotton Mill—A Brooks and Doxey Installation

IN celebrating the opening of the Dah Tung Cotton Mill located on Tsung Ming Island near the mouth of the Yangtze, its general manager, Mr. Yao Sih-chow, describes in typical Chinese fashion the origin of this self-contained enterprise which brought an up-to-date mill to the centre of an important cotton-growing district and to a local market which consumes all its product. Such a happy and fortuitous combination of business conditions is sufficiently rare in modern industrial enterprises, and in China indicates that sound business judgement is not always absent in new undertakings. Mr. Yao had spent about thirty years in general construction work, especially in the erection of cotton mills and in time was looked up to amongst the Chinese as an expert in this line. Mr. Yao says that "in the autumn of 1919, friends, natives of the Tsung Ming Island, came to consult him with regard to the erection of a cotton mill in their native town, Pao Chin. "Their years of experience had led them to feel that this organization would be profitable, I also was convinced that this island was valuable not only for cotton growing, but also a yarn market on a large scale. Because of its great output of cotton, raw material could be depended upon, and our yarn could supply the demands of the many weavers among the population. It seemed certain that great profit might be anticipated from these two conditions. Notwithstanding this, I was not absolutely certain in my belief until I had discussed matters fully with that great pioneer of the textile industry, Mr. C. C. Nieh. He approved of the plan and rendered valuable assistance in every way."



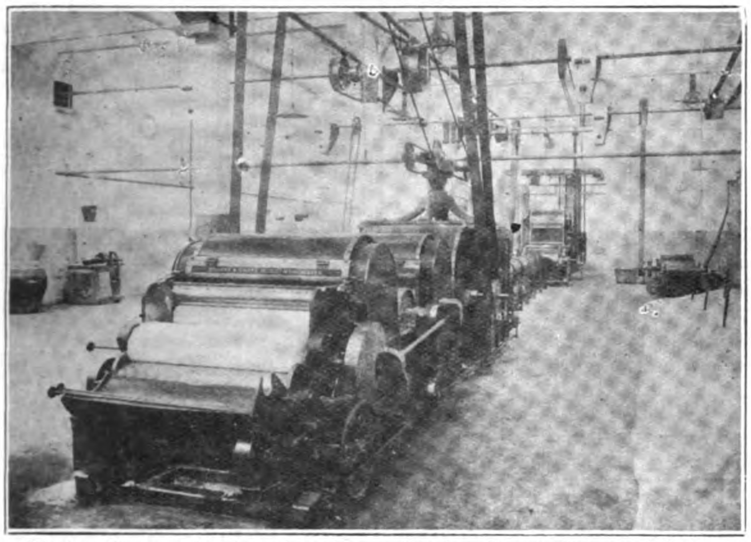
B. & W. Water Tube Boilers, 2,010 sq. ft. heating surface each, equipped with Economizer and Superheaters

"The rapid completion of this organization was entirely due to the co-operation and confidence afforded by my colleagues in this work both at Shanghai and Tsung Ming. Undeservedly, I was appointed to manage the affairs in general, to secure locations, erect buildings, order plants and register in the central government. During the course of preparation many hindrances and difficulties were confronted and overcome. The most notable obstacle was the late delivery of machinery caused

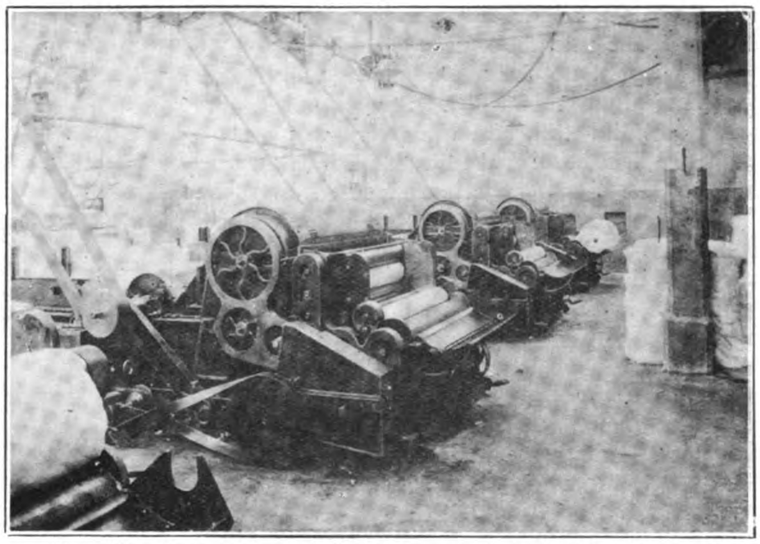


Power Plant of the Dah Tung Cotton Mill: Sulzer Brothers 400 B.H.P. Engine: 1—75 H.P. Fairbanks-Morse Crude Oil Engine and 45 K.W. G.E. Generator

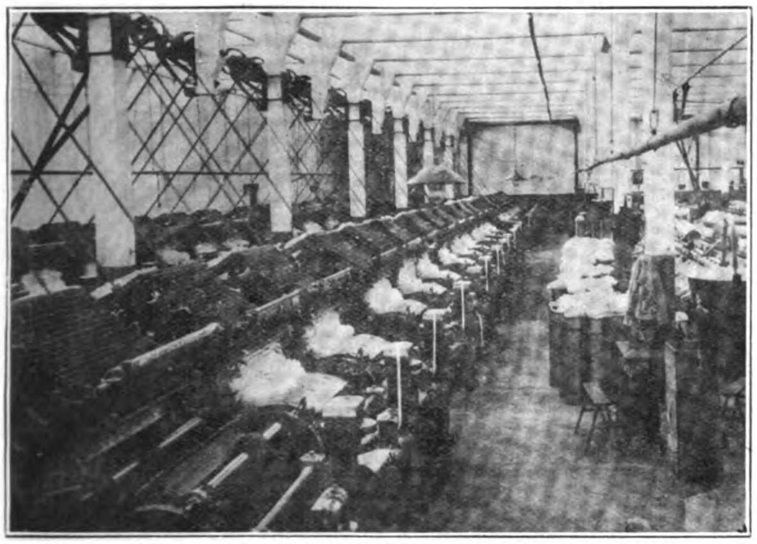
# BROOKS AND DOXEY MACHINERY IN THE DAH TUNG MILL



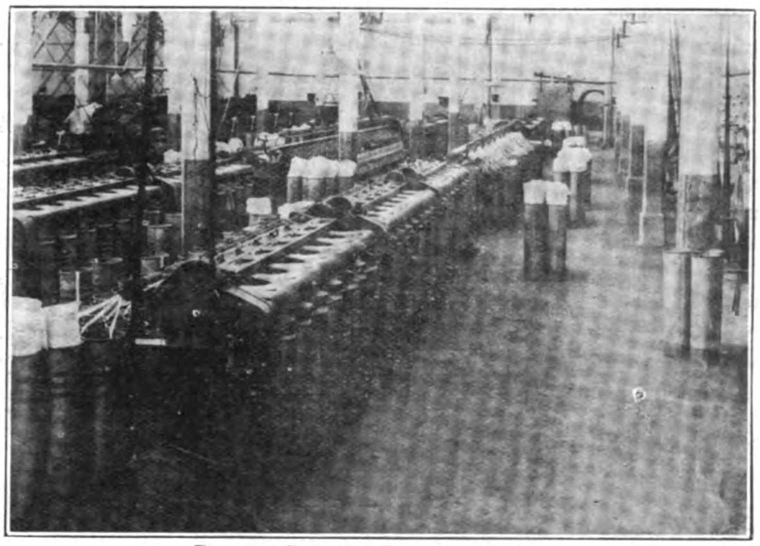
Mixing Room: Equipped with one Roving Waste Opener, Waste Picking Machine. Bale Breaker. Feed Table, Automatic Hopper Feeder and Vertical Exhaust Opener



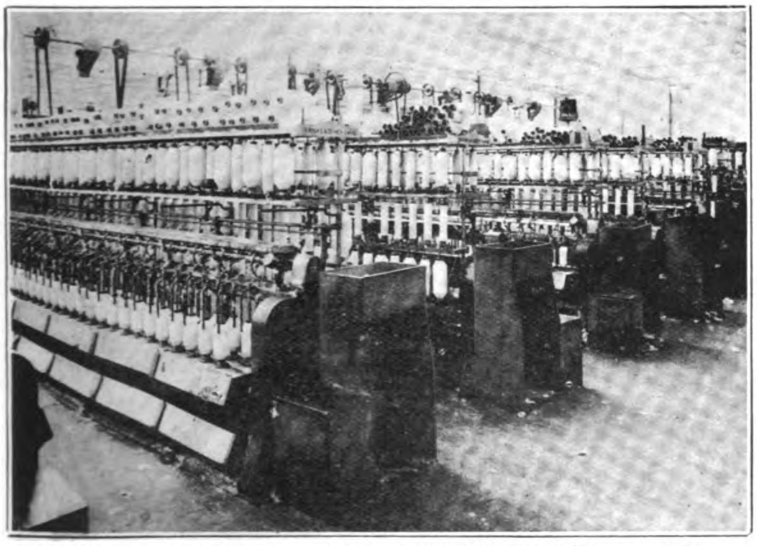
Scutching Room: Equipped with four single Beater Scutchers and Lap Machines



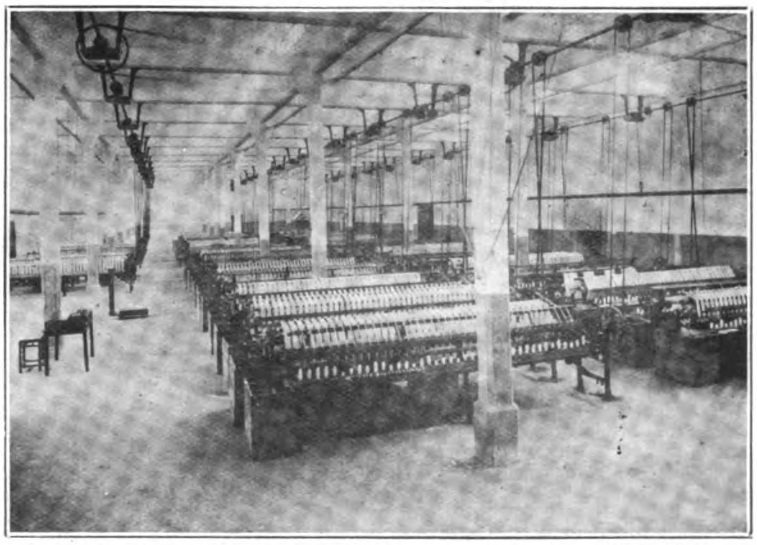
Carding Room: 42 Single Iron Revolving Flat Carding Machines



Drawing Room: 6 Drawing Machines



Slubbing and Roving Room: 6 Improved Slubbing Frames, 8 Intermediate Frames, 16 Roving Frames



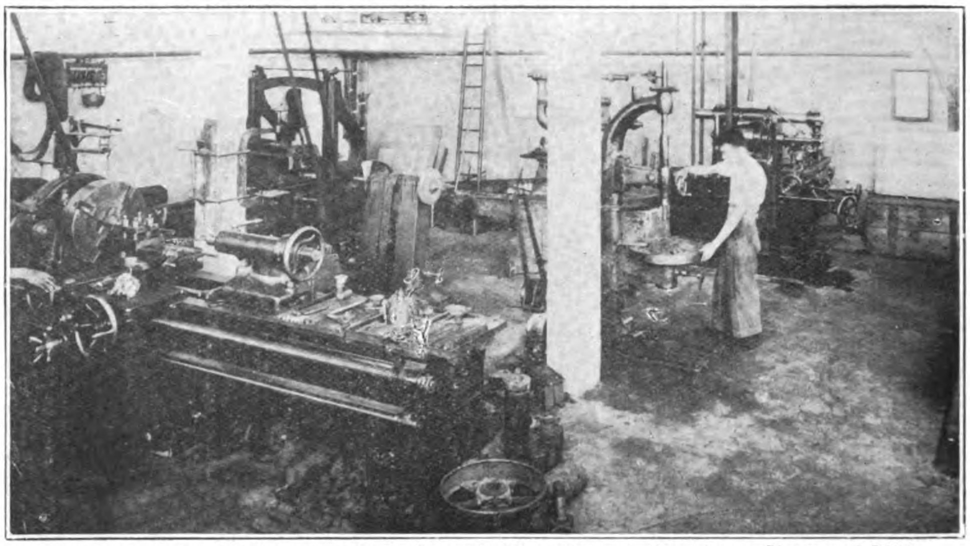
Reeling Room: 70 Reeling Machines made by the Chung Wah Industrial School

by successive, serious strikes in England. But on the other hand we had the advantage of an early settlement of exchange.

"Now the organization and establishment of this undertaking have been carried to completion, after three years of strenuous labor, and it would seem that I should be able to retire. However, upon consideration I realize that the Dah Tung Cotton Manufacturing Co., Ltd. by which title the organization itself is known, has up to the present only a spinning department. The weaving department remains to be introduced in the near future, and to this goal our best energies will be concentrated."

Mr. G. S. Aveyard, manager of the engineering department of Jardine, Matheson & Company, Ltd., carried Mr. Yao's story along in his address at the official opening by saying:

"It would not be out of place to tell you something about this mill as a foreigner sees it. It is a splendid mill, and when Mr. Yao approached my firm he placed himself entirely in the hands of the textile experts and acted on their advice. He wanted a mill that could produce good yarn, in fact, the best yarn, but he also wanted a mill that could produce yarn as cheaply as possible in order that the profit per bale of yarn would be as large as possible. I can assure you that you have now a mill that will accomplish all this, the yarn that can be produced at this mill should be equal in quality to that of other mills, in fact, in many instances it will be much better and when times are bad, as we know the profit produced should always be greater than other mills. You have a mill at a low capital cost per spindle, and when times are bad and other mills are not making money you should be able to carry on without making any losses."

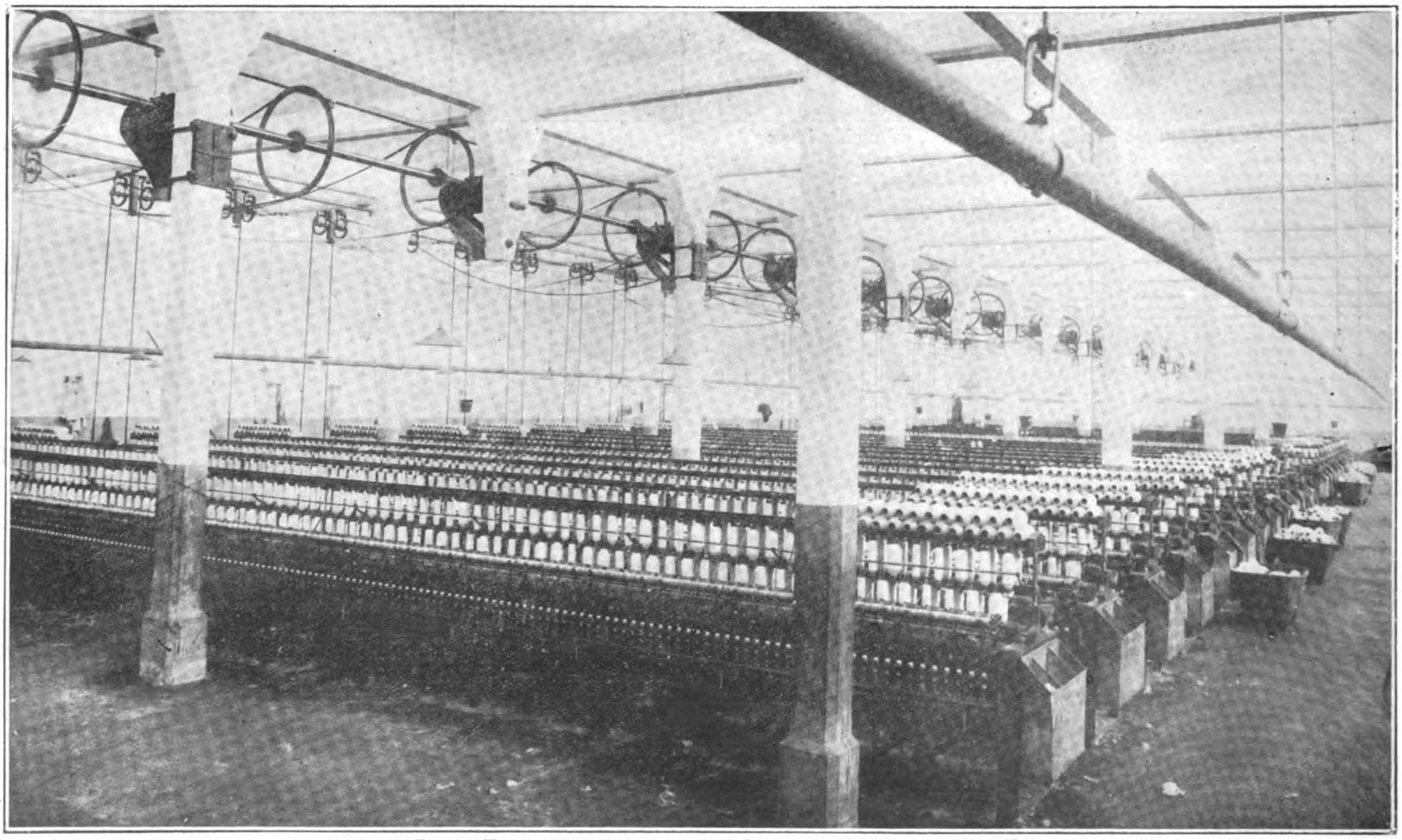


Machine Shop: Equipped with one Lang 10½" Lathe; one Parkinson Universal Milling Machine, one Archdale Cutter Grinder, and one 28-foot Lathe made in a local Chinese Machine Shop.

The main mill building is of the shed type, of the most approved modern design by a well-known Shanghai architect. Inside, the building is spacious and lofty, the machinery having been arranged with a generous regard to convenience in handling the material at the various stages, while the comfort of the work people have been carefully considered and provided for. Dormitories have been erected for the workers and staff in the mill compound, in addition to recreation buildings and grounds.

The entire plant was contracted for and imported by Jardine, Matheson & Company, who act as agents in China for the great textile machinery firm of Brooks & Doxey of Manchester, England. The whole of the mixing, scutching, carding and spinning machinery was manufactured by this firm, and represent the most up-to-date and improved types of textile machines made in England. At present, the plant is equipped with 10,000 spindles for the production of 10 to 20 counts, but provision has been made for considerable extensions. In addition, the Dah Tung Company intend to install in the near future a number of looms for the manufacture of cloth.

The power plant consists of two Babcock & Wilcox water-tube boilers, each with 2,010 square feet of heating surface, working at 160-lbs. pressure. The boilers are provided with superheaters, one Green's economizer, and two Weir's feed pumps. The main engine is a Sulzer Brothers Uniflow type of 400 B.H.P. In the engine room is also a 45 kilowatt General Electric generator driven by a 75 h.p. Fairbanks-Morse crude oil engine.



Spinning Room: Equipped with 25 Brooks & Doxey Warp Ring Spinning Frames.

In the various departments are found the following machines, all from Brooks & Doxey (1920), Limited:—

1 Bale Breaker.
1 Roving waste opener.
1 Patent thread extractor.
1 Improved automatic hopper feeder.
1 Improved porcupine feed table.
1 Improved vertical exhaust opener.
4 Single beater scutchers.
42 Revolving flat carding engines.
6 Drawing frames each three heads and seven deliveries.
6 Improved slubbing frames 80 spindles each.
8 Improved intermediate frames 126 spindles each.
16 Improved roving frames 150 spindles each.
25 Warp ring spinning frames 400 spindles each.
3 Improved yarn bundling presses.
1 High speed 16 spindle braiding machine.
1 Patent automatic flat grinding machine.

# American Textile Mills in China

## The Wing On Cotton Mill

### A Saco-Lowell Installation

ONE of the most complete modern cotton mills in China built within the past few years is the new Wing On Cotton Mill which has just been put into operation and which represents in design and equipment the latest and most approved American ideas in textile engineering. The mill contains 30,720 ring spindles and was designed to spin 10's to 20's yarn.

About two years ago the Wing On Company decided to invest part of their surplus in a textile plant. This company orginated about twenty-eight years ago in Sydney, Australia, with a department store. Since that time the Wing On Company has opened stores in Hongkong and Shanghai and hotels in Canton and Shanghai. Their Shanghai store is one of the most interesting establishments of the city, carrying a complete line of merchandise and serving its trade in a manner which compares favorably with large department stores in the United States. Seven hundred employees are directly connected with the store and taking into consideration the repair shop, which serves as an auxiliary to the store, and the Great Eastern Hotel, the Wing On Company carries on its pay-roll approximately eleven hundred employees. The success of the Company is evidenced in the fact that while the original capitalization has never been increased it has, in addition to the growth just mentioned, a surplus of more than three times the capital stock. When it was decided to enter the manufacturing field, the Wing On Company instructed their engineers to design a mill which in every detail would represent the latest and most approved ideas both in building and equipment. Of the results obtained they should be justly proud.

The main mill building is 565-ft by 120-ft. two stories, with a two story L 50-ft. by 80-ft. It is of reinforced concrete throughout with steel sash and has two monitors 40-ft. wide extending practically the length of the building, which insure light and ventilation for the top floor. Throughout the building hardwood floors are used for all working spaces. There are three elevators for conveying stock from one floor to the other and several stairways located at convenient points. The lighting is well arranged, all units being equipped with metal reflectors of approved design and all wiring for motors and lighting is concealed in steel conduit. The mill is heated from its own heating plant. The picker room is equipped with automatic sprinklers.

The godown is located about 40-ft. from the picker room end of the main mill and is also of reinforced concrete construction, two stories, 165-ft. by 95-ft. It is provided with ample platforms and runways of concrete, one platform extending to the baling room on second floor of the main mill for convenience in handling bales of yarn. The godown is well lighted and equipped with automatic sprinklers.

The office building is a very handsome structure of three stories, 100-ft. by 60-ft. of reinforced concrete, well lighted and heated and with hardwood floors. The first floor contains the main office together with numerous private offices while the upper floors are fitted up as living quarters for members of the staff.

In addition to these buildings there is a spacious machine shop, a boiler house, switch house, transformer house, and a large lunch room, all of these buildings being well designed and located. A concrete tank provides for fire protection and service requirements.

One interesting feature of the plant lies in the fact that a modern sewerage system has been provided, thus eliminating one of the most objectionable features of the average Chinese mill.

The specifications for the textile machinery all of which, with the exception of the reels, was supplied by Saco-Lowell Shops, are very complete, embodying the most recent improvements, and every detail has been well provided for.

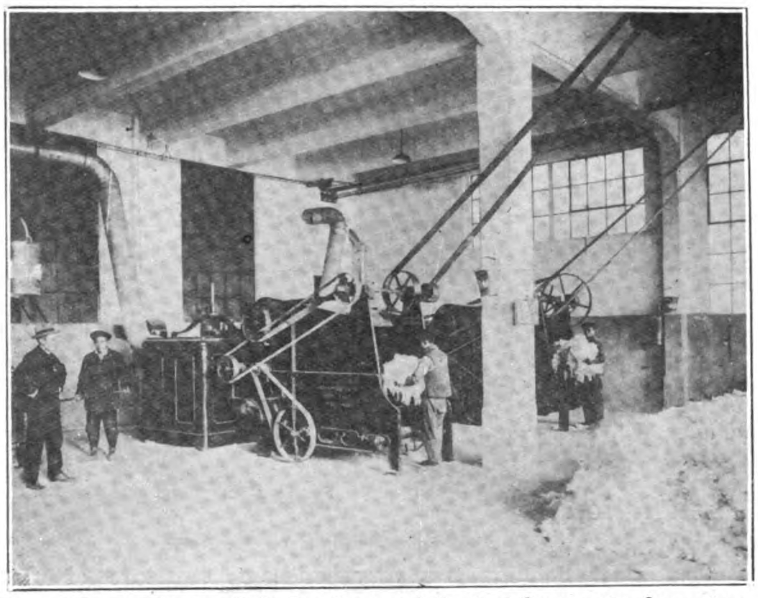
The bale of cotton is first weighed and taken from the godown across the areaway to the opener room, located in the first floor of the L of the main mill. Here it is opened by hand and mixed with cotton from a number of other bales, ample floor space being provided for this purpose. It is then delivered by hand to one of the large bale breakers connected to a vertical opener and passing through an automatic conveyor system is delivered into one of the half dozen storage bins in the picker room. In addition to the machines mentioned, a waste willow is also provided to be used when low grade or dirty stock is run.

Between opener and picker rooms, is a waste room in which is located a number of machines for handling various grades of waste. It is the intention of the mill to re-work only high grade and clean waste and all low grade waste will be sold.

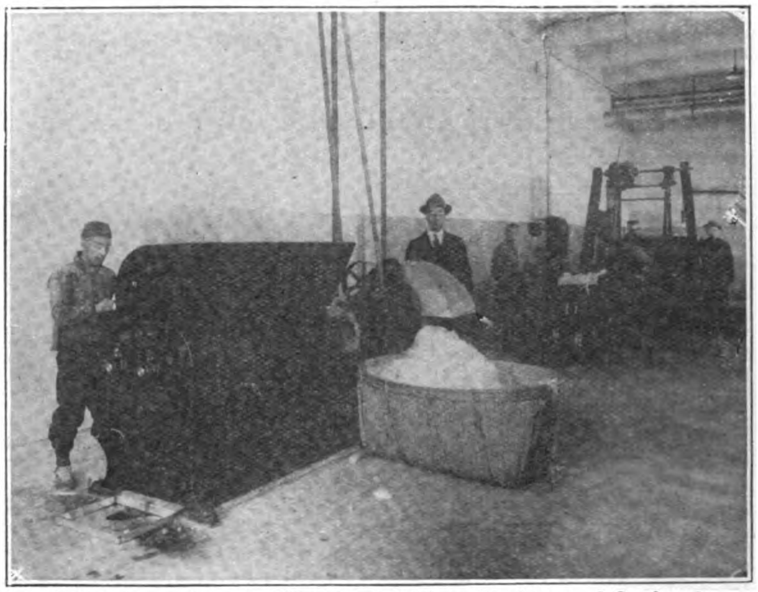
In the picker room six cotton storage bins of concrete are located next to waste room partition. The stock from the bins is fed into a breaker picker, thence to intermediate and finisher pickers. The laps from the finisher pickers are carefully inspected and weighed and if the weight variation exceeds a fixed amount, are rejected and re-worked. All of the machinery in opener, waste and picker rooms is driven from individual motors.

From the alleyway in front of finisher pickers a doorway leads direct into card room where, running full length of the room, are two rows of cards. Parallel with the cards, the drawing frames and slubbers are arranged in a row extending length of mill, and the remaining space is taken up with one complete row of intermediate and roving frames. The four rows of machinery approximate the same length and this room presents a very practicable working unit, in that the stocks moves always in a forward direction.

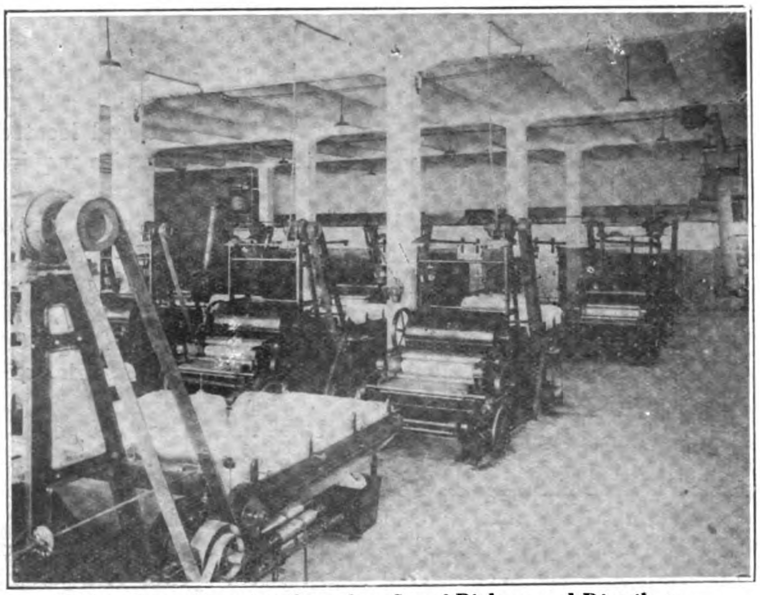
# THE WING ON COTTON MILL



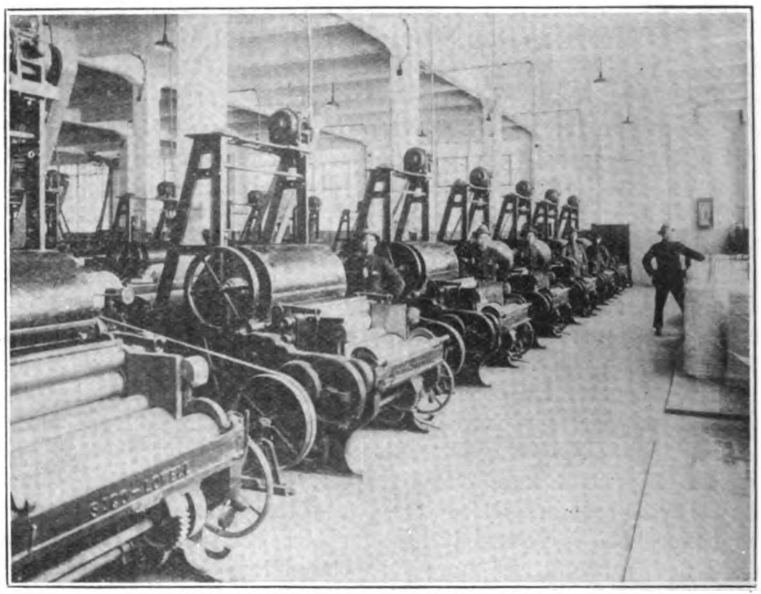
Opener Room Showing Bale Breakers and Vertical Openers in Operation



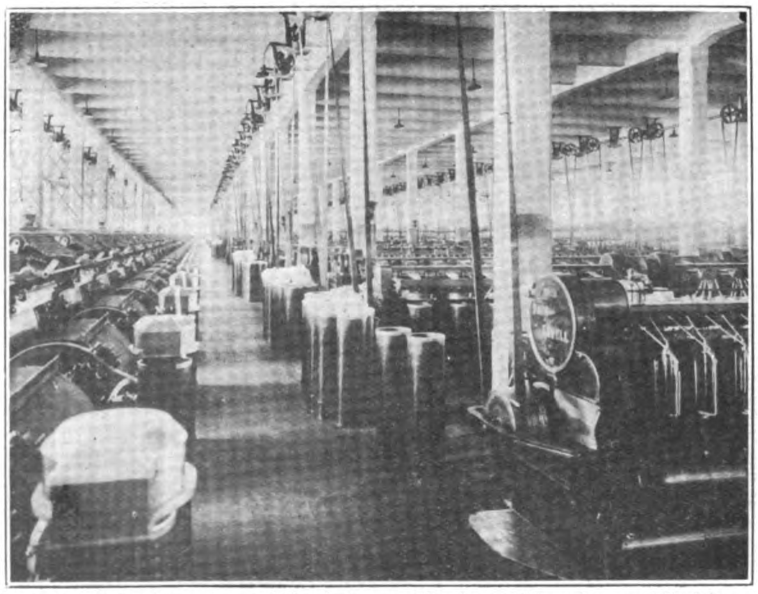
Waste Room Showing Two-Section Waste Machine and Card and Picker Waste Cleaner



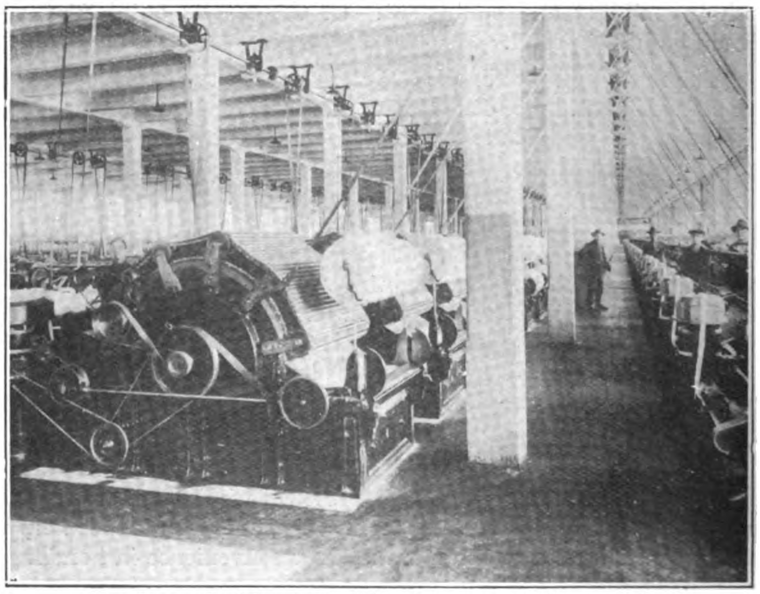
Picker Room Showing Complete Set of Pickers and Distributor System over Storage Bins



Picker Room Showing Finisher Pickers

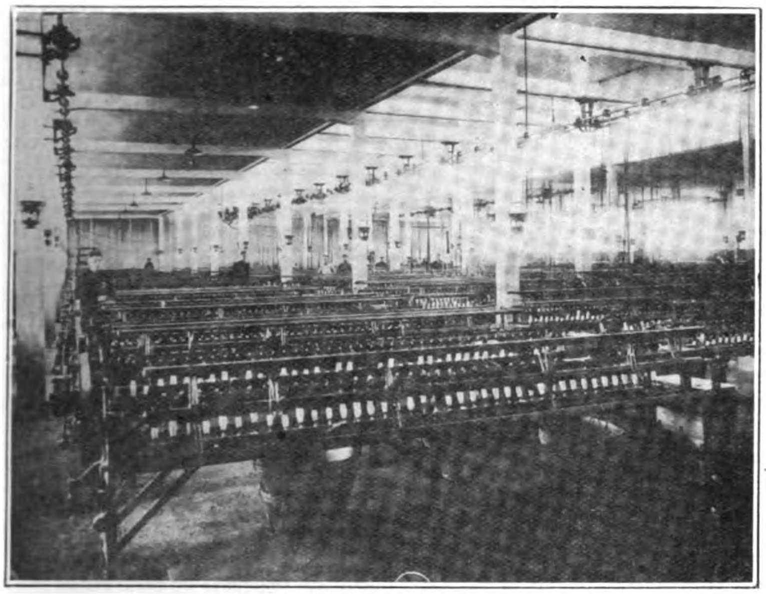


Card Room looking down Alley between Cards and Drawing and Slubbers

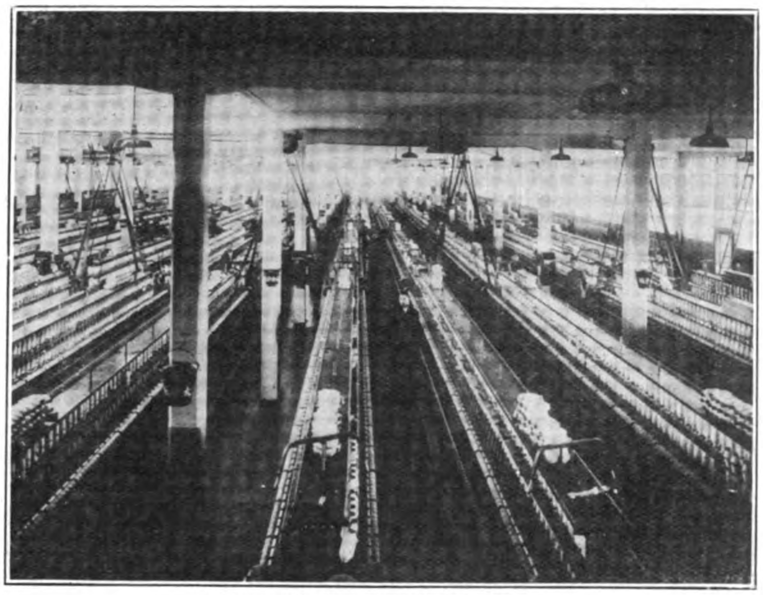


Card Room looking down Alley between two Rows of Cards

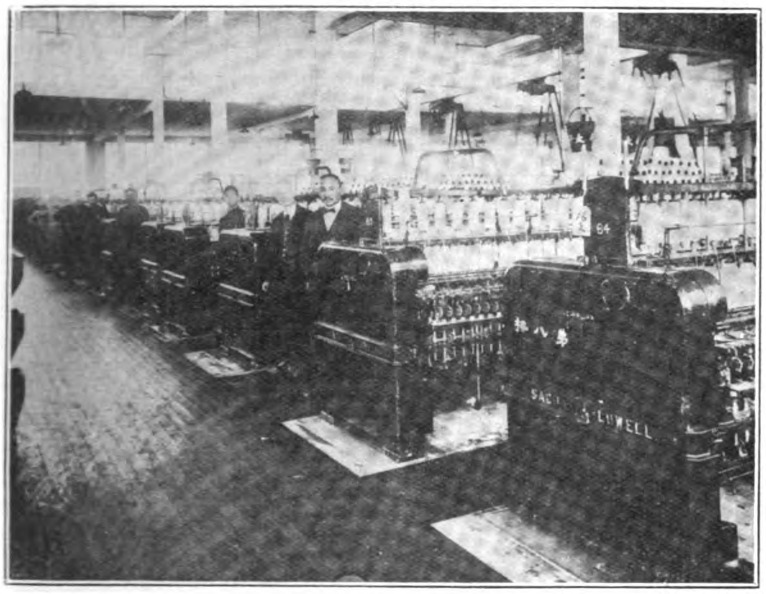
# A SACO-LOWELL INSTALLATION

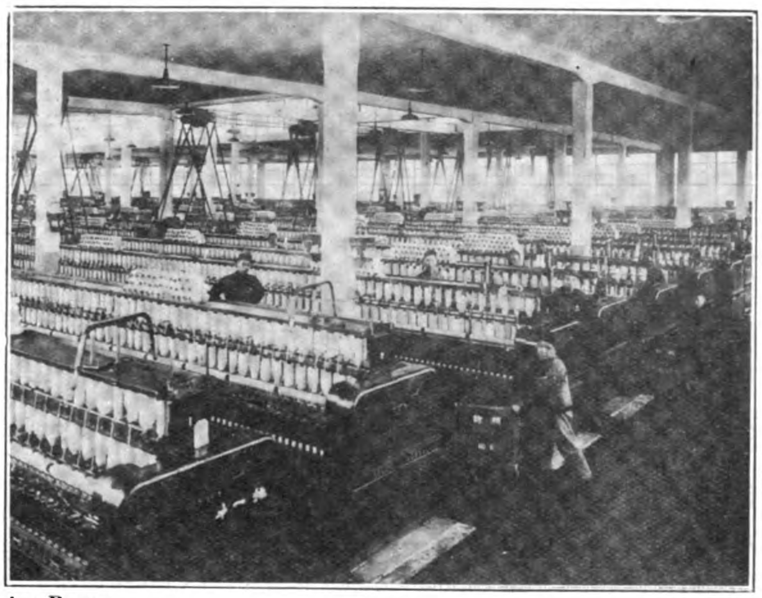


Reeling Room

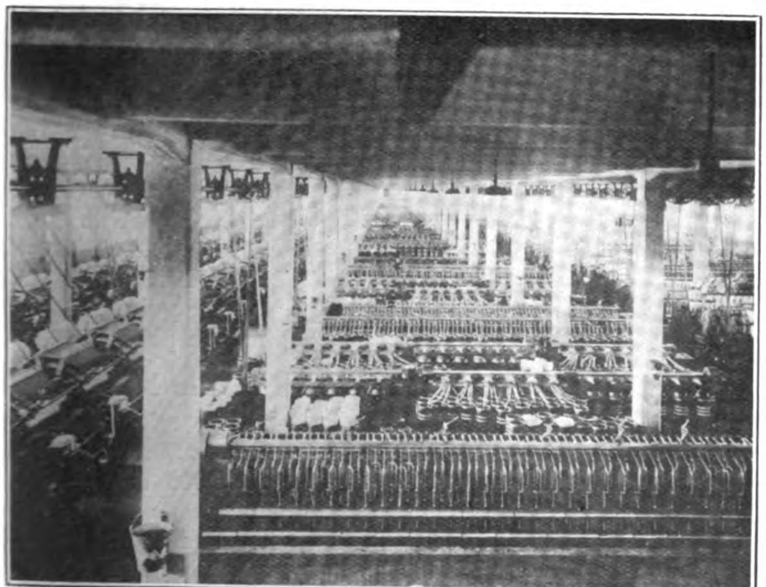


Elevated View in Spinning Room

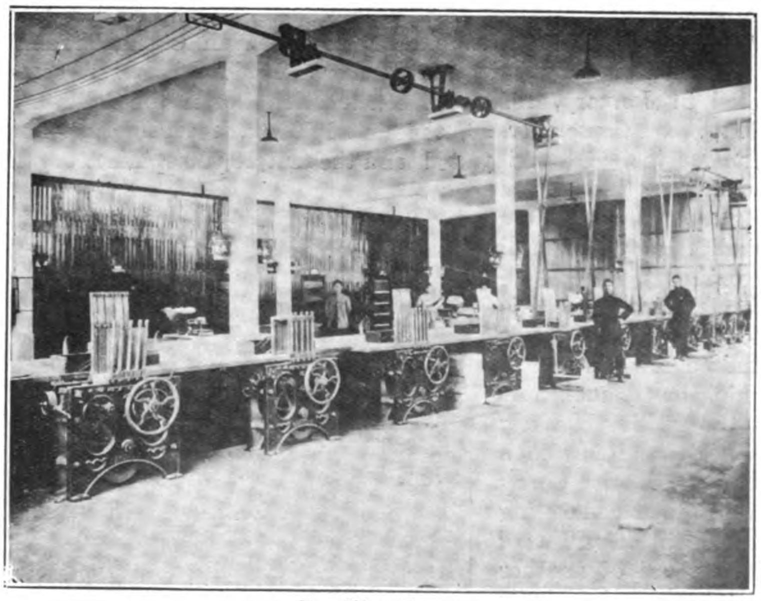




Views in Spinning Room



Elevated View in Card Room, Showing Arrangement of Drawing Frames and Slubbers



Bundling Room

The machinery in this room is driven distinct in two units. At either end of the room concrete platforms are provided for the motors, being partitioned off from the room. At each end one motor drives the two rows of cards, one motor drives drawing and slubbers, and one motor drives intermediate and roving frames, the machines from the two latter lines being driven from quarter turn belts. In each of the two sections motors, shafting and amount of machinery driven is identical. A commendable feature of this arrangement is that each motor drives direct to main line shaft and no counter shafts or belts are required. Located under the motor platforms are necessary testing rooms, overseer's room, supply room, etc. Careful attention is paid to the weighing and sizing of stock as it passes through this department.

In the spinning room there are ninety-six spinning frames, the standard 4-frame motor drive being used. These motors, as well as all others in the mill, were supplied by the International General Electric Company. The arrangement of machinery in this room allows plenty of working space and the natural lighting is excellent.

The specifications for textile machinery call for the latest improvements such as ball bearings on pickers, metallic rolls on drawing case hardened rolls on roving and on spinning frames case hardened rolls, tape drive, metallic threadboards, aluminium separators, etc.

From the spinning room, returning in direction of the godown, there are partitions across the mill which provide room for necessary testing rooms, supply room, overseer's room, etc., as well as yarn conditioning room, where the yarn is treated with proper moisture before going to the reels. The reeling room, in which are located two hundred power reels of local manufacture, occuplies two-thirds as much floor space as the spinning room. Two motors are used to drive this room and for the shafting ball bearings of S.K.F. type are used. At the end of the room a partition separates the yarn storage bins, and the bundling and baling presses, which are power driven. In the L over the opening room a well arranged supply room is located. Convenient to the baling press is the runway and platform leading to yarn storage area in godown.

All supplies and accessories are of best grade and a number of new ideas as far as Chinese mills are concerned have been introduced, such as roving boxes with rubber-tired wheels.

The heating plant is located approximately 350-ft. from the main mill. A vacuum steam heating system is used with two 5-48-10 American Radiator Company's "Ideal" boilers, but provision has been made in the boiler room for the installation of three additional boilers of the same size for future extension to the mill. The 8-in. steam supply from boiler house to mill building is carried in concrete trench. American Radiator Company's "Peerless" wall radiation is used throughout the mill. A Worthington vacuum pump handles return water of condensation and Hoffman return steam traps are used on the radiation for drips on the mains. Ample and efficient fire protection equipment has been provided throughout the entire mill.

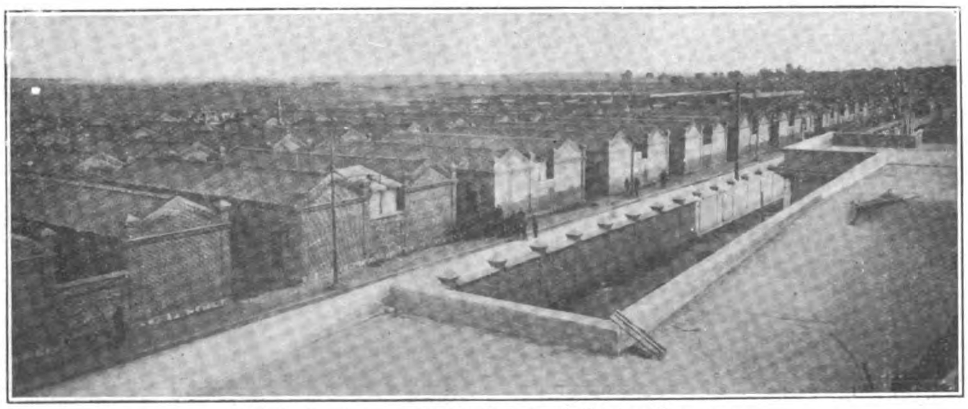
The plant was designed by Andersen, Meyer & Company, who furnished all of the textile and electrical equipment, supplies, transmission material, and heating equipment with the exception of machinery and transmission material in reeling room, which were furnished by local concerns.

# Dah Shing Cotton Mill

## An American Mill Designed, Supplied and Erected by Chinese Engineers

THE completion of a 20,000 spindle cotton mill together with a 1,000 k.w. central power station within eleven months is a record which the Dah Shing Cotton Mill at Shihkiachwang, Chihli, has recently accomplished. The company was organized in November, 1921 by Messrs. Hsu Yung-ting, president of the Hupei Government Cotton Mill, and Mr. E. F. Chang, former mill manager of the Hua Feng Cotton Mill, Woosung. The contract of supplying machinery and the complete mill equipment including designing and erection was awarded after competitive bidding to the Wah Chang Trading Corporation of Shanghai on December 5, 1921. Plans were completed in January, 1922 and construction began the following month. On September 20, the first 1,000 k.w. turbo generator unit was installed and tested and the first 10,000 spindles began to produce yarns. By November 1, the 20,000 spindles were in full operation.

Shihkiachwang is situated about two hundred miles south of Peking on the main line of the Peking-Hankow Railway, and is also a terminal of the Cheng Tai Railway connecting with Tai Yuan Fu of Shansi, and of another railway to be built which will connect with Changchow on the Tientsin-Pukow line. Thus the town is linked by the railways connecting with sources of raw materials and markets for disposing finished goods in the province of Chihli, Honan, Shansi and Shensi. Shihkiachwang is the military stragetic point in North China, but its industrial importance has not been recognized. The cotton produced in the provinces of Shansi must pass through this city before it goes to the other markets, and a large amount is also raised in the surrounding districts The local cotton was sold at thirty dollars per picul, while the same cotton was selling at twenty-six taels or thirty-six dollars per picul in the Shanghai Cotton Exchange. There is also plenty of coal from the Chingching and Lincheng coal mines situated about one hundred miles away from the city and sold at about one-third of the price at Shanghai. The carpenters and masons and spinners are receiving from 30 cents to 35 cents a day and skilled laborers, such as mechanics and firemen are paid from $1.00 to $3.00 per day.

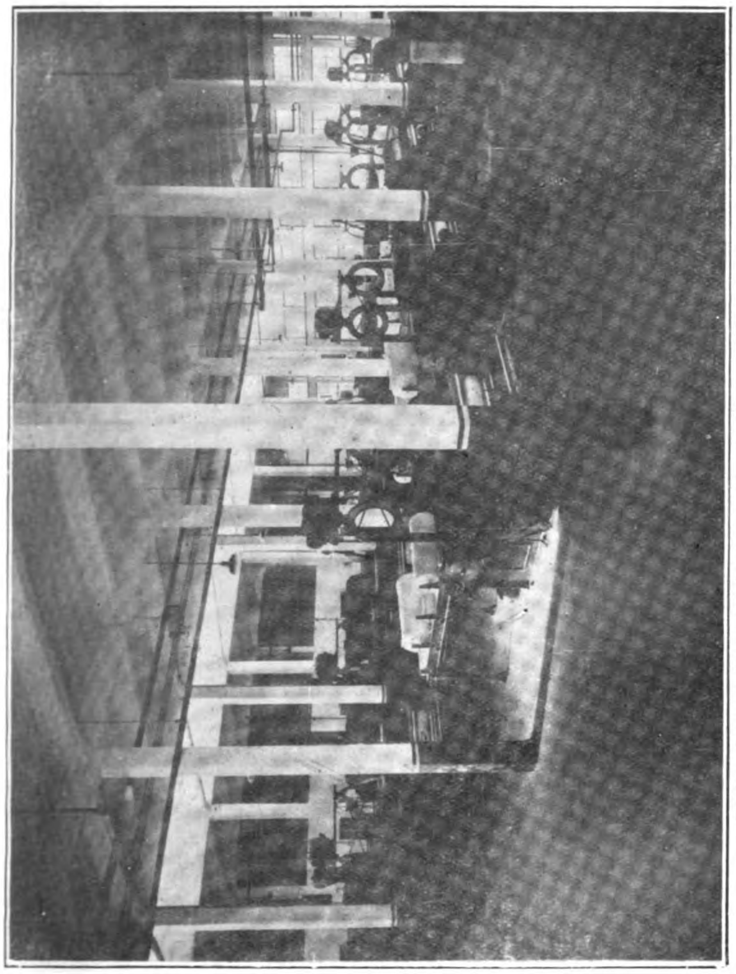


Dah Shing Cotton Mill: Laborer's Living Quarters

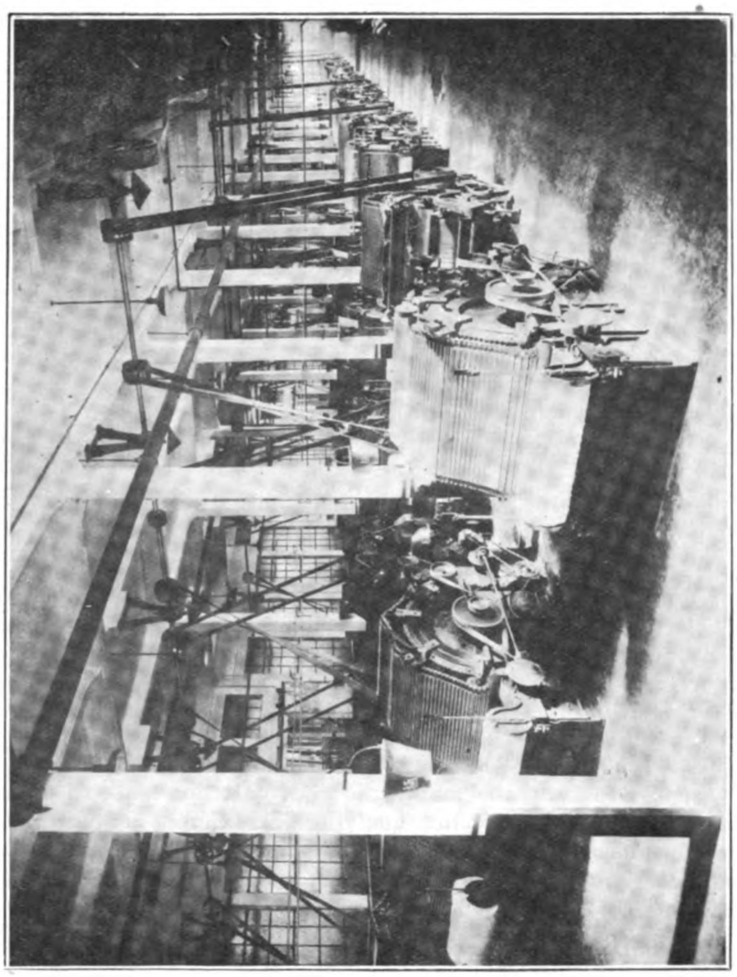
### Textile Machinery

The mill is planned for an ultimate capacity of 50,000 spindles and 1,000 looms. At present it is running with 20,000 spindles. The picking machinery, cards, drawing, slubber, inter-

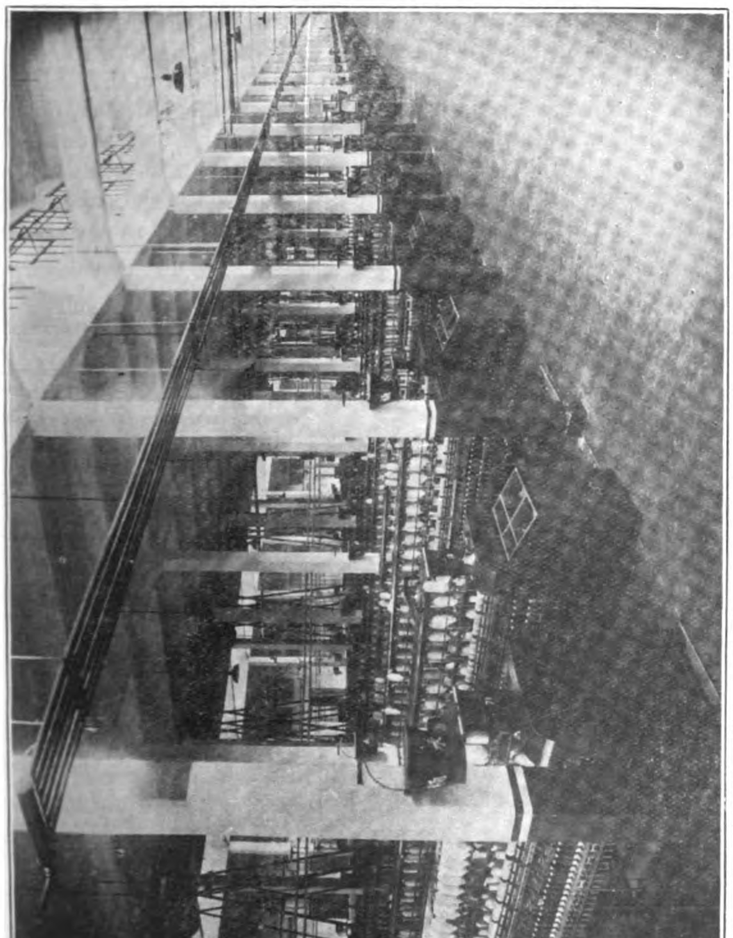
# THE DAH SHING COTTON MILL: AN AMERICAN MILL DESIGNED, SUPPLIED AND ERECTED BY CHINESE ENGINEERS



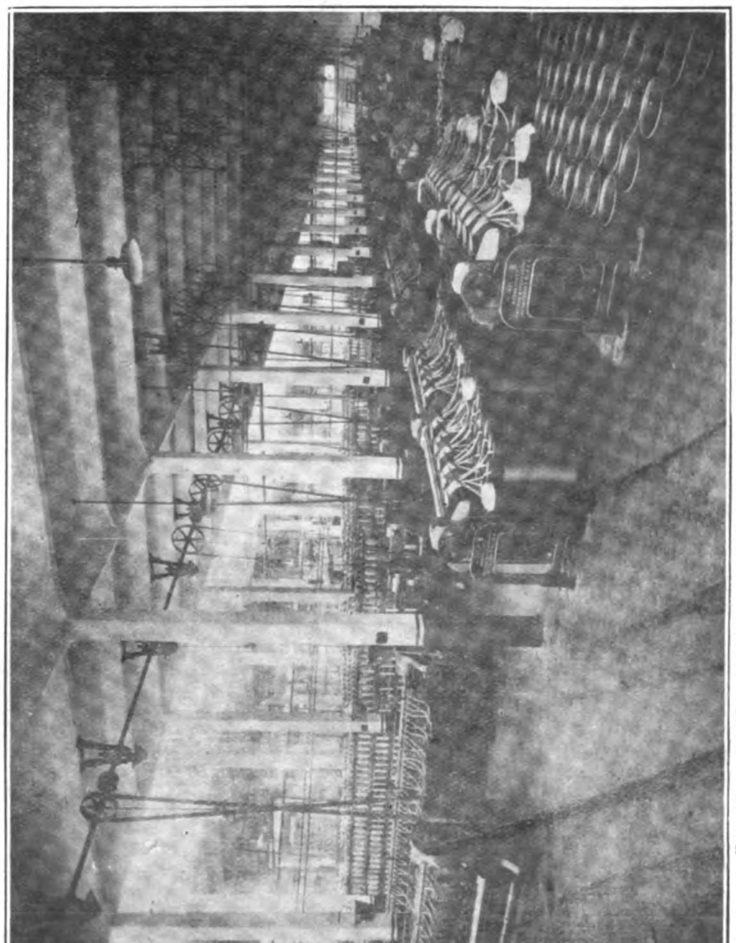
Picker Room: Woonsocket Machine and Press Company Equipment



Carding Room: 40-inch Cards from Woonsocket Machine and Press Co.

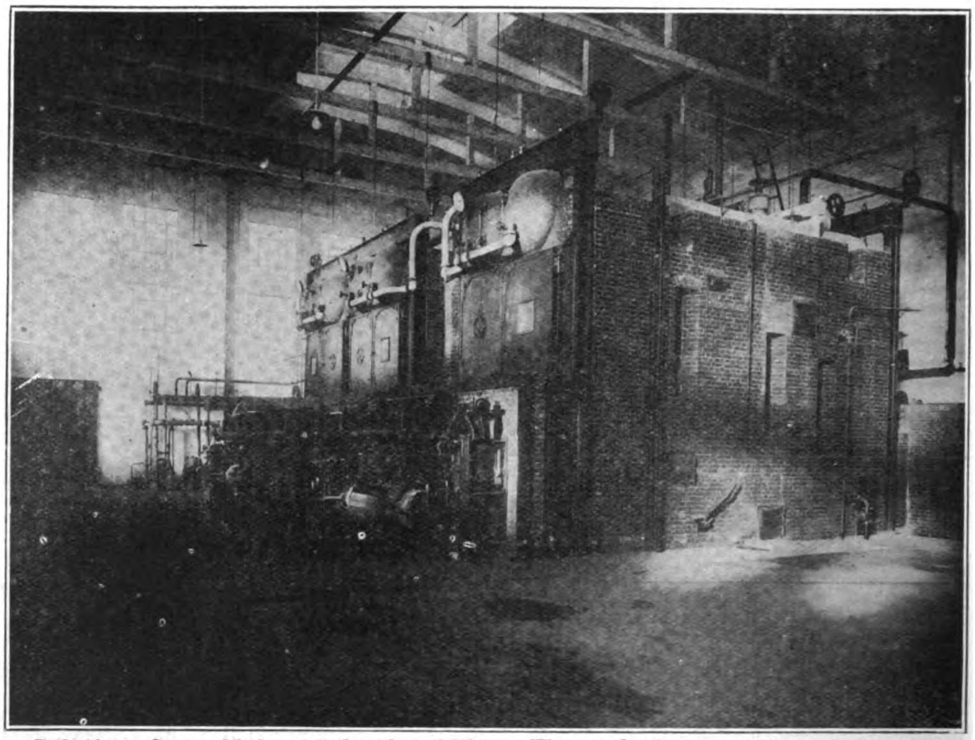


Spinning Room: Equipped with Fales and Jenks Spinning Frames



Drawing and Roving Frames: from Woonsocket Machine and Press Co.

mediates and roving frames are manufactured by the Woonsocket Machine & Press Company of Woonsocket, R.I., U.S.A., and the spinning frames by the Fales & Jenks Machine Company of Pawtucket, R.I., U.S.A., supplied by the Wah Chang Tradıng Corporation of Shanghai, the sole agents of the above manufacturers in China. The whole mill buildings are of reinforced concrete fire-proof construction, Provisions foı heating and ventilation are well taken care of.

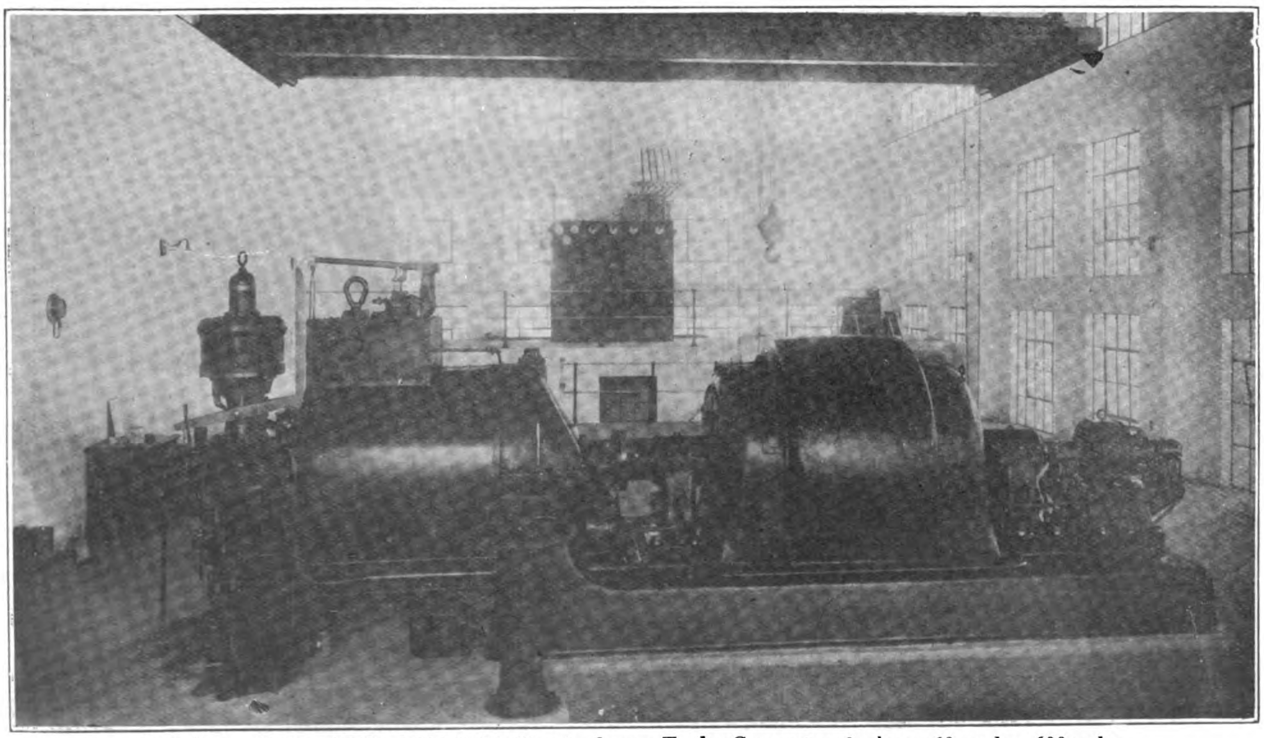


Dah Shing Cotton Mill: 3 Babcock and Wilcox Water-tube Boilers, 3,140 sq. ft. Heating Surface, equipped with Mechanical Chain Grate Stokers

The main mill is a one floor concrete building with sky lights consisting of 27 bays, 13 feet in length and 154 feet in width. The picker room (128-ft. by 104-ft.) is separated from the main mill by an alley of ten feet. Three two-beater breaker lappers having one porcupine beater and one blade beater and five finisher lappers with one beater are installed. The opening room is next to the pickeı room separated by a fire wall. The bales are opened in the opening room, and the cotton then passes through the bale opener and blown through the condenser, then to the lattice conveyer which carries the cotton to different bins. From these bins, the tenders feed the cotton to the breaker lappers, then to the finishers. The greatest care is taken of the laps as they come off the finishers, and a set of scales is used for weighing each lap in order to ensure uniformity.

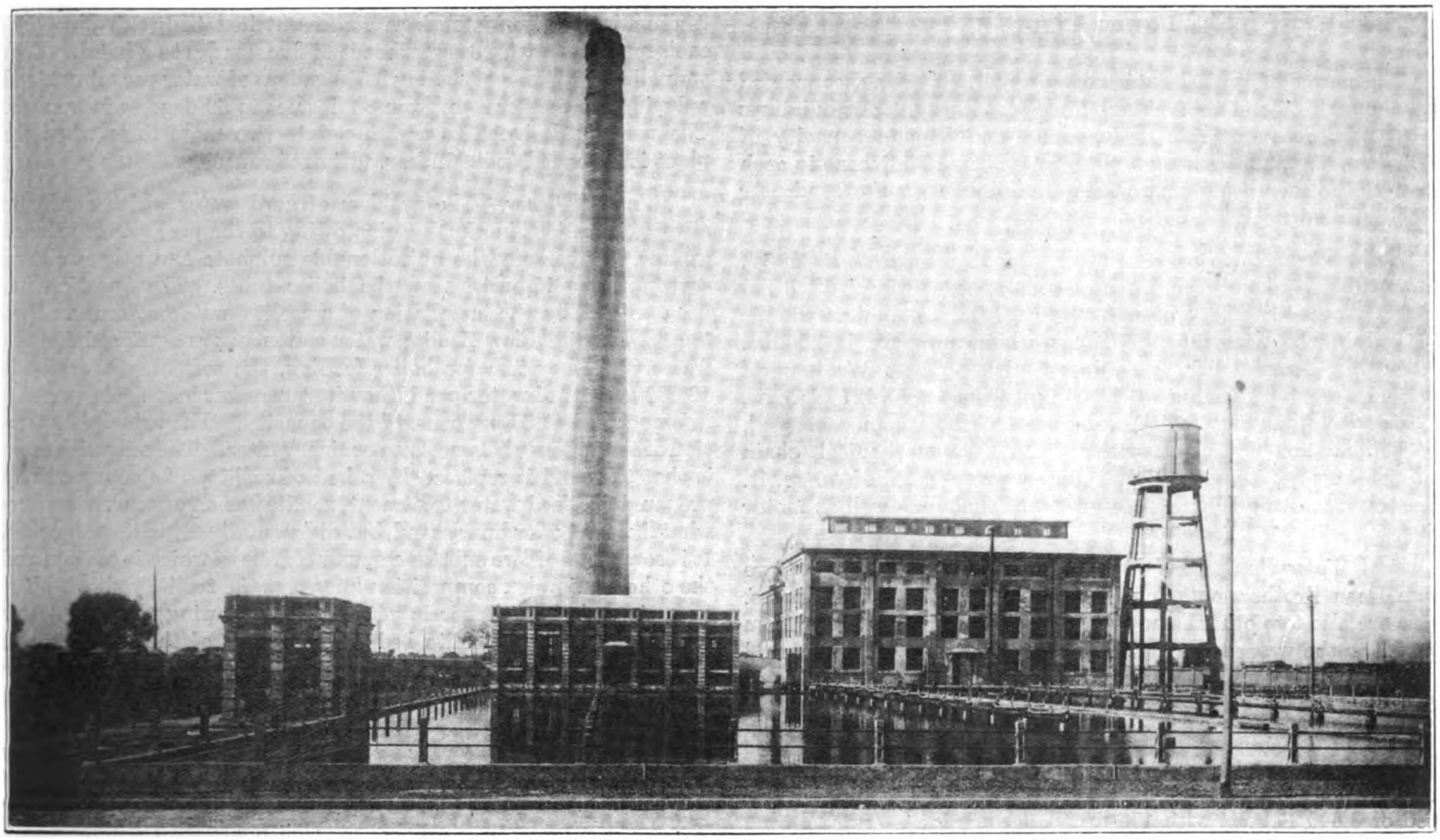
From the picker room, the cotton laps are carried to the card room, separated from the main mill by a partition wall, so that during the process of stripping, the flying waste cannot get onto the other machines. Eighty Woonsocket cards are arranged into twenty rows of four each, and spacious working alleys are allowed, so that there are ample room for repairing, stripping, grinding and transporting the laps and roving cans.

Sixteen drawing frames of two heads each, five deliveries per head are set up in two rows for two processes system. Metallic top rolls are used, as they are considered more suitable for short Chinese cotton than the leather top rolls used in other cotton mills. The twelve slubbers of eighty spindles each and twenty intermediates of one hundred and two spindles each are arranged in five thousand spindle units. The thirty-six roving frames of one hundred thirty-six spindles each and seventy-two spinning frames of two hundred eighty-eight spindles each are arranged in ten thousand spindle units. On the slubber, intermediate and roving frames, the front top rolls have ball bearings, which eliminates friction, thus less power consumed, and longeı life for the rolls. On these frames, the well-known chain drive horse head which used together with doly compound eliminates entirely the use of the angle and vertical gears and the elimination of all fast running bevel and spur gears. The spinning frames are of Fales & Jenks pattern, $2\frac{3}{4}$ inch gauge with $1\frac{3}{4}$ inch ring, equipped with self-weighted top rolls, separators, metallic thread boards, and shell front top rolls. The spindles are of tape drive regulated with tension devices, so that the spindles are enabled to run very smoothly. The production of 1.1-lbs. of sixteenth cotton yarn per day of 24 hours on the Fales & Jenks frames has been obtained by the mill within the first month of operation, in spite of inexperienced laborers.



Dah Shing Cotton Mill: 1,000 K.W. Westinghouse Turbo-Generator, 3 phase, 60 cycles, 600 volts

The cotton yarn from the spinning frames passes through the two C.G. Sargent's yarn conditioning machines before reeling. The friction of the yarn condition machines is to set twist, soften the wax on the cotton fibres and to lessen breakage of yarn on reeling. The Sargent yarn conditioning machine sprays the warm water which comes out from the steam ejectoı evenly on to the yarn, which are laid on the apron, traveling at an adjustable speed, according to the counts of the yarn to be conditioned. A steam coil arranged under the apron is used to dry the wet



DAH SHING COTTON MILL, SHIH-KIA-CHWANG, CHIHLI PROVINCE
Designed and Erected by the Wah Chang Trading Company
General View of Power Plant: Showing Foundry, Pump House, Spray Cooling Pond, Power House, Chimney and Water Tower

yarn at a temperature not over 120 degrees F. with a steam pressure of 35-lbs. This improved method of conditioning the yarn on the bobbins is thoroughly treated from outside to core, and dried before the same comes out of the machine. The yarn after conditioned is very soft in handling and has a better tensile strength.

## Humidifier System

The dry air in Northern China causes cotton fibres to radiate from the centre and produce what is called the "oozy yarn." The modern fire-proof building with the machines running at very high speed produces static electricity, which causes more waste and poorer quality of yarn. The installation of a humidifying system has the effect of killing electricity and regulating the moisture contents in the air, thus preventing waste and broken ends. The humidifiers installed in this mill are of the turbo type manufactured by the Parks & Cramer & Co. This system gives a uniform humidity throughout the mill building. The average relative humidity in the spinning room is about seventy, and that in the card room is about fifty. No humidifiers are equipped in the picker room.

## Electric Drive

Both group and individual systems of electric drive are employed in the mill. The motors are 40 degree rating squirrel cage induction type of Westinghouse manufacture. The size and capacity of the induction motors were specified exactly according to power requirements of the spinning frames in order to secure better power factor on the generator, and therefore higher efficiency, however, overloading may happen on the motors on account of changing of conditions and furthermore, the neglect of cleaning motors may be liable to cause burn out. Forty degree rating induction motor can stand a constant overload of 20 per cent.

In the picker room, the "A" frame individual drive is adopted. The breaker lapper and the roving waste opener are individually driven by one 10 h.p. motor, and the finishers by one 5 h.p. motor. The vertical opener together with the bale opener is driven by a 7½ h.p. motor mounted on the vertical opener, while the willow and the thread extractor are driven by a common 10 h.p. motor hung from the ceiling through a jack shaft. Another motor of 20 h.p. also hung from the ceiling, drives the condenser distributing lattice and exhaust fan for the dust ceiler.

The cards are driven in groups of 20 each by four 25 h.p. motors, while four other motors of the same size drive the drawing frames, slubbers and intermediates arranged in four groups, two of which consist of four drawing frames, three slubbers and four intermediates, and another two of which consist of four drawing frames, three slubbers and six intermediates. The roving frames are driven by four 20 h.p. motors in two groups of eight frames each, and another two groups of ten frames each. For the spinning frames the Westinghouse "Universal four frame" drive is adopted, that is one 25 h.p. motor drives a group of four frames of 288 spindles each. The motors have outboard pedestal with two double faced centre, flanged pulleys on one end of the shaft, and are equipped with an extra bearing. This drive combines the advantage of individual drive. In case of breakdown of a motor, only four frames are out of commission, and it has also the advantage of group drive utilizing the advantage of high efficiency of a large motor and less first cost. The Universal four frame drive motors are suspended from the ceiling, this providing larger spaces for the spinners and ensuring greater safety to the workers.

The reeling room consists of 250 reels driven by two 10 h.p. motors and one 10 h.p. motor in the packing room drives the four small bundling presses and one large baling press. The air compressor for the humidifier system is driven by a 100 h.p. slip ring induction motor. All the motors are equipped with auto-starters, provided with overload and no voltage protections

## Power Plant

The power house is located along a railway siding, connected with the main line of the Peking-Hankow Railway. The buildings are of reinforced concrete designed for an ultimate capacity of 4,000 k.w. The generating and boiler rooms are adjacent to each other, the former being a two story building, with the condenser on the ground floor.

*Boiler Room Equipment.*—There are at present 3 B. & W. water tube boilers, each having a heating surface of 3,140 sq. ft. Another battery of two 3,140 sq. ft. h.s. boilers will be installed in the near future. The working pressure is 200-lbs. per sq. in. Each boiler is equipped with a B. & W. integral type superheater, having a heating surface of 427 sq. ft., capable of imparting 120° F. superheat to the steam generated. All boilers are equipped with B. & W. mechanical chain grate stokers of Linsi type, having a grate area of 70 sq. ft. The stoker shafting is arranged for steam engine as well as motor drive.

*Feed Water Pumps and Heater.*—In the boiler room are two steam Dean Brothers outside end packed plunger type feed pumps. There are also two other same type pumps for pumping water from the well to the water tower. The feed water heater, manufactured by the Casey Hedges Co., is of open type, having a capacity of 2,200 h.p., capable of heating 75,000-lbs. of water per hour from 80° F. to 200° F.

*Turbine.*—At present there is installed a Westinghouse combination impulse and reaction type steam turbine, running at a speed of 3,600 R.P.M. with 175-lbs. boiler pressure. This turbine is designed for condensing service, and operated with superheated system of 473° F. It is equipped with necessary modern indicating gauges such as tachmeter, steam pressure, bearing oil pressure, vacuum and water pressure gauges.

*Generator.*—The generator has a rating of 1,250 k.v.a. at 600 volts, 3 phase, 60 cycles, 80 per cent. power factory, 3,600 r.p.m., direct connected to the above turbine. The excitation is applied by a direct coupled D.C. exciter of 9 k.w. at a pressure of 125 volts. The generator is of enclosed type, and air for ventilation is treated with a Spray Engineering Co.'s air washer.

*Condenser.*—Westinghouse surface condenser is installed direct under the turbine having 2,500 square feet of cooling surface. This condenser is equipped with Le Blanc unit type, the air, condensate and circulating pumps, driven on a common shaft by a 125 h.p. A.C. induction motor direct coupled through a flexible coupling. The vacuum can be maintained at 29 inches when the cooling water is 75°.

*Switchboard.*—The switchboard, also of Westinghouse make, consists of five slate panels, one generator and exciter panel, three power feeder panels and one lighting panel. Two of the power feeder panels control two triple-conductor lead covered armored underground cables of about 1,000 feet long each supplying power to motors in the mill, while the other controls motors in the power house. The lighting panel controls six 220 volts lighting feeders strung on poles, as well as six 15 k.v.a. single-phase transformers stepping down the generator voltage to 220 volts for lighting.

*Traveling Crane.*—The turbine room is equipped with a 10-ton Niles-Bement-Pond hand power crane for handling heavy pieces for inspection or overhauling.

*Water.*—Water for power house condensing, and general mill supply is drawn from artisen wells. In consequence it becomes necessary to conserve this water, which is accomplished through a spray-system. Warm water from the condenser is discharged into a concrete spray pond where, after cooling, it is drawn to an open water channel connecting the pond with the condenser suction tunnel. The warm water is discharged against pressure through spray nozzles mounted on pipe lines on concrete stands in the pond. The spray nozzle separates the water into fine mist, thus cooling it. The equipment consists of, as at present installed, two pipe lines each mounted with 13 spray heads of five nozzles to a hand. Each spray line is capable of cooling 2,600 gallons of water per minute and reducing the temperature from 85 degrees to 50 degrees fahrenheit. The pond is designed to accommodate two more lines when the plant is extended to 4,000 k.w. ultimate capacity.

*Water Softener.*—The problem of hard water which confronts all power stations in North China owing to the presence of mineral matter, particularly the objectionable sulphate and other mineral scale forming impurities on the boiler tubes. The question has been solved by the installation of a zeolite water softener. Two Sparks Upward Flow Zeolite water softeners are equipped for the water supply system for boiler feeding, the softening capacity is 48,000 gallons of water per 12 hours at zero hardness. At present, it is operated at 25 per cent. of the capacity. The principle operation of the softener is same as an ordinary filter. The only difference is that the sand is replaced by a bed of zeolite. As commercially prepared for feed water treatment, zeolite has an appearance somewhat like that of ordinary sand, but differs markedly in its properties. It is composed of two substances, namely one of which is sodium and the other a complex composition known as the zeolite radical. The operation of the softener is very simple, allowing the raw water passed through the zeolite bed from the top of the softener and which becomes completely soft or zeo hardness without the addition of any chemical to obtain the softness. After 24 hours' operation of each unit, the sodium originally in the zeolite is replaced by the calcium or magnesium from the hard water. As more and more of the sodium is replaced, the zeolite gradually becomes inactive. However, the softening property of the same could be recovered by exposing the mineral to a brine solution made with common salt, which will restore it to its original condition. With the installation of the above softening plant, no scale or sludge has been found in the boiler tubes after three months' operation. The coal consumption of the whole plant has been calculated up to date at 3-lbs. per k.w. hour.

# Activity in Cotton Mill Machinery

FOLLOWING the activity of cotton-spinning in Manchuria and China the competition in selling machinery for spinning is growing more and more severe daily. At present, the Fuji Cotton Spinning Company and a South Manchuria Railway Co. interest are planning to establish a factory with 30,000 spindles in Liaoyang, and the Toa Shoken Kaisha is to start a factory of 20,000 spindles in Mukden. These have been followed by the establishment of works by the Fukushima Cotton-spinning Company in Tiehling, and also by Mr. T. Wada and others, who are now to open a factory of about 25,000 spindles.

In Japan also, as a preparation for the imminent abolition of night work, many concerns are preparing to extend their factories. In consequence, not only British manufacturers of spinning machinery, but also American manufacturers have begun to compete with each other in sales. Under their instigation, the Mitsui Bussan, the Okura Gumi, Messrs. Takata & Company, Messrs. Suzuki Shoten, and Messrs. Hunter & Company, and other foreign firms are actively competing for the new business.

Hitherto, British machinery has been most popular in Japan, but the American-made machines are steadily capturing the market. Though the British machines are still superior to the American manufactures in spinning thicker yarn, the American machines do as well in spinning slender yarn. In future, the competition is generally expected to intensify, rather than slacken, as the demand for machines is on the increase.—*Osaka Mainichi.*

# Manufacturing in Manchuria

PRIOR to the building of the South Manchuria Railway the Chinese in Manchuria were engaged almost entirely in agricultural pursuits, or primitive manufacturing industries based on agriculture. They pressed oil from soya beans for food and light, ground flour, distilled native drinks, made coarse silk, wove baskets and produced other necessities of life as a by-product of farming.

But within a very few years, with the coming of American locomotives, steam shovels, mining machinery, electric generators—all the varied labor-saving machines of the modern industrial era—a great change has taken place in this ancient land of the Manchus. Millions of foreign capital, largely from Japan, have poured into Manchuria to be used in developing her rich stores of raw materials, and in establishing new industries for their utilization. The South Manchuria Railway since its establishment has purchased in America $75,000,000 worth of railway equipment and materials, and machinery for mining, steel-working and other industries.

The industrial development of Manchuria along modern lines is being fostered by the South Manchuria Railway through the central laboratory, the geological institute, the agricultural experiment stations, the bureau for economic research, and other similar organizations.

The growth of manufacturing in Manchuria is shown by the following reports :—

*Factories in Kwantung Leased Territory* (1918)

| | Factories | Capital (Yen) | Products (Yen) |
|---|---|---|---|
| Port Arthur | 15 | 539,500 | 341,179 |
| Dairen | 155 | 40,880,001 | 109,426,117 |
| Palantien | 7 | 155,000 | 603,544 |
| Pitzuwo | 20 | 148,000 | 823,483 |
| 1918 | 197 | 41,722,501 | 111,194,323 |
| 1917 | 216 | 36,127,661 | 58,313,003 |
| 1916 | 204 | 33,628,496 | 43,137,839 |
| 1915 | 198 | 21,784,865 | 27,697,647 |
| 1914 | 187 | 20,936,561 | 14,454,438 |
| 1913 | 202 | 20,357,630 | 23,534,072 |
| 1912 | 204 | 22,424,192 | 22,246,852 |
| 1907 | 77 | 1,924,174 | 2,681,868 |

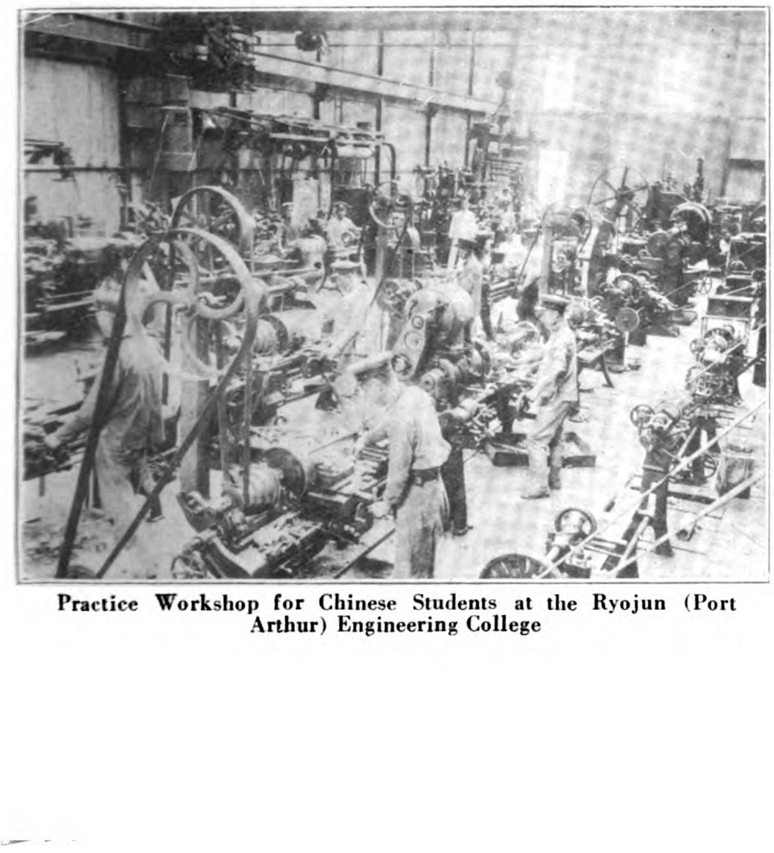
*Factories in Railway Zone* (1918)

| | Factories | Capital (Yen) | Products (Yen) |
|---|---|---|---|
| Yingkou | 1 | 55,478 | 90,000 |
| Wafangtien | 14 | 166,000 | 869,262 |
| Liaoyang | 6 | 451,712 | 1,389,510 |
| Anshan | 11 | 370,000 | 514,585 |
| Mukden | 10 | 10,676,000 | 3,420,255 |
| Penhsihu | 9 | 7,042,000 | 8,355,406 |
| Fushun | 20 | 6,913,850 | 2,143,945 |
| Tiehling | 1 | 3,000,000 | 2,338,545 |
| Kaiyuan | 15 | 900,000 | 1,961,217 |
| Changchun | 18 | 4,291,500 | 3,768,216 |
| Ssupingchieh | 5 | 155,000 | 495,630 |
| Kungchuling | 4 | 85,771 | 304,156 |
| Antung | 17 | 1,629,000 | 6,319,688 |
| 1918 | 131 | 33,736,311 | 31,970,415 |
| 1917 | 117 | 29,855,245 | 29,648,862 |
| 1916 | 92 | 16,722,531 | 11,666,113 |
| 1915 | 71 | 11,593,676 | 9,773,849 |
| 1914 | 57 | 3,600,269 | 6,344,758 |
| 1913 | 53 | 4,009,131 | 4,386,513 |
| 1912 | 41 | 2,448,265 | 3,681,381 |

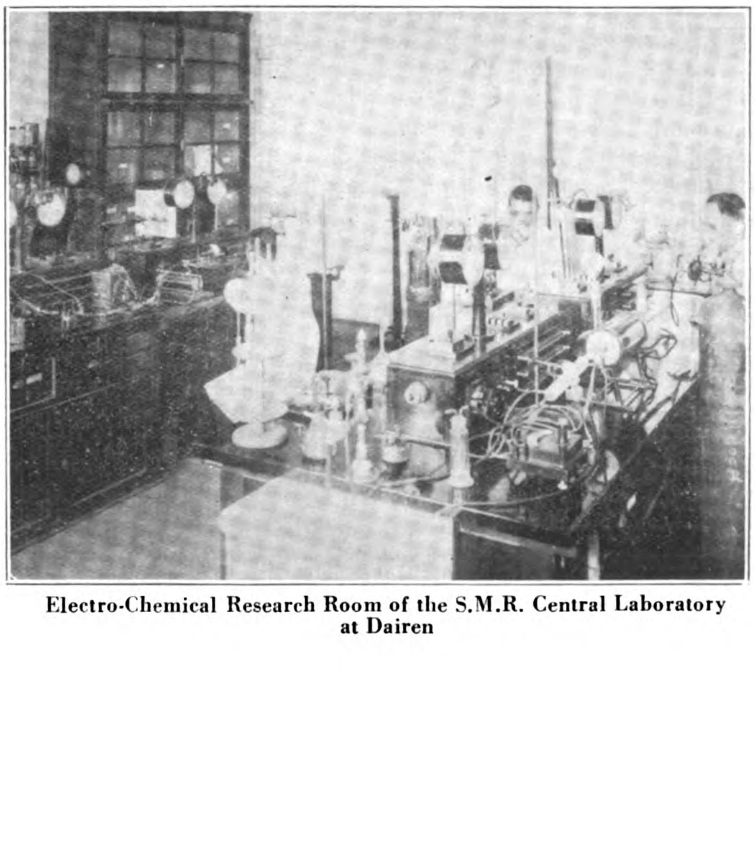
In North Manchuria and along the line of the Chinese Eastern Railway a number of factories are located. In North Manchuria the last published reports showed 18 steam flour mills, 30 breweries, 1 sugar mill and 4 steam lumber mills. Along the Chinese Eastern Railway the last reports showed 13 bean mills, 15 breweries, 13 workshops, 3 tobacco factories, 1 sugar and 12 other factories.

*Bean Oil and Bean Cake*—Bean milling ranks formost in Manchurian manufacturing industry. Since ancient times the Chinese have used the oil of the soya bean as food and a source of light, but only within the past few years, since the South Manchuria Railway inaugurated its campaign of industrial development, has the soya bean and its varied products become of importance in world trade.

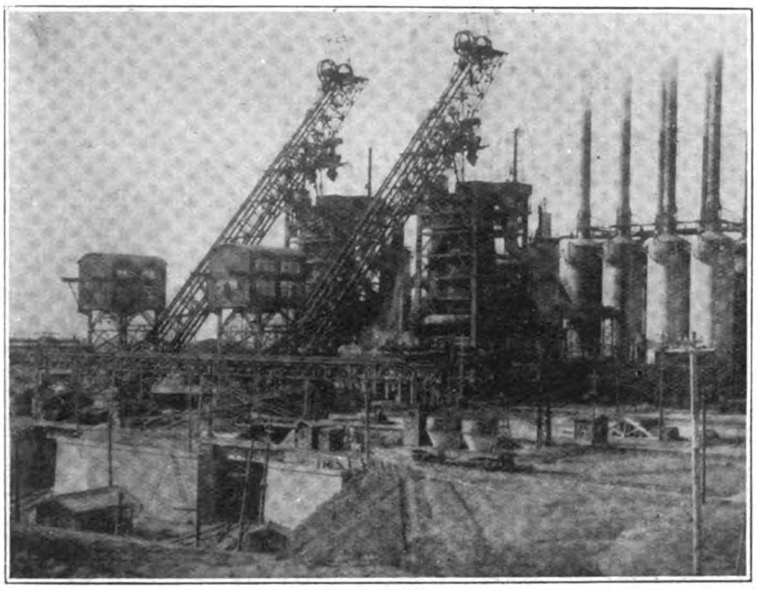
Native *yufang*, or oil mills, are found everywhere in Manchuria, and in these the cake is ground by mules or donkeys and the oil is expressed by hand labor. The residue is bean cake. The Japanese introduced power presses, driven by steam, electric, gas and water power, and most of the modern mills are of this type.



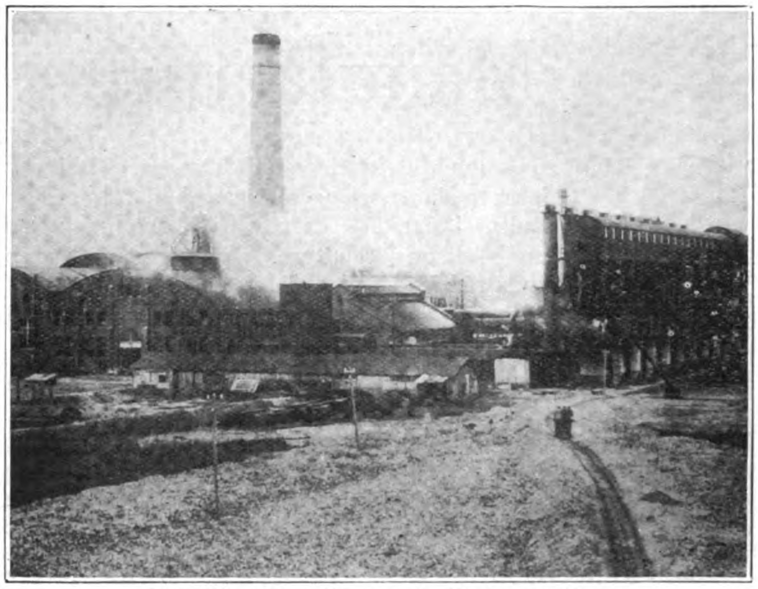
**Practice Workshop for Chinese Students at the Ryojun (Port Arthur) Engineering College**



**Electro-Chemical Research Room of the S.M.R. Central Laboratory at Dairen**



Anzan Iron and Steel Works



Mond Gas Power Plant at the Fushun Colliery

A much more efficient method has lately been developed through the research department of the South Manchuria Railway. This is the chemical extraction method. The beans are soaked in benzine until the oil is dissolved. Then, by heating the compound, the oil is separated from the benzine. By this method nearly all the oil in the beans is extracted, and not only is there no waste of oil, but the residue, in this case not in the form of cake but in bulk, is better fitted for fertilizer. By the expression system, 133 pounds of beans give about 12½ pounds of bean oil and two pieces of bean cake each weighing 61 pounds. By. the chemical extraction system the same amount of beans usually gives 17½ pounds of bean oil and 106 pounds of bean meal. The new method is at present employed by only one company, Suzuki & Company, in Dairen, which firm operates the largest bean-mill in Manchuria. Yingkou was formerly the centre of bean milling in South Manchuria, but Dairen is now far in the lead, with more than sixty mills producing 390 tons of oil and 3,700 tons of bean cake a day.

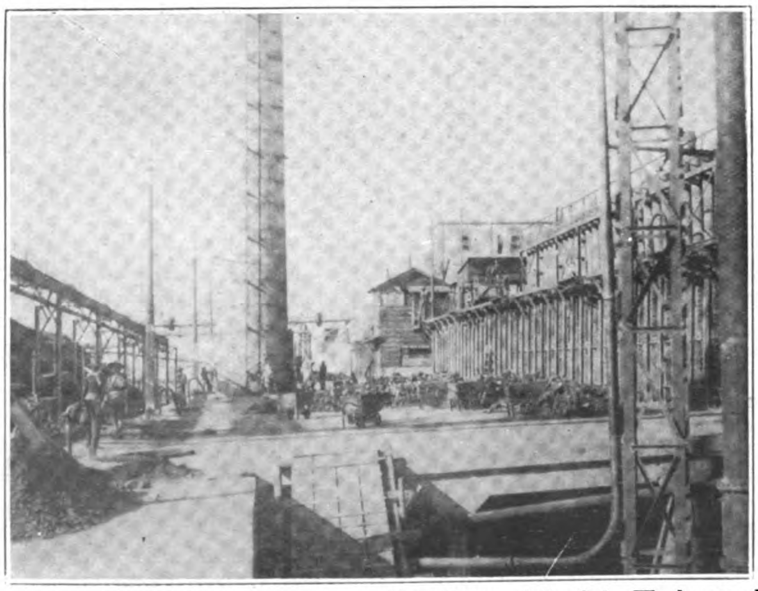
The Chinese have used bean cake largely as cattle feed and very little as fertilizer. But recently the cake has found a growing market in Japan and China as a fertilizer as well as cattle feed.

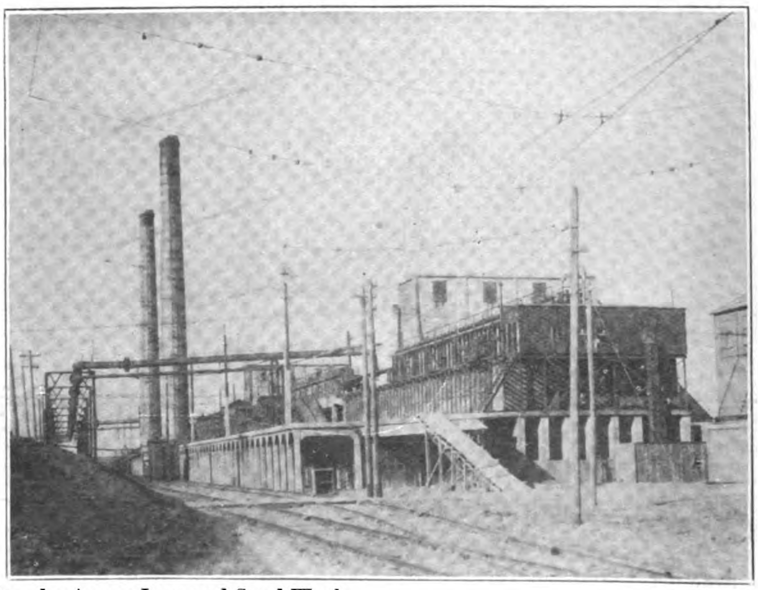
To facilitate the shipment and marketing of soya beans the South Manchuria Railway has organized a "mixed storage system." Beans are classified at receiving points, and receipts, negotiable at the bank, are issued, which call for the delivery of like quantities and qualities at terminal points.

*Flour Milling.*—There are two kinds of flour-mills in Manchuria called respectively *mofang* and *huomo*, which literally mean "grinding house" and "fire mill." The former is the native mill which, employing two to ten coolies and four to twelve donkeys, conducts the work on a small scale. This kind of mill is found everywhere in Manchuria, and constitutes the local manufacturer only next in importance to distilling and oil-milling. However, mills of this kind are mostly conducted as a by-work by grain merchants, distilleries and oil mills. The "fire mill" is the mill provided with modern machinery to which steam or electricity is applied as the motive power.

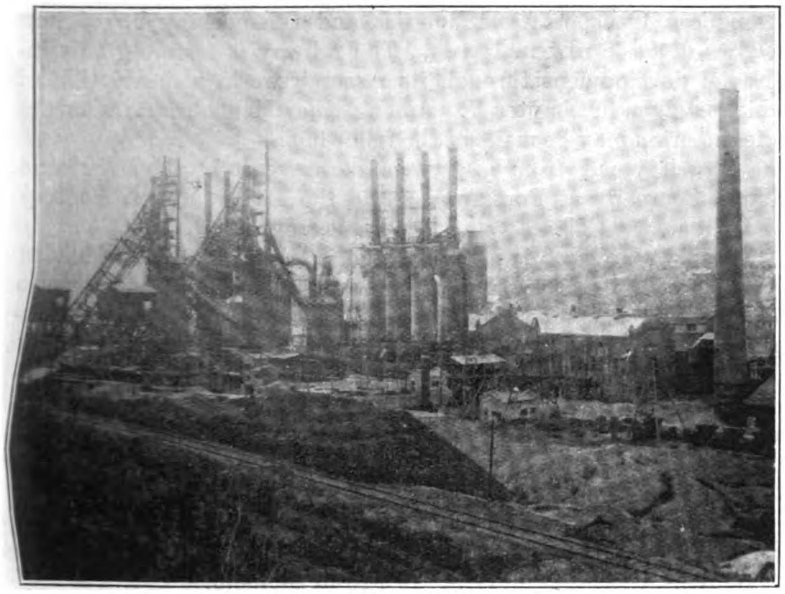
Flour mills planned on an extensive modern scale in South Manchuria have come into existence under Japanese management since the close of the Russo-Japanese war. The Manchuria Flour Mill at Tiehling was the first of the kind to be founded. Since then other mills have been established at Mukden, Changchun, Kaiyuan, Kirin and Dairen.

A recent Japanese consular report shows that there are 45 flour mills in Manchuria with an annual capacity of 19,000,000 bags and a market value of $30,000,000. The Japanese mills have a daily capacity of 25,000 bags. The largest company is the Manchurian Flour Mill Company, with a daily output of 17,500 bags in its mills at Harbin, Changchun, Tiehling and Mukden. The Chinese-Japanese Flour Mills at Dairen and Changchun have an output of 5,600 bags and the Asia Flour Mills at Kaiyuan produce 2,000 bags a day. There are 36 Russian and Chinese mills with a daily output of 38,400 bags. During 1919, 1920 and 1921

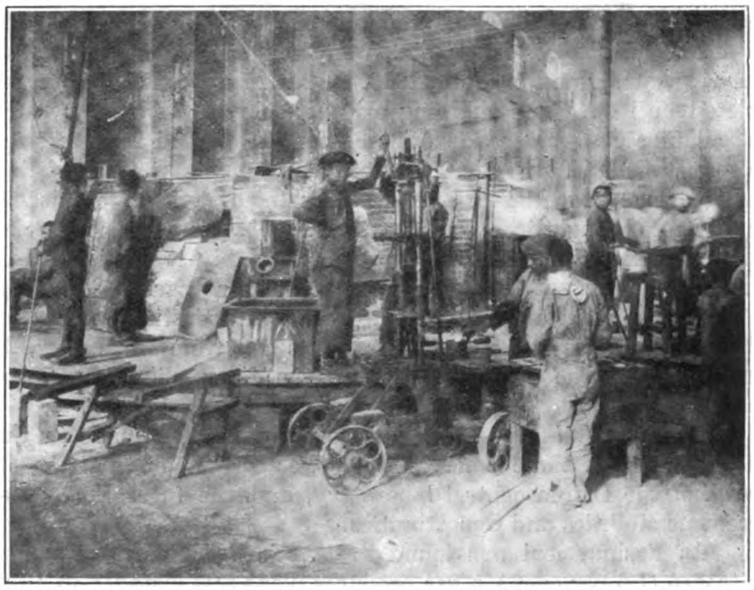




Two Views of the Coke Works attached to the Anzan Iron and Steel Works



Penchihu Colliery and Iron Works



Ceramic Experimental Institute operated by the S.M.R. at Dairen

more than 500,000 tons of Manchurian wheat was exported to Europe, but this was an unusual movement due to special trade conditions. Normally Manchuria has an import balance of flour.

*Beet Sugar.*—One of the newest industries in Manchuria is the manufacture of beet sugar. An experimental farm was established outside Mukden in 1906, and it was shown that sugar beets could be successfully raised in Manchuria, but the industry was not established until the South Manchuria Railway had conducted successful experiments in 1913-1914. The formation of the South Manchuria Sugar Refining Company at Mukden in 1916 by Japanese capitalists followed. The Russians had previously built a factory near Harbin, and a Chinese factory had been established at Hulan, also in North Manchuria. The Mukden refinery was opened with a capital of 10,000,000 yen, and has been a great success. Beets are cultivated over an area of 6,000 acres, supplying the refinery during the winter months. Crude sugar is imported for refining during the remainder of the year.

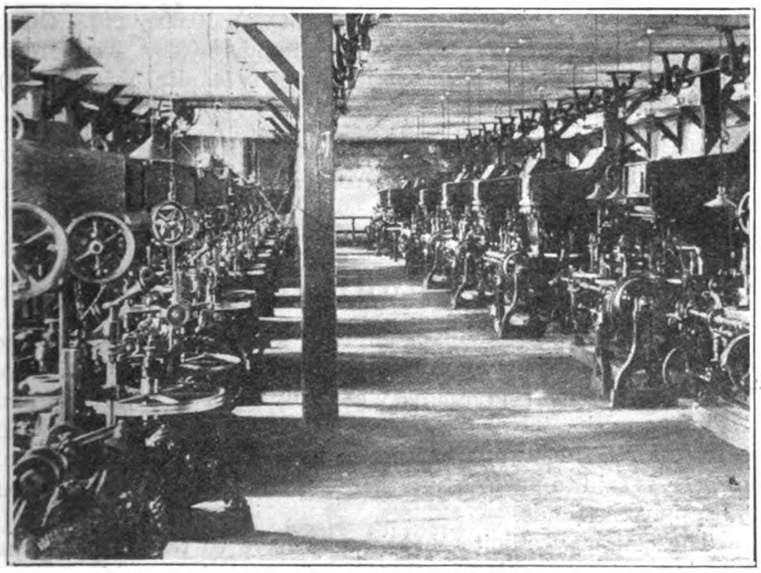
*Distilling.*—The distilling of beverages for domestic consumption has always ranked as an important native industry in Manchuria. The liquors used by the Chinese are chiefly *shumshu* (sorghum alcohol), distilled from *kaoliang* and *huangchiu*, made from millet. The distilling of *kaoliang* spirit is native to Manchuria. The grain is mashed and steamed, and there is added to the mash barley-malt or bean-malt, and a small quantity of wheat or corn. The cask is buried in the ground for some days and let ferment, after which the contents are distilled. The product is similar to whisky. Mukden and Liaoyang are the centres of the distilling industry, the output of which is about 13,000,000 yen a year.

*Brewing.*—From barley and hops raised in Manchuria, beer is now being made by the Manchuria Beer Brewery Company. The fermenting of *saké* has also been undertaken at various places.

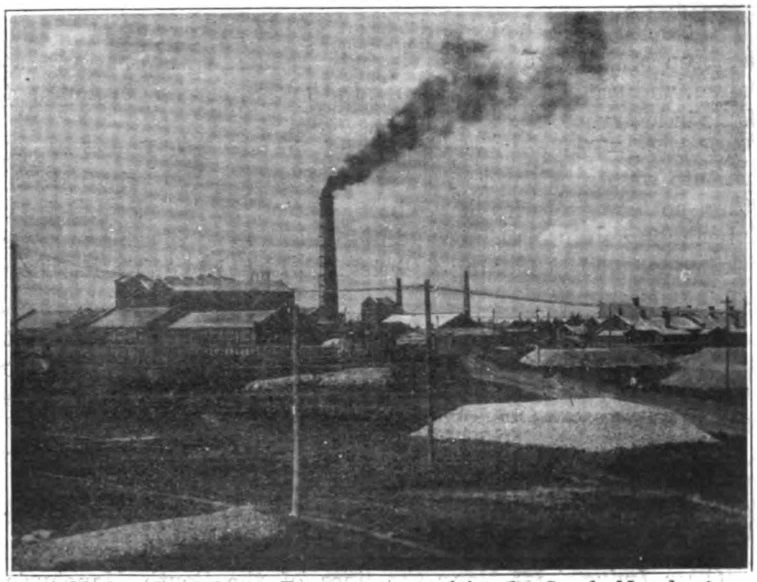
*Wild Silk.*—The greater part of the wild-silk cocoons produced in Manchuria have been exported, and Chefoo in Shantung, a centre of the silk industry, has reeled much of the Manchurian silk. Small wild-silk filatures are operated by many Chinese farmers in Manchuria who use very primitive methods. The *tussah* silk produced by the natives has not been of good quality, and the Dairen central laboratory for some time has been devoting much attention to improving the manufacturing methods. As a result, the industry has been developing, especially in Antung. Silk spinning should eventually be one of the largest Manchurian industries.

*Iron and Steel.*—One of the most ambitious undertakings of the South Manchuria Railway has been the building of the great steel works at Anshan, to utilize the ore of the Anshan iron mines. Since 1917, when the work was inaugurated, the development of this plan has gone steadily forward. Millions of dollars worth of modern equipment and machinery was imported from the United States, and the installation has been made under the most approved American engineering practices.

Blast furnace No. 1 with a capacity of 200 tons a day, a charging elevator, four hot stoves, two blowing engines, four boilers, two



Interior of Asiatic Tobacco Company Factory at Yinkou



A Modern Beet Sugar Factory operated by the South Manchuria Beet Sugar Company at Mukden

generators of 3,000 kilowatts each, and settling and cooling ponds, a filter bed, a water tower, etc., were completed in 1918, and the furnace was lighted in April, 1919. Blast furnace No. 2 was completed in 1920. The charging elevator, electric tramway, water circulating system, ore depôt, etc., for the second furnace were also installed. Two batteries of coke ovens (one battery consisting of 40 ovens), together with the coal washing system, were finished, and where brought into service early in 1920. Two more batteries were added in the following year. Ultimately it is planned to increase the output to a million tons of iron a year.

At Penhsihu another steel works is in operation, producing 200 tons of pig iron a day. It draws its ores from Miaoerkow, 24 miles away. The capital (14,000,000 yen) is supplied by Chinese and Japanese.

*Chemical Industry.*—Notable progress has been made in the development of the chemical industry, as a result of the research work of the Dairen central laboratory, and the future holds out great possibiLties and opportunities.

As Fushun coal was found to contain a high percentage of nitrogen (1.6 per cent.), a gas producer plant was installed in 1914 to recover the ammonia. A second was put up in 1917 and a third is now in course of construction. The daily output is thirty tons of ammonium sulphate and thirty tons of coal tar. Sulphuric acid, calcium carbide, calcium cyanide and other chemicals are being produced. Two sets of sulphuric acid plants, with a daily capacity of fifty tons, have been installed.

The beehive coke ovens at Fushun are producing sixty tons of coke a day. An installation of thirty sets of by-product recovery coke ovens is being planned.

At Dairen there are the Electro-Metallurgical Company, the Manchuria Barium Industry Company, the Sohte Manufacturing Company, the China Electric Industry Company, the East Asia Electric Industry Company, the South Manchuria Electricity Company and the Manchuria Paint Company. At Fushun is the Electro-Chemical Company, at Mukden the Mukden Chemical Company, and at Antung the Manchuria Blasting Powder Factory.

*Cement.*—The ever-increasing demand for cement in Manchuria, North China and Eastern Siberia on the one hand, and the abundant presence of the material necessary for its manufacture, limestone and clay, on the other, induced the Onoda Cement Company of Japan to establish a branch factory in the small town of Choushuitzu, a suburb of Dairen, as early as 1907. The output is 250,000 barrels a year. The factory is ideally situated, the limestone being obtained from the hills right behind it and the clay in the field just in front, and a line of railway has been built to connect the factory with the railroad. The factory output consists of cement, paving bricks and building bricks. At Choushuitzu is also located the Dolomite Cement Company, and there is another cement plant at Mukden.

*Glassware.*—With plenty of silicious rock at hand, glass-making has been stimulated by the Ceramic Experimental Institute at Dairen, and progress is being made in the commercial development of the industry.

*Pottery.*—The pottery division of the Ceramic Experimental Institute was transferred to the China Ceramic Company in 1920. Other pottery factories have been started in Mukden, Dairen, Kungchuling and Choushuitzu, and in addition there are a number of kilns engaged in making firebrick. Wulakai in Kirin has long been a pottery centre.

*Lumber.*—Many sawmills are now in operation at Antung, at the mouth of the Yalu, and at Kirin on the Sungari river. The lumber industry on the Yalu river has been developed by the Yalu Lumber Company, a Chinese-Japanese organization established in 1908 with a capital of Y.3,000,000. This same company also organized the Yalu Sawmill Company, with a capital of Y.500,000. At Kirin are located the Mitsui Company's mill, the Kirin Timber Company and a branch of the Yalu Sawmill Company.

*Other Industries.*—Along the lines of the South Manchuria Railway many new industries have been started since the extension of modern transportation facilities and the opening up of new sources of basic raw materials. The railway is fostering this industrial development through its research work, a description of which is given in Chapter V. Among other Manchurian industries brief mention may be made of the following :—

Starch is made from beans, *kaoliang* and corn by the Manchuria Starch Company at Port Arthur and the Dairen Starch Factory at Dairen. At Chientao starch is made from potatoes.

Smoking tobacco is manufactured in the Yingkou and Mukden factories of the East Asia Tobacco Company, which has grown to be a formidable competitor of the British-American Tobacco Company. Smaller tobacco factories are also located at Mukden, Dairen and Changchun.

Hard oil, stearine, glycerine and soap are made from soya bean oil by the Dairen Fat and Industrial Oil Company, and the Mukden Chemical Company is producing gelatine and animal and vegetable oils.

Bean noodles for South China and the South Seas are made by the Chinese-Japanese Bean Noodle Company. Two new companies at Dairen are making imitation rice from *kaoliang.*

The cereal *kaoliang*, as a result of research work of the South Manchuria Railway, has become useful in many ways. Calcium lactate is an important by-product. Lactate acid is made from the calcium lactate and is used extensively in fermentation, dyeing, tanning and other industries. The manufacture of paper from *kaoliang* pulp is another growing industry. The pulp closely resembles timber pulp and makes an excellent grade of paper. From the ash of *kaoliang* stalks potassium salts ore obtained for use in the manufacture of glass, medicines, fertilizers and other products.

Hemp bags and other products are made by the Manchuria Hemp Manufacturing Company at Dairen, and the Manchuria-Mongolia Fibre Industry Company at Mukden.

Boat building and repair work is undertaken by the Dairen branch of the Kawasaki Dockyard Company.

Railroad car and engine shops, equipped with the best American machinery, are operated by the South Manchuria Railway at Shakakou (near Dairen) and Liaoyang. Other iron-working plants are the Dairen Machinery Works, the Manchuria Mechanical Works, the Antung Iron Works and the Osaka Iron Works.

Among other Japanese enterprises may be mentioned the manufacture of matches, gunpowder, fertilizer, dye-stuffs and wickerwork.

Paper mills at Kirin, Liaoyang and Petuna, and dyeing and weaving works at Yingkou, Liaoyang and Chinchow are among the long-established native industries.

Industries based on wool and leather have been recently started. Formerly hides, bones, wool and other animal products were exported. At Mukden are located the Manchuria-Mongolia Fabric Industrial Company (capital Y.3,000,000) and the Manchuria-Mongolia Wool-Weaving Company (capital Y.10,000,000). Other factories are located at Harbin, Mukden and Dairen. The largest is the Manchuria-Mongolia Shokusan Company (capital Y.5,000,000).

# Tokio Subway Contract

The Foundation Company of New York having secured the preliminary contract for the construction of underground railways in Tokio, involving a preliminary expenditure of G. 14,000,000 and proceeding ultimately to G.29,500,000, negotiations are now in progress for financing the enterprise in New York. Competition, however, is said to be keen and there is even a chance that London will supply the funds.

The company admits that it may have to raise the capital there but points out that in that event orders for machinery and other supplies will also be placed with British houses.

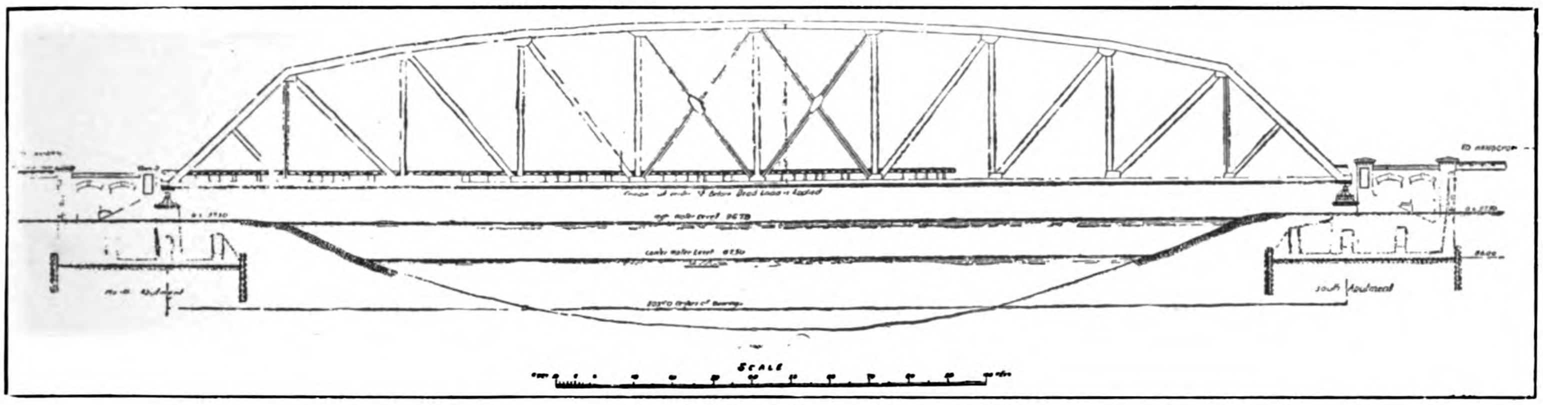


Fig. 3.

# Construction of a 305-Foot Span Railway Bridge

*By E. T. Forestier, A.M.I.C.E.*

**Paper Read Before The Engineering Society of China**

THE following is a short description of the design and construction of a through steel railway bridge of 305-ft. span which carries the Shanghai-Hangchow-Ningpo Railway over the Lo Tien Wan creek, a branch of the Whangpoo river, 38 miles from Shanghai.

The new bridge, which up to the time of writing is, the author believes, the longest simple span bridge at present in China, replaces a bridge of two spans of 104-ft. each, the substructure of which was in a precarious condition and had been condemned owing to scour in the bed of the creek near the centre pier. The condition of the

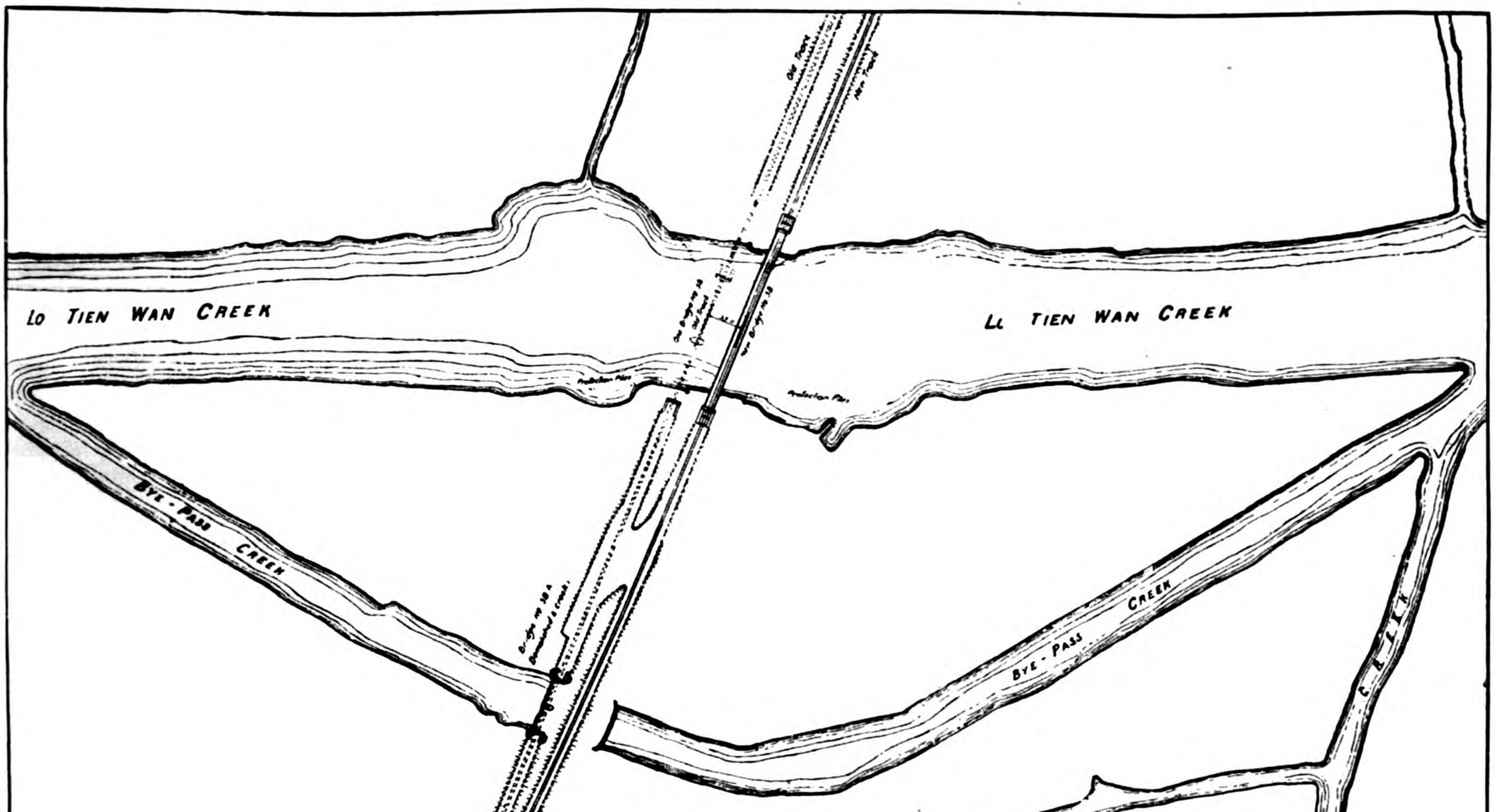



Fig. 1. Plan showing Bridge Location, By-Pass Canal and Realignment of Track

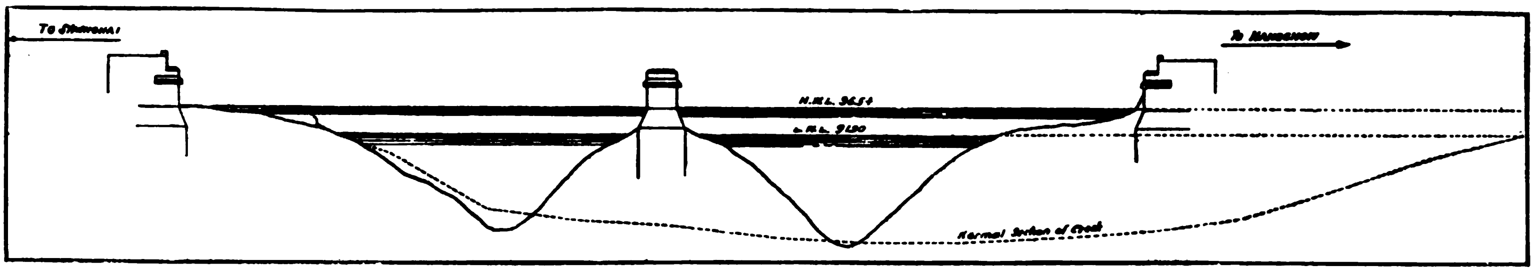


Fig. 4. Section on Centre Line of Old Bridge

old bridge, which was constructed by Chinese engineers twelve years ago, forms a very good object lesson in the dangers which are bound to arise by the restriction of a natural tidal waterway.

On referring to Fig. 4 it will be seen that the area of the cross section of the actual waterway along the centre line of the old bridge is very much smaller than the normal cross section of the creek, in fact it is only about 41 per cent. of the latter and, as the creek is tidal the velocity of the current under the bridge was very considerable.

In addition to this, the centre pier of the old bridge was not built in a line with the stream, but placed at right angles to the centre line of the bridge which crossed the creek on the skew. This caused the current to be deflected towards the bank and resulted in the bank being washed away, the erosion taking a semi-circular shape which gave a circular motion to the water and caused a whirlpool to be formed. The creek being tidal this occurrence took place both at ebb and flood tides and the effect was the same on both the up stream and down stream sides of the bridge, although more intense on the latter side. Fig. 1 illustrates this and shows how the banks were eroded by the whirlpools which were formed.

Not only were the banks of the creek damaged, but, what was much more serious to the safety of the bridge, the whirlpools scoured craters in the bed of the creek 77-ft. deep on the down stream side and 40-ft. deep on the up stream side, measured at high water. It was the former scour which caused the danger to the pier, as the latter was just at the edge of the crater.

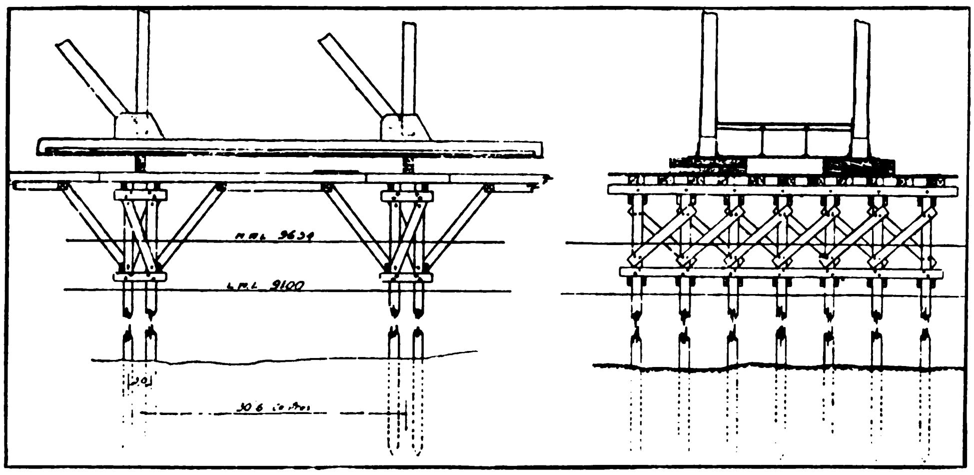


Fig. 5. Detail of False Work

It was not long after the old bridge was completed that the Chinese builders realized the mistake which had been made in restricting the waterway, and a canal to act as a by-pass, and so relieve the main stream, was excavated round the bridge on the north side, see Fig. 1. The relief given by this by-pass was, however, very small, if not negligible, as was subsequently shown after it had been stopped up by the new bank which was constructed to carry the new track diversion. After considering several schemes it was decided to construct a new single span bridge 55-ft. away from the old bridge and measuring 305-ft. span between centres of bearings. This necessitated realignment of the track for some distance, but this work presented no difficulty.

*Substructure.*—On account of the very bad nature of the foundation, the abutments of the new bridge, due to the heavy load they have to carry required special consideration, the ordinary mass masonry type of bridge abutment being out of the question as its own weight, in order to distribute the load over a sufficient area, would have been excessive. It was natural, therefore, that a reinforced concrete raft abutment was adopted.

The load on the foundation is made up as follows :—

| | | |
|---|---|---|
| Superstructure— | | |
| Steelwork, etc. ... ... | 253 tons | |
| Train load ... ... | 400 „ | |
| | —— | 653 tons |
| Substructure | | 707 „ |
| | | —— |
| | | Total 1,360 tons |

The allowable bearing pressure employed is 1,200-lbs. per square foot and, in order that the average pressure, *i.e.*, the total weight divided by the bearing area, should not be more than this amount, the size of the foundation was made 52-ft. by 47-ft. In addition the foundation is piled with 12-in. square piles 40-ft. long staggered at 4-ft. centres to provide for the eccentric load; also, the edges of the foundation are piled with sheet piling 5-ins. thick and with guide piles 10-ins. square, both 30-ft. long. All piling is of Oregon pine.

As the foundation was particularly bad it was decided to try and consolidate the ground by driving the sheet piles first and the 12-in. bearing piles afterwards. This, however, did not work out in practice, because when the bearing piles were being driven the sheet piling was bellied outwards, and after the latter had gone as far as its flexibility permitted, the earth contained within the foundation was forced upwards. In view of the results obtained with the method adopted in piling these two abutments and also experience on other work in this part of the country, the author is satisfied in his own mind that it is impossible to consolidate the ground more than what it is in its natural state, by any such means as just described. The author, however, wishes it to be distinctly understood that he refers only to the ground below what might be termed " the level of permanent saturation ; " also, that these observations apply to the silt as usually found in the Yangtze valley flats.

Above the level of permanent saturation it is quite possible to consolidate the ground, and excessive settlement of a structure whose foundations do not reach to this level is probably nothing more or less than the compressing of the ground above this level.

The author is strongly of opinion that while the bearing pressures usually adopted in Shanghai may be satisfactory when applied below the saturation level, they are far too high when applied to the soil above this level, and that for important structures it is essential to carry the foundations below this level; also, he is of the opinion that the allowable bearing pressure of 1,700-lbs. per square foot usually employed in Shanghai is too high if employed

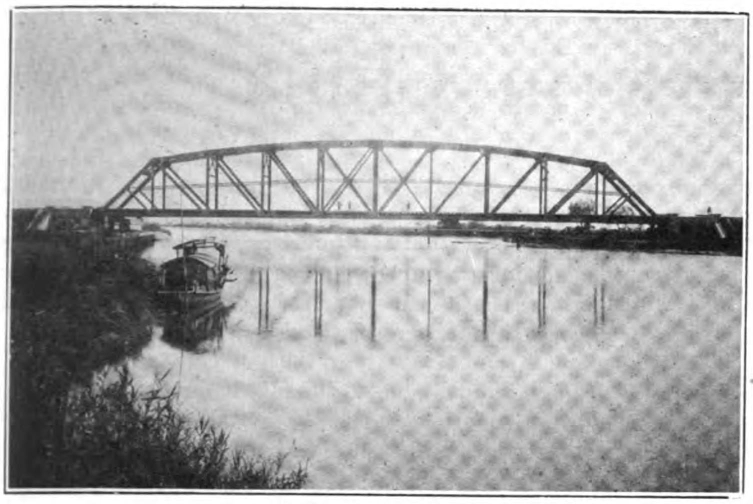


Fig. 6. Bridge No. 38

without piling. As already mentioned, the pressure worked to was 1,200-lbs. per square foot, which is the maximum pressure employed by both the Shanghai-Hangchow-Ningpo and the Shanghai-Nanking Lines, but even so no important structure is usually erected without the foundations being liberally piled, and results have shown that this practice is sound, as settlements have been small and of no account. More trouble, however, has been experienced with abutments sliding than settling, and a pair of abutments, which were a record as far as sliding was concerned, were also a record as far as settlement was concerned, in so far that after they had moved the settlement was hardly measurable.

The shoes of the bridge rest on two pedestals which form part of two main inverted cantilever ribs, 3-ft. thick. These main cantilevers are connected together and distribute the load to four cross beams, which in turn distribute the load to the main slab. The cross beams, as will be seen from the diagram, are in the form of beams supported at two points with cantilever ends, the points of support being the main cantilevers. It will be noticed that the lengths of the cantilevers of these cross beams are rather long in proportion to the middle part, and consequently the advantage of continuity is not fully obtained, in fact, the moment in the centre part is a negative moment. This is unavoidable as the distance apart of the main cantilever ribs is governed by the distance apart of the main girders. The upper part of each main cantilever is merely a wall supporting the concrete cross beams which carry the track on the abutment, and which for lightness and appearance, is made in the form of two arches. The wing walls are thin reinforced curtain walls going only 1-ft. below ground level and are make monolithic with the abutment at the high end and at the low end supported by a pillar resting on the end of the rear cross beam. This design was adopted, in preference to carrying the wing walls down to the foundation slab, as it is of lighter construction, and the question of reducing dead-weight was the governing factor of the design.

Horizontal struts are provided between the cross beams supporting the track to allow for the side bending moment which is introduced in these beams by the longitudinal force created by the sudden application of the train brakes.

All main reinforcing steel is of 1-in. square rib bars while ¾-in. square bars are used in the floor slab, all minor shear reinforcement, etc., is of ⅜-in. diameter indented bars. Altogether there are about 26 tons of reinforcing steel in each abutment. The stresses used in the steel and concrete are 16,000-lbs. and 600-lbs. per square inch respectively, and the concrete is of 1 : 2 : 4 mix.

Levels taken about two years after the bridge was finished, indicated a maximum settlement of 1.20-ins.

*Superstructure.*--The girders have curved upper chords with N type web member bracing and call for no special comment. A good idea of the bridge can be obtained from Figs. 3 and 6.

A few remarks regarding the falsework, however, may be of interest. Fig. 5 shows a typical cross section of the falsework which, as will be noticed, is rather substantial and had to be on account of the depth of water and the soft nature of the creek bed for several feet down and which was liable to cause excessive settlement due to the weight of the steelwork, a rather serious matter in the case of a large bridge on account of the difficulty of jacking up. Events subsequently showed that the number of piles in the bents was by no means excessive, as just before the girders were closed in the middle, a gang was employed doing nothing else but jacking up the panel points. The settlement, however, was not excessive, and was kept in check by the jacking gang without difficulty, although the full camber as provided by the design, was not quite obtained, but the last middle section of both top chords entered without difficulty. However, there was not a sixteenth of an inch to spare. The length of the longest piles used for the falsework was 68-ft., they were 12-ins. square and, of course, had to be spliced. Another reason for making the falsework substantial was in order to withstand the wind pressure on the bridge before the structure had been closed, and also the side pressure caused by the flow of the water. The height of the girders is 43-ft. in the centre, and the distance from the top of the falsework to the creek bed about 49-ft., therefore making the highest point about 92-ft. above the bed of the creek.

After the new bridge was opened to traffic the steelwork of the old bridge was removed and the centre pier and south abutment blown up and reduced to 5-ft. below low water and the creek widened on the south side to its normal width.

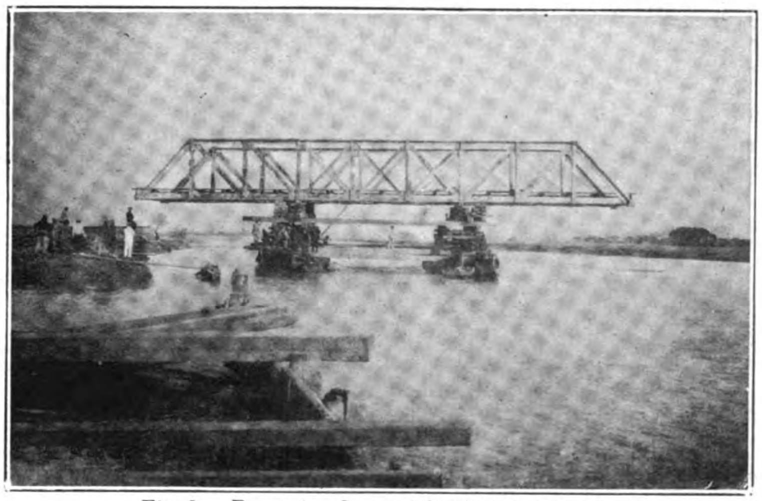


Fig. 8. Removing Span of Old Bridge No. 38.

The old deck span was easily landed, but the through span required considerably more work. Two native boats of about 50 tons capacity were floated underneath and falsework built up on these. Due to the tides not being high enough to balance the displacement, it was not until the third attempt that the bridge could be floated, but on this occasion the tide was at its highest and the shoes cleared by about an inch, which however, was sufficient to float it out. Fig. 8 shows the span being floated out.

# Anzan Cement from Slag

The results of technical tests held over samples of cement manufactured from the slag produced at the Anzan Iron and Steel Works, by the experts of the central laboratory, Dairen, and also the Anzan Works have shown that, in pulverization, expansion, and tensile power, etc., Anzan cement is found to compare favourably with Portland cement, as demonstrated by the use of over 200 barrels thereof.

In passing, the annual consumption by the S.M.R. Co. alone averages 300,000 barrels.

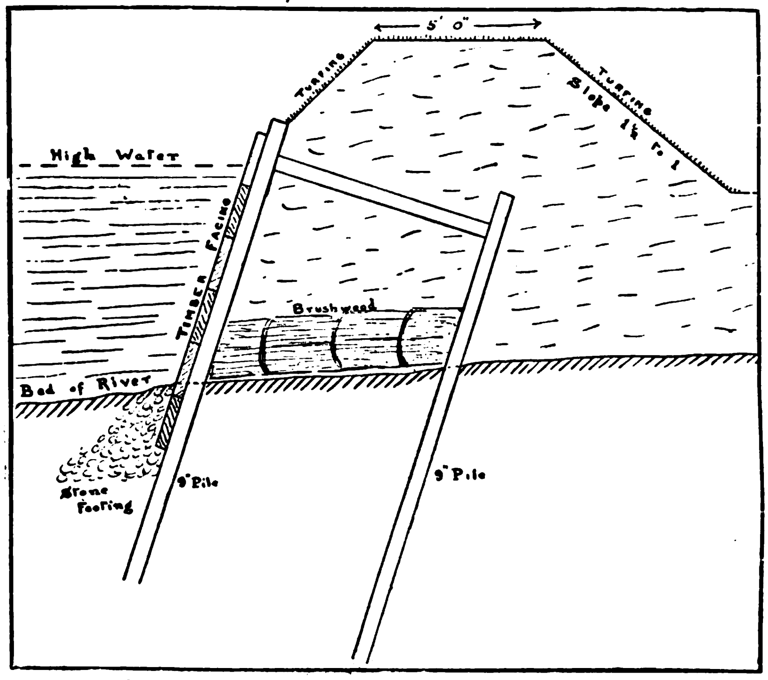
Cement-manufacturing promises to be another lucrative enterprise for the Anzan Works.

The current quotation is Y.4.60 per barrel in 3 bags for delivery at Lishan station. Each bag being bought back for 20 sen each, the net price is Y.4 per barrel, which is very moderate.

# Conservancy Work in China

THE rivers of China may be considered to be her chief commercial routes up to the present time, partly owing to the lack of roads, and partly owing to the slow development and maladministration of the railways, which in most countries would necessarily be the chief traffic carriers.

Having regard to the vital importance of there rivers it is well worth while to consider what steps can be and should be taken to conserve them, in order to render them both more efficient in their working and less dangerous to the community than they are at the present time.



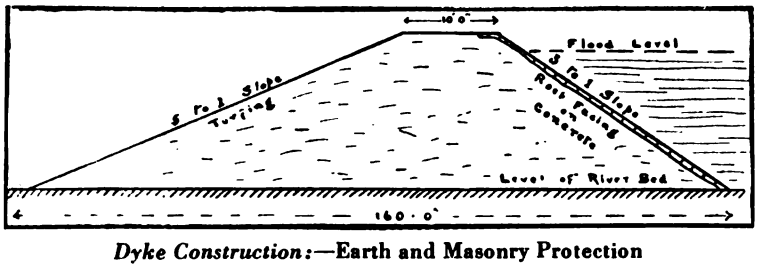

*Dyke Construction:*—**Light Timber and Earth Portection (Yung Ting River, China)**

Practically every year there is considerable loss of life and an enormous loss of land and foodstuffs owing to one of the chief rivers of China breaking its banks and flooding the surrounding country.

Therefore it is the intention of this article, first, to analyse the causes of this recurrent destruction, and second, to consider what ameliorative measures can be employed.

The prime causes which lead to a river overflowing its banks are to be found in exceptionally heavy rainfall or the sudden melting of snow or ice in the mountainous regions of its watershed, and in some cases this flooding has even been of a beneficial nature, owing to the fact that alluvial matter has been brought down by the current and deposited on the plains bordering the river.

This beneficent effect is naturally dependant on the velocity of the current, which, if too rapid, owing to the mountainous region of the source or the course of the river, brings sudden destruction in its wake.




*Dyke Construction:*—**Earth and Masonry Protection (Han River, China)**

Changes in the vegetation and forest growth over the drainage area, the cutting of timber, and the placing of land under cultivation, thus serving to increase the rapidity of the drainage, all have their share in increasing the dangers of floods.

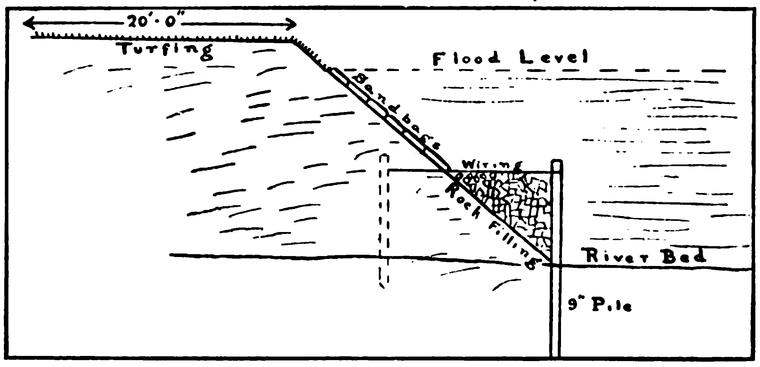
Furthermore, a non-tidal river with a constant flow has a tendancy to erode its banks, due to the fact it impinges alternately against either side, scouring the bank on the concave side, and then becoming diverted to the concave bank opposite and a little lower down stream.

This erosion is assisted by the fact that there is a natural lack of uniformity of soil materials forming the banks, and the friable sand or earth yields more easily than does a rock or clay formation.

The centrifugal force of the current will be thrown over to the concave side of the river channel, exerting greater pressure there, threatening to break any dyke protection, and by scouring and deepening the channel immediately under the bank, undermining the pile or rock facing under water.

In China these causes are particularly noticeable, partly owing to the immense volume of water in the main Chinese rivers, and the extreme rapidity with which they rise, and also on account of the fact that the lower courses of these rivers are for the most part through strata which is easily eroded, and where stone for rock facing work is not easily obtainable.

Moreover, the flooding of rivers in China has very often the reverse effect of that of the Nile or the Ganges, and instead of a deposit of alluvial soil when the flood recedes there is left behind a stretch of sand which ruins the agricultural possibilities of the area of a generation.




*Dyke Construction:*—**Earth and Turfing with Sandbag and Rock Protection (American & Holland)**

It is particularly noticeable in Chinese rivers also, that while erosion is taking place on the concave side, accretion is taking place on the convex, and this is almost invariably of a sandy and impoverished character.

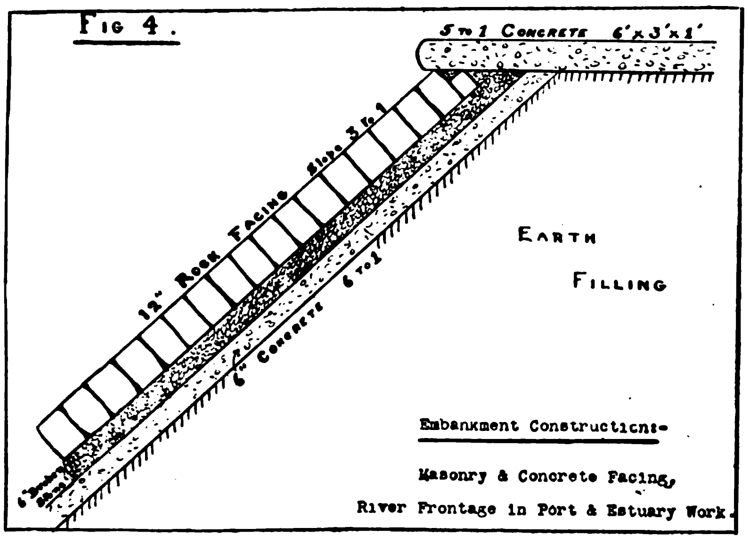
Having regard to these facts, it can be accepted as an axiom that river conservancy is a vital necessity in almost all navigable Chinese rivers, and it only remains to consider the most economical and efficient methods.

To train a river to its course it is advisable to commence operations as near the source as possible, that is to say, as soon as the river leaves the mountainous region where its channel is defined by natural barriers of rock.

For a comparatively small flow, the light timber and earth dyke as outlined in Fig. 1 will be found to be sufficient, and many slight variations on this design can be made, according to the materials available on the spot.

Brushwood mattressing was used instead of timber facing in the work which we carried out on the Yung Ting river, Chihli Province, and in Hupeh on the Han river, we found bamboo work satisfactory, though I am not certain as to its lasting qualities.

A slope of 1½ to 1 is the maximum allowable, as even then there is a liability to slide, and for an outer slope 3 to 1 is usually advised, giving good foundation stability, and allowing turf to grow satisfactorily.




*Embankment Construction:*—Masonry and Concrete Facing, River Frontage in Port and Estuary Work

As the volume of water increases, probably some hundred miles or so from the source, the nature of the dyke protection will change, a stronger type, as in Fig. 2 becoming necessary. Fig. 3 gives a sketch of dyke work on the Han river, the toe of the embankment being protected by rock filling behind piles, these having a penetration of from 10 to 18-ft., and being wired back to a series of retaining piles in the dyke itself.

Sandbags can be used as a temporary protection in an emergency, but should be replaced by rock as soon as possible, while turf is only satisfactory at a point above high water, as it is apt to die if submerged for any length of time.

In cases where erosion has already taken place, a training wall or permeable dykes can be used, as illustrated in Fig. 5 the wall serving to direct the course of the current, while not offering a direct obstacle to it, and the permeable dykes retarding the flow of the stream and causing it to deposit the sand, gravel, or earth which it is holding in suspension.

Spur dykes are also of service in directing the stream, but when used in series it should be remembered that the distance between them should not exceed their own length, and that the last of a series should not be placed at such an angle to the current as to form an eddy behind it.

These two facts are usually neglected in practice in China, and the results are most destructive, erosion taking place with extreme rapidity.

A grave difficulty arises in some parts of China from the fact that rock or other suitable materials are not available in large quantities, and that sand has to be used very considerably.

The practice in Holland and Denmark in such cases is to use various kinds of marsh grasses, such as "starr" or "marram" grass, planted in twelve inch sods about two feet apart, and these in the course of a few years form an impenetrable mattress, binding the sand together and obviating the danger of shifting sandbanks which is so prevalent and so difficult to reckon with.

In cases where the bank has already been destroyed, and it is therefore necessary to carry out work under water, the following may be found to be satisfactory in its results.

If the bottom is weak a layer of brush or fascine mattresses should be first sunk, and upon this are raised two longitudinal banks of narrower mattresses, one on the land side and one on the river side, at such distance apart as to be included in the width of the original bank, and each layer retiring inwards from the one below.

These mattresses should be weighted with rock if available to prevent shifting while in course of construction, and when the bank is satisfactorily aligned by these means, the heart can be filled in with earth or other material, until the whole is completed.

These constructions, as above outlined, will be found sufficient for most needs, but in the case of work in an estuary or a port it will be desirable to strengthen the dyke in some such manner as shown in Fig. 4 in order that the wash created by considerable navigation shall not destroy the banks.

In Holland and in England the practice is to support the toe of the embankment with sheet piling and rock rubble, while the concrete facing is laid on twelve inches of clay or broken brick to avoid subsidence.

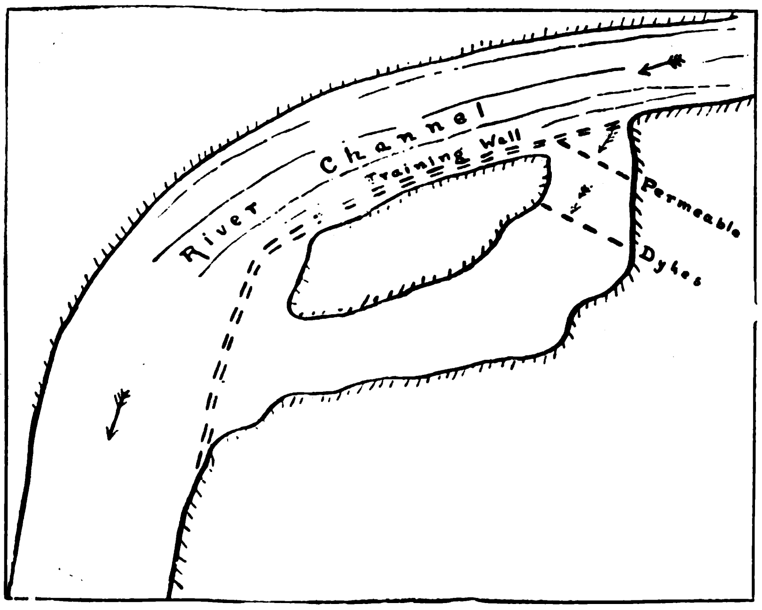
There is some difference of opinion as to the respective value of vertical walls as opposed to sloping ones, engineers arguing that (1) in a vertical wall the stones, being laid directly upon one another, they mutually assist in rebutting the thrust of the water, and that the danger of sliding is avoided.

(2) That the scour at the base of a sloping wall is considerably increased.

Actual practice appears to use the two types of construction about equally, and economy would dictate the use of the sloping wall as requiring less material for the same area.

It is necessary to consider next the fact that although the banks may be adequately protected, the results are of little comparative value to navigation unless the channel of the river be kept clear also, and this in China is a matter of some difficulty owing to the amount of sand deposited on the bottom in innumerable bars and banks.

An increase in velocity owing to the straightening of the channel will scour some of this deposit, but in the main channel of the larger rivers it will be almost inevitable that dredgers should be employed.

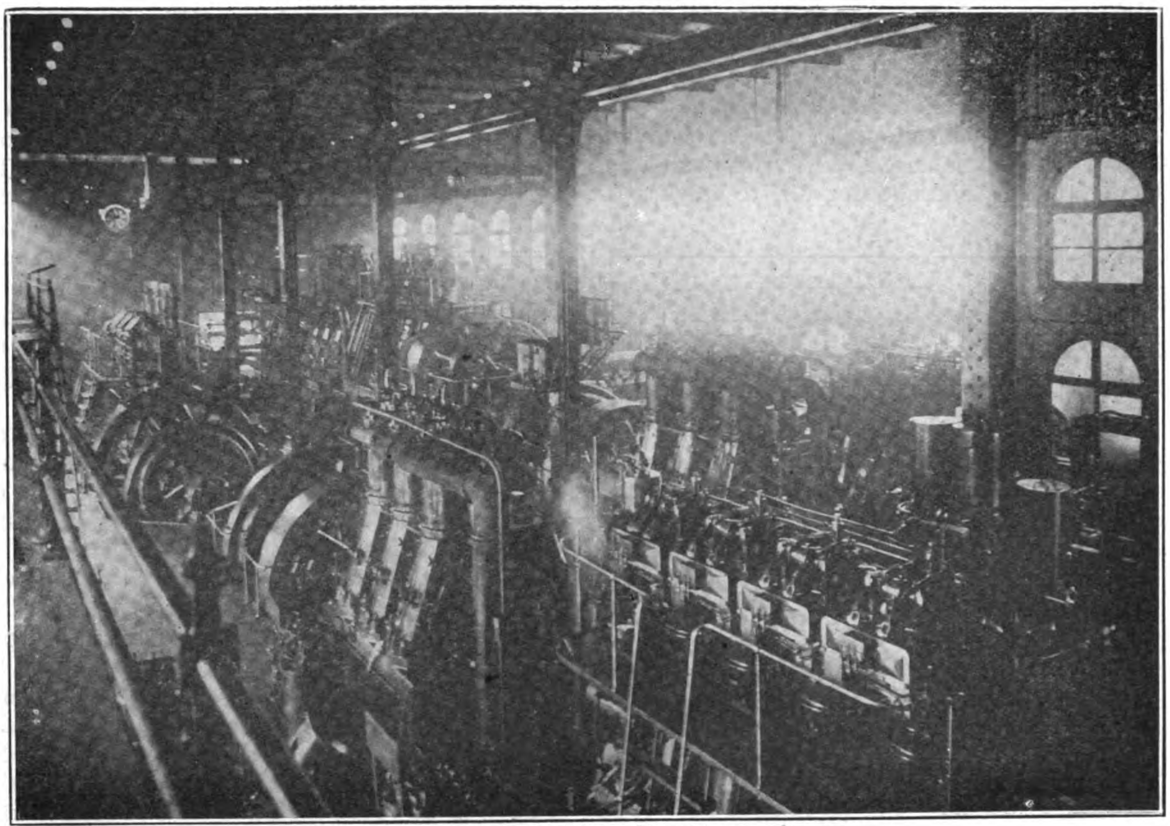



*River Erosion:*—Use of Training Wall and Permeable Dykes

This is an expensive item in conservancy, but in view of the value of navigable rivers to China it seems to be unavoidable, and once the initial cost is met the annual outlay will not be very considerable in comparison to that necessitated by embankment construction on a large scale.

In conclusion, I would urge the reader once again to consider the scarcity of good roads in China, the small extent of her railways in comparison to the territory to be covered, and the lack of direction of those that do exist, and the conclusion will be that the rivers of China are of the utmost importance to her commercial welfare, and agricultural prosperity, and that without a well considered scheme of conservancy they must inevitably fail to attain to that utility for which they are fitted and intended.

LAWRENCE IMPEY.

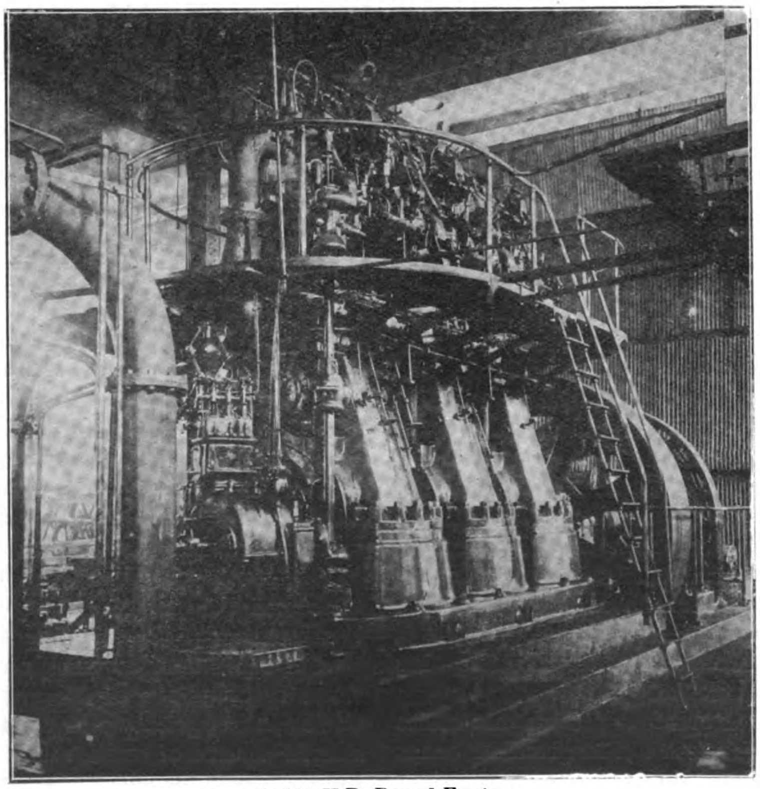


Canton Electric Light Plant: Diesel Engine Room

# The Canton Electric Light Plant

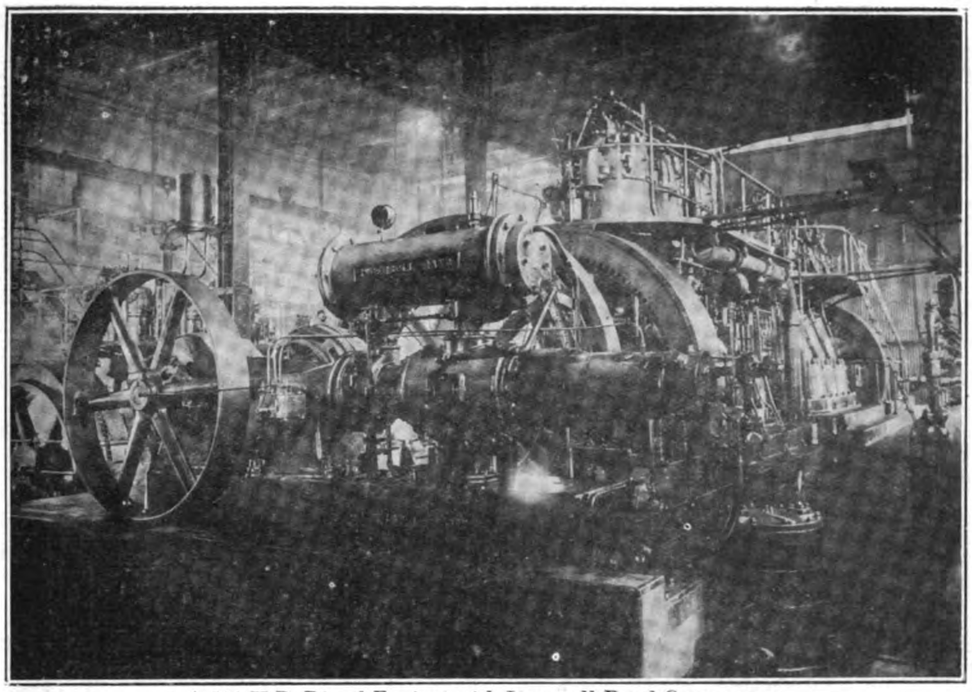
*By Tse Tsok Kai, Director of the Kwantung Electric Supply Company*

PRIOR to 1909 the electric lighting plant was operated under a European concern with an exclusive franchise of 30 years for supplying the city of Canton with light and power. It was repurchased by the Chinese in 1909. At that time the plant consisted of 4 175 h.p. condensing compound steam engines with 4 200 h.p. water-tube boilers complete with economizers and induced draft fans, and 3,200 h.p., 1,300 h.p. and 2,500 h.p., 4-cycle direct connected Diesel sets were added from time to time. The last addition was completed at the end of 1915, and consisted of the 2,500 h.p. sets. There were nineteen single-phase distribution feeders in all. The switchboard system is of very old type. The generator panels are located at one end of the switchboard gallery, feeder panels at the other and a "plug type" transfer board between, which is so arranged that by means of double pole air break plug switches, any of the feeders can be connected to any one of the generating sets. The units are not operated in parallel, each being independent of the other. The air compressors on all the Diesels are piped up to one another for convenience and it has been found in many instances that this arrangement has helped especially during the last three years when every machine had to run during the week with a heavy overload.



A 500 H.P. Diesel Engine

Some of the small Diesel sets though old have given very useful service. For fully five years due to the constant demand which because of the war could not be relieved, none of these machines have had a thorough overhauling. At 6 p.m. daily every set had to be running otherwise some section of the city would go without light. A 300 h.p. Hick Hargraves set ran continuously night and day for fully two years perhaps with no more than 12 hours shut down in a whole week. During five years exactly five long shut downs happened to the Diesels, in each instance the shaft being damaged, due to either piston head studs breaking or connecting rod brass bolts shearing. Interruptions due to cracked valves or fracture of small copper oil tubing occurred at intervals. To improve these conditions it was decided to install a new turbine plant and this has been in successful operation for the past five months.



A 500 H.P. Diesel Engine, with Ingersoll Rand Compressor

The new turbine plant located adjacent to the Diesel plant, was designed for an ultimate capacity of 30,000 k.w.

The present installation consists of equipment for two 2,300 volts, 60 cycles, 3 phase, 2,500 k.w. at 80 per cent. P. F., G. E. Curtis steam turbine sets. The steam pressure at the throttle is 215-lbs. with 1,500 F. superheat. At the end of the turbine room are located the switchboard and electrical equipment. The electrical galleries are five stories high. In the basement the oil circuit breaker cells with sectionalized busses, are located. These cells are of concrete and arranged in groups of four. The first floor is for switch cells for future extension. On the second floor are installed two 50 k.w. exciters, one motor and one steam driven. On the third floor is located the switchboard proper. The switchboard is of bench type, with electrically operated remote control and furnished with the latest electrical equipment. Ample room is left in this floor for future extension. The fourth floor is for voltage regulators and the fifth for G. E. aluminium lightning arresters and choke coils. At present there are nine outgoing feeders all three phase. The feeders leave the building on the fifth floor wall through bushings. All control wiring and outgoing feeders within the building are laid in steel conduits. When the switchboard was laid out, it had special reference to the future requirement of the plant and is, therefore, essentially different from an arrangement as would be designed for the present installation.

In the turbine room are also located two Worthington feather valve, horizontal crank and flywheel, steam driven, rotary dry vacuum pumps, one for each turbine, besides the engine room instruments and the overhead 25-ton motor-driven crane.

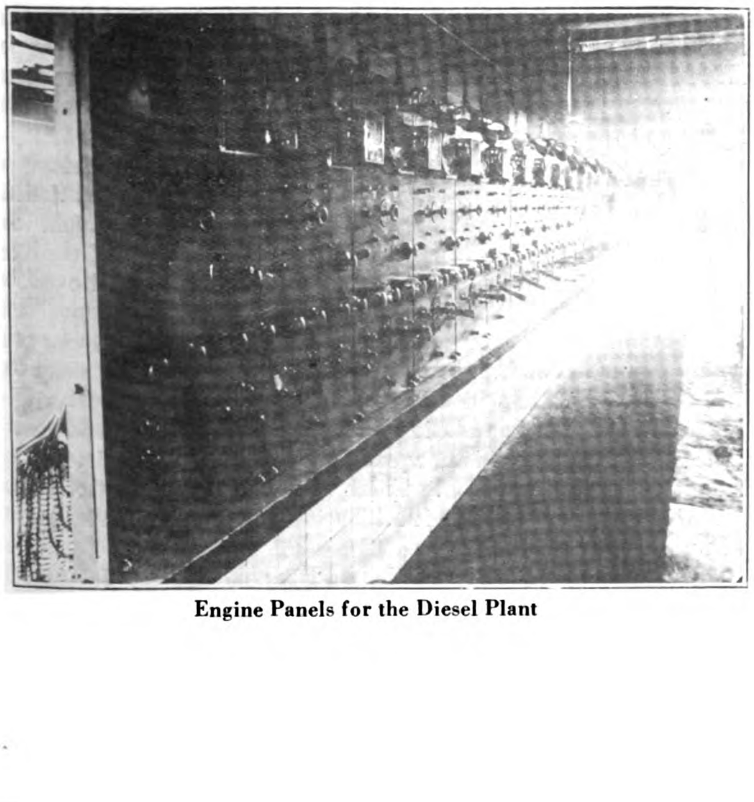
Underneath the turbine room is the condenser basement where 2-9,000 sq. ft. effective cooling surface Worthington surface condensers are connected to the turbines through corrugated copper expansion joints.

The boiler room runs adjacent to and parallel with the turbine room by a door at the gang plank gallery. The condenser basement is inter-connected. In the boiler room there are 4 750 h.p. Stirling boilers with steel casing and two turbine-driven boiler feed pumps. The four boilers are arranged in two batteries facing each other. Each boiler is equipped with one B. and W. superheater, one special 8-in. Lagonda automatic steam stop and check valve which has an extended spindle and handwheel so it can be operated from the boiler room floor. Each boiler is also provided with a Cope's automatic feed water regulator and two blow-off valves. Boiler steam pressure is 225-lbs. per sq. in. with 150° F. superheat.

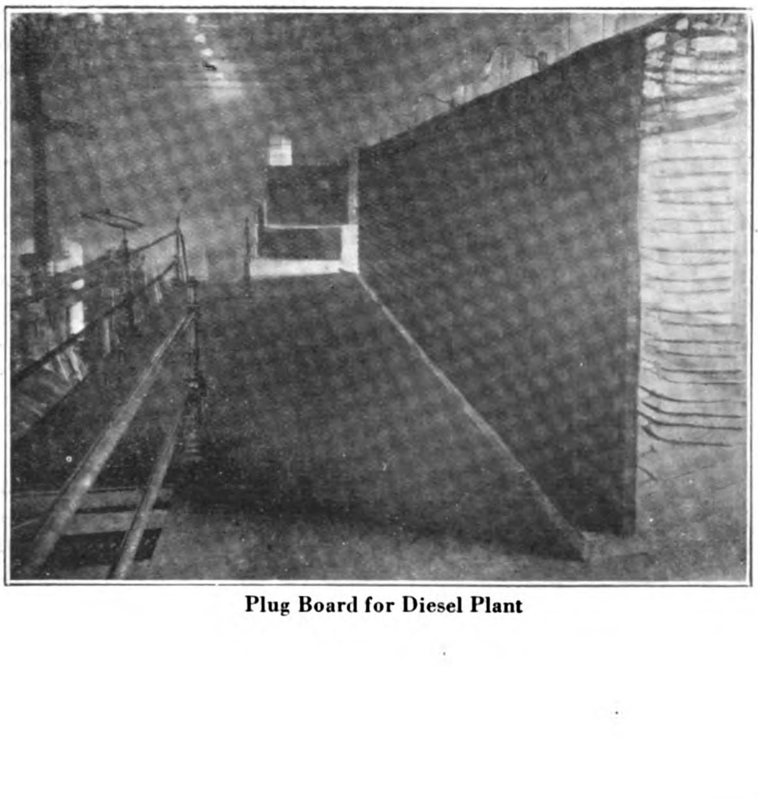
The furnaces were designed to take care of low-grade bituminous coal and are of the Dutch over extension type extending about 6-ft. in front of the boilers and being 9-ft. deep.

As the coal bunker is not installed at present, coal is carried into the station by coolies and lifted up to the boiler hoppers by the same hoist as that used for removing the ashes.

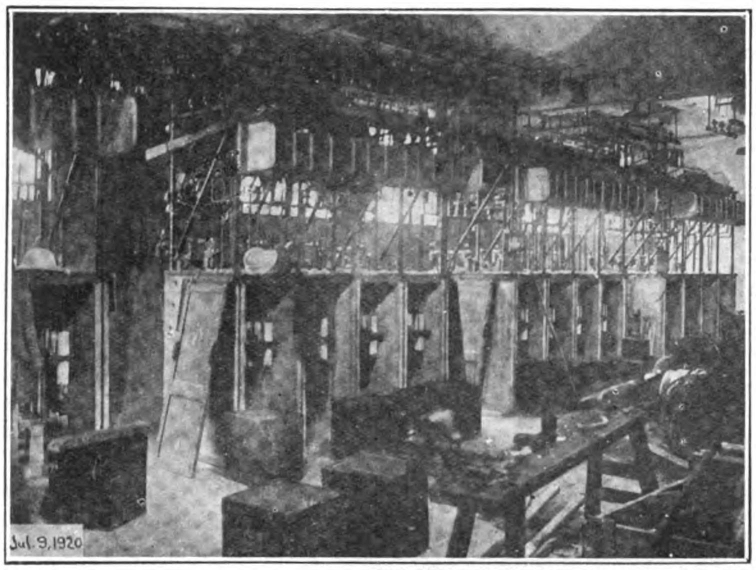
The building is of reinforced concrete throughout, with steel window frames and wire mesh glass panes. The pilasters are of reinforced concrete up to the condenser and boiler room floors from these points steel columns are used in order to save space. The roof is a 3-in. concrete slab with steel roof trusses. Glass is used on all 4 sides, so that the building is very bright inside, and large hinged windows provide sufficient air circulation. Additional ventilation is provided in both turbine and boiler rooms by louvres in the roofs. All floors are designed to stand a load of 300-lbs. per sq. ft. and are carried on I-beams. The floors are reinforced concrete, 6-in. thick.

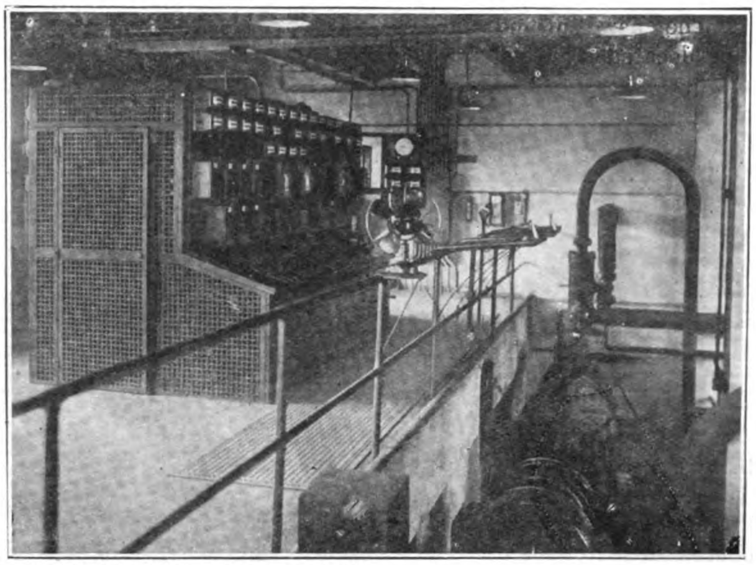


Engine Panels for the Diesel Plant



Plug Board for Diesel Plant



Switchboard for New Turbine Plant in Canton Electric Light and Power House

In the construction of the power plant the greatest difficulty encountered was in the circulating water system for the condenser plants. This, of course, like the rest of the power plant, was designed for an ultimate capacity of 30,000 k.w. The nature of the ground at the plant location is porous due to it being reclaimed ground, the filling having taken place over a period of many years.

To complete the river end of this job it was necessary to put down a cofferdam, and although this served the purpose to a limited extent, eventually divers had to be employed to finish up the excavation and concrete work. The bed of the river was a mass of huge boulders, some weighing as much as four tons while the majority were between 300 and 400-lbs. With such a bottom it seemed nearly impossible to keep the water out. The original intention to pump the water out of the cofferdam and do the excavation and concrete work in the dry, was found to be possible only during low water and fortunately this condition existed until the screen house was completed, but with the rainy season coming on and the continued high water it was impossible to keep the water down when discharging water from the cofferdam at the rate of 10,000 gals. per min., so it was decided to give up the attempt and use other methods.

Divers were then employed and the excavation for the connecting tunnel was completed under water. This was followed by pouring an auxiliary concrete slab under water. The sides of the tunnel were then made in three foot sections with tongue and groove joints, these being made of concrete above the water with the reinforcing iron protruding at right angles, at the top and bottom of each section. These large blocks of concrete were then lowered to the bottom and were set in position by divers under the water and the reinforcing iron connected across at the bottom to opposite sections. The permanent concrete bottom of the tunnel was then poured under water and allowed to set. The pumps were then started up and the water brought down to within four feet of the bottom, and it was kept at this point while the forms for the top were put in place, the reinforcing iron connected across and the concrete poured. When finished the tunnel was an excellent job.

The reason for going down so deep with the intake water tunnel was due to the rise and fall of the river, which has a variation at different seasons of about 13 feet. The condenser plant was designed to operate on the syphon principle, and the discharge water tunnel was run on the top of the intake water tunnel. A water lock was provided in the discharge water tunnel to seal the discharge pipes from the condensers to keep the construction costs down. Height of the syphon is 23-ft.

Although a little troublesome when started the plant is now giving every satisfaction. The completion of the circulating water system was the hardest job, indeed it is considered to have been the most difficult piece of river engineering ever attempted in South China.

The system when finished, is to consist of three-phase feeders with three single-phase feeder regulators on each circuit, and single-phase mains to which are connected large size line transformers. A three wire, grounded neutral secondary system, is used. For 80 per cent. of the load 25 K.V.A. pole type line transformers are found to be economical. Formerly the pole work done on ladders is now done on climbers.

As the local authorities allow balconies to be erected over the side walks on the 80-ft. wide streets, extending to the street curbing, poles have to be set in the streets and alley arms are resorted to so as to keep the poles as close as possible to the curb. On the 70-ft. wide streets the poles are placed in the side walk close to the curb with standard cross arms.

In order to connect some of the Diesel plant circuits to the turbine plant, a new transfer board was erected by which any of the single-phase circuits can be switched over to any one phase of the turbo generator. This is accomplished by using D.P.D.T. automatic hand operated oil circuit breakers.

The single-phase feeders are connected through disconnecting switches to centre poles of the oil circuit breakers. Two poles of the breaker are connected to the "plug" board for single-phase alternators and the other two poles to one phase of a three-phase bus, which is connected to the turbo plant. Thus by throwing the breaker one way the feeder could be connected to a single-phase alternator and throwing it the other way would connect it to the three-phase bus of the turbo plant. This board has made the working of the Diesel plant very flexible.

As to street lighting the multiple system is still being used in the narrow streets but on the broad streets, a system of series incandescent lamps of 40 watts, has been installed. There are about 600 of these lamps in use. The city is also planning for ornamental lighting at the street corners.

Before the new turbo plant was in operation, it was necessary to stop the connection of any new lights. As soon as these restrictions were removed, a large number of prospective consumers applied for current. In the second month following the removal of these restrictions 1,156 metre consumers were connected up, and over 300 flat rate consumers added. At present there are still over 600 applicants for metre connections every month. Contracts for supplying power to 250 h.p. in motors have been closed and about 300 h.p. to 400 h.p. are still under negotiation.

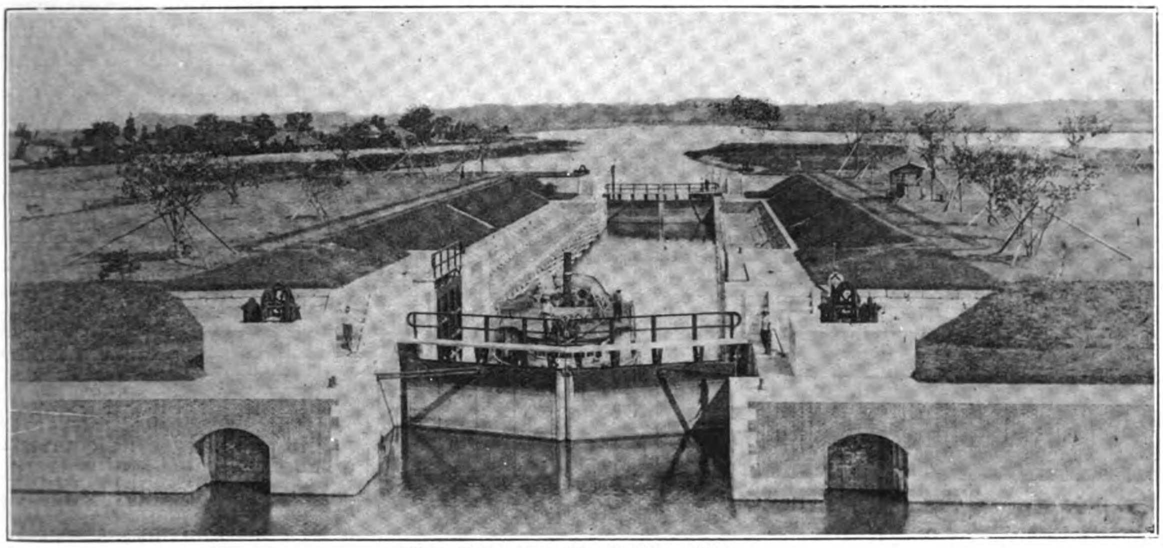
All the house installation work which formerly was entirely done by the company, is now executed by contractors licensed by the city after examination. There are about 60 such contractors. All wiring must comply with the city rules and regulations for wiring.

On account of increased demand for power, the company is asking tenders on a complete 5,000 k.w. equipment.

# Japan's River Improvement Program

## With Special Information on the Tonegawa Scheme

INNUMERABLE small rivers keep Japan a well-watered land, but for centuries these rivers have been the curse of the country sweeping over their banks in merciless floods inundating the surrounding fertile lands, and leaving behind barren wastes of sand and stone. In the old days no attempts were made to make these waste lands fertile again. The diversity of local governments placed the possibility of any alleviation of the intolerable conditions quite outside the realm of practicality. River embankments to hold back the floods were regularly erected by the feudal lords, and as regularly swept away next flood-time.



The Yokotone River Water Gate

When the country was unified in 1868, the imperial government adopted a policy of national control of all river improvement work. The national treasury was unable, however, to bear the burden entailed, but within the limits of financial ability some work of constructive importance was regularly accomplished. The first river improved under the direct supervision of the central government was the Yodogawa, in 1873. This river is the most important inland waterway in the Kwansai district, and empties into Osaka bay outside the eastern part of the city of Osaka. Since 1873, what are known as the fourteen big rivers under direct control, the Tone, Shinano, Kiso, Kitakami, Sho, Abukuma, Fuji, Ayano, Mogami, Yoshino, Chikugo, Oi, and Tenryu rivers, have all been the objects of government activity. From 1873 to 1886 the central government expended a total of Y.3,086,328 on bank protection works, and in strengthening banks where the flood torrents were most likely to get out of control. No general plan covering the improvement of the internal waterways of the country as a system of inland transportation was prepared during this period, so that at best all the work done was more or less of a haphazard nature, and only for the most urgent purposes.

In 1886, the government adopted plans for the improvement of all rivers in Japan. By this plan the central government undertook all work of improving river beds and courses, while the local governments (prefectural) were charged with the duty of preserving the river banks, and with building flood protection embankment works. From 1887 to 1895 under this plan, the central government budgeted Y.850,000 a year for construction, and during the total period a total of Y.6,724,209 was actually expended on the most necessary work.

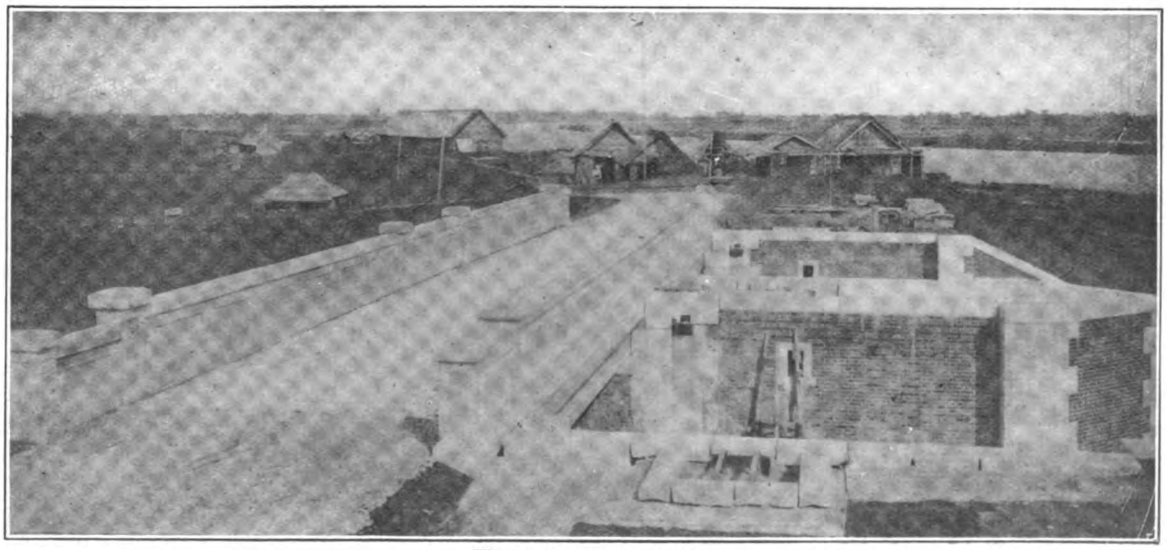
In 1896, a new law was promulgated, which placed the improvement of important rivers under the control of the department of home affairs; and provided that a part of the costs should be paid by the local governments interested.

The home department began the work of building up the banks of the Yodogawa, and the Chikugogawa. Under this law between 1896 and 1910, the Tone, Sho, Kuzuryu, Yodo, Shinano, Koryu, and Watarase rivers were all materially bettered. The total costs of all constructions during these years amounted to Y.11,641,698, an annual expenditure of Y.776,113.

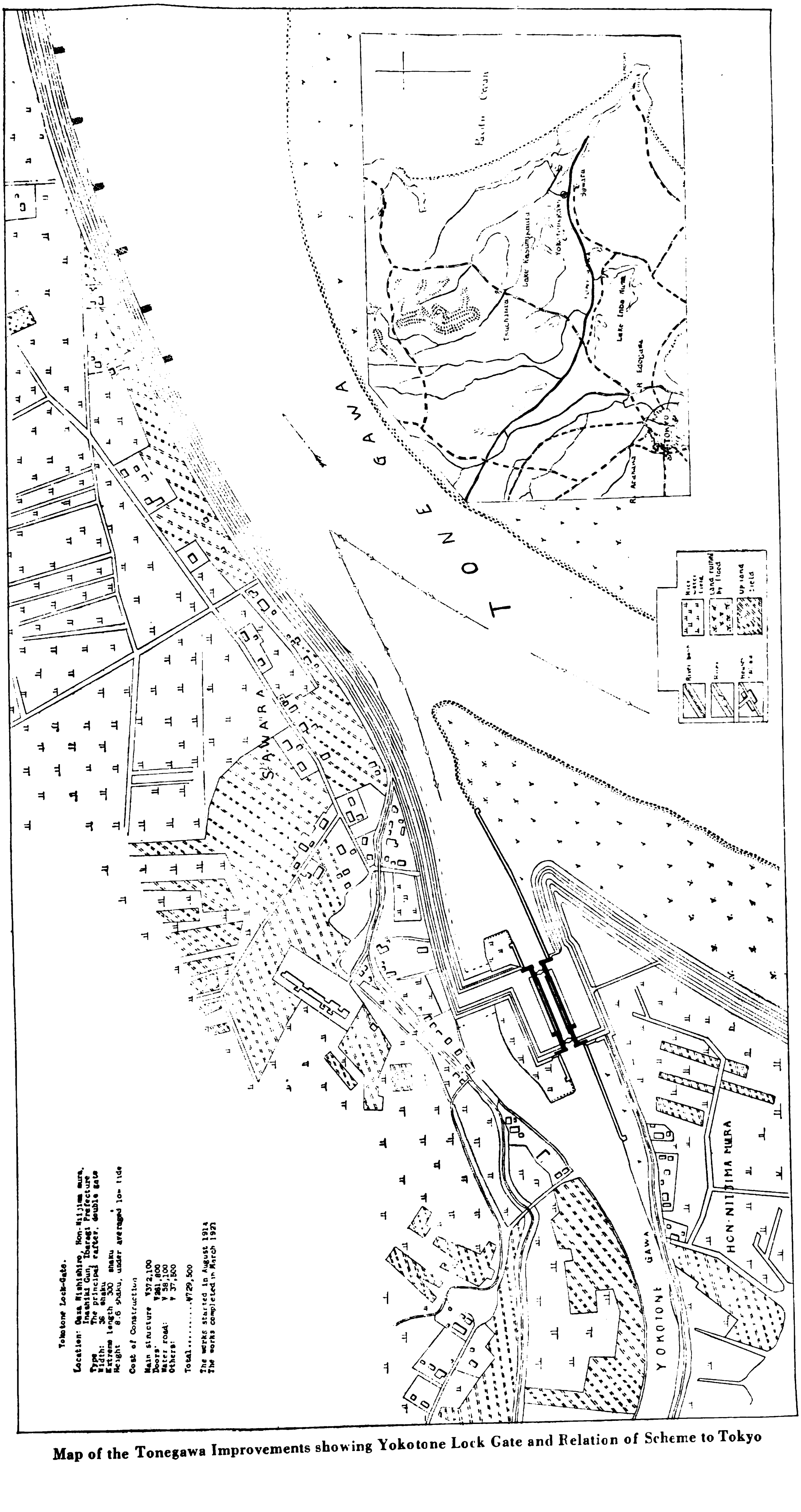
In 1910, the whole country was visited by disastrous floods and the government then established an "Extraordinary River Investigating Committee" to engage in an extensive survey of the rivers of Japan, so that a plan for the fundamental improvement of the intolerable flood conditions might be worked out. In 1911, the committee drew up a plan spread over a period of eighteen years calling for a total expenditure of Y.176,744,471, of which Y.135,757-974 was allowed by the diet from the imperial treasury. The balance of Y.40,986,497 was to be paid from prefectural government funds.

This plan provides for (1) direct improvement of rivers, and (2) the prevention of floods by reforestation of waste mountain lands.

At the time this plan was adopted there were nine rivers being improved: the Tone, Shinano, Sho, Kiso, Kuzuryu, Yodomi, Koryo, Yoshino and Onga. Including these, 65 rivers in all were selected to be the centre of the government's plans of improvement



The Inaba Water Gate




Map of the Tonegawa Improvements showing Yokotone Lock Gate and Relation of Scheme to Tokyo

and construction of inland transportation waterways. Construction was to be accomplished in two periods, and these nine rivers, together with 11 others, the Ara, Kitagami, Iwaki, Omono, Mogami, Agamno, Jintsu, Fuji, Kako, Hii, and En, were selected for the first period of construction work, at a cost estimated at Y.164,-314,471.

The rivers included in the second construction period are the Abukuma, Tenryu, Chikugo, Naka, Naruse, Tama, Shonai, Yasaku, Naka, Yamato, Ki, Yabe, Sagami, Kuji, Ota, Yoshii, Ura, Maruyama, Seki, Chiyo, Asahi, Yoneshiro, Go, Natori, Ashida, Sakawa, Tedori, Kikuchi, Suzuka, Watari, Kano, Niiyodo, Kawauchi, Kuma, Ota, of Hiroshima prefecture, Ono, Oyodo, Oita, Mabuchi, Kimozoku, Hiji, Tsurumi, Shira, and Aisaka.

Along with the improvements planned in the courses of these rivers, work for the prevention of sand drifting was to be carried out under the direct control of the home department. Such work might also be carried out by the prefectural governments, in which case, a proper subsidy was allowed from the national funds. The estimated costs of all these sand drifting prevention works is Y.12,430,000.

The plan was put into execution at once, but in 1913, largely due to the political unrest, the work for that year had to be postponed. Consequently the budget appropriations were extended to 1929, and the dates of completion of construction on each river extended one year also. Many additions to the original plans were adopted, thus causing further extensions in the time for construction.

By 1918, work had been commenced on the Ara, Kitagami, Agano, Omono, Mogami, Kako, Iwaki, and Jinzu rivers. But the rise of prices occasioned by the European war, caused a lack of funds, and there was a partial alteration in the budget of 1919, which was in part also necessary by the inclusion of certain most necessary changes in the amended plans. In 1919, a further Y.12,259,405 was added to the original estimate, and in 1920, another increase of Y.22,444,648

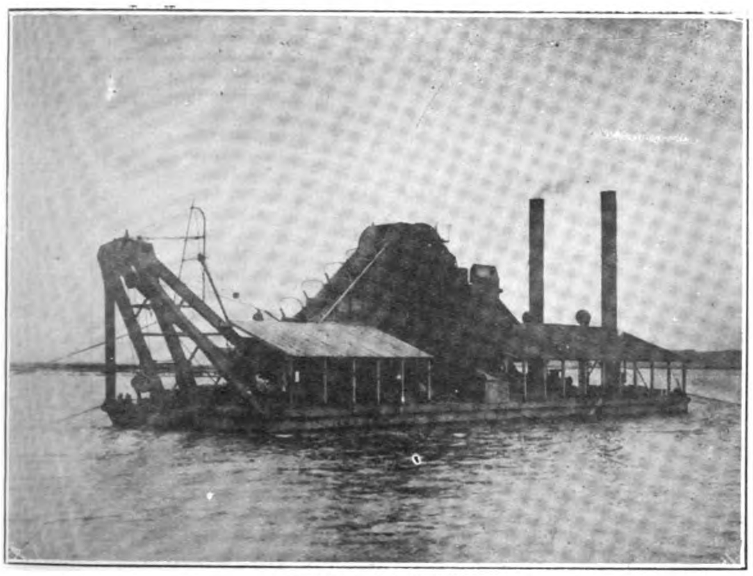
was allowed. The budget for river improvement as a consequence was altered to:

| | |
|---|---|
| National Treasury account .. .. | Y.161,945,360 |
| Local government account .. .. | 48,503 164 |
| Total .. .. .. .. | Y.210 448,524 |

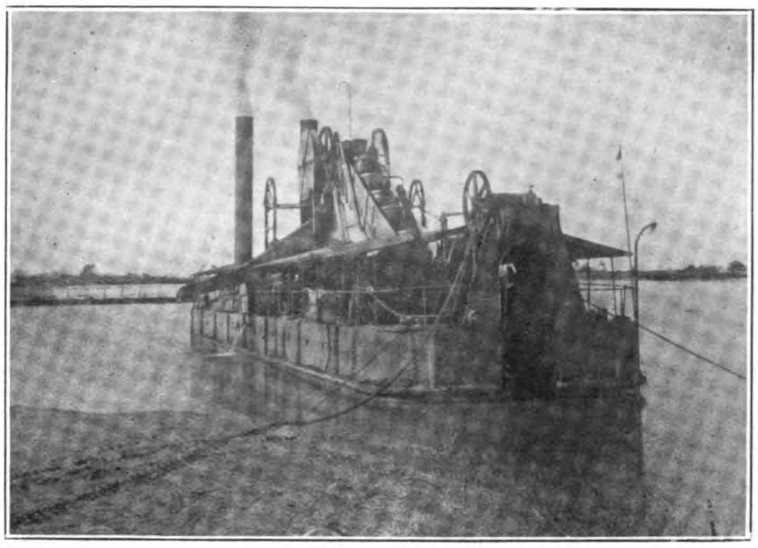
The national government has confined its operations to work on the main streams of the most important rivers. Work on branch streams, or the upper waters of the principal rivers where navigation is not extensive has been left to the local authorities.

Many of the rivers included in the second period of construction, are frequently in flood, and cause great damage. The local Aga, Abukuma, and Maruyama rivers. Construction in all these cases has been carried out under the direct supervision of the central government.

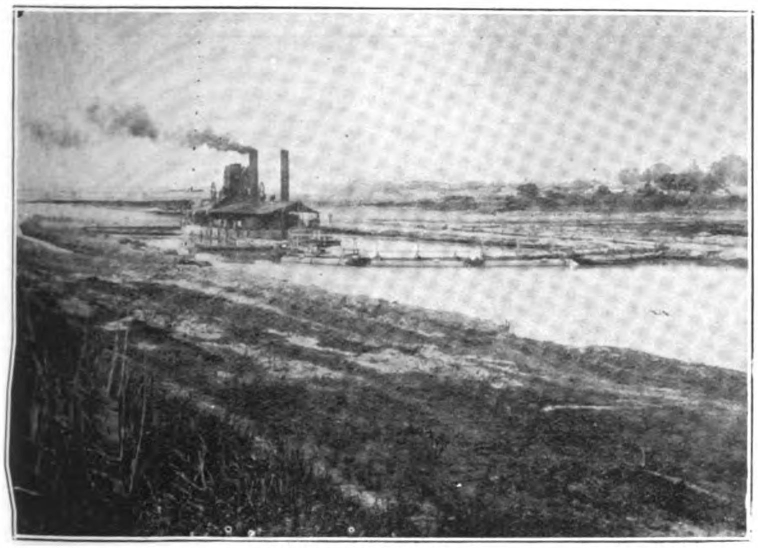
The works planned for the Yodo Gawa were completed. But disastrous floods in 1917 occasioned an extension of these operations. In 1918, a new program was adopted, for construction over a period of six years. Part of the expense is being met by the local authorities, the balance is defrayed by the national treasury. Funds for the subsidizing of river improvements amount to Y.50,-217,600. By 1933, the central government will have defrayed Y.26,370,600 on present authorized construction, and the balance of Y.23,847,000 will be paid by the local authorities.



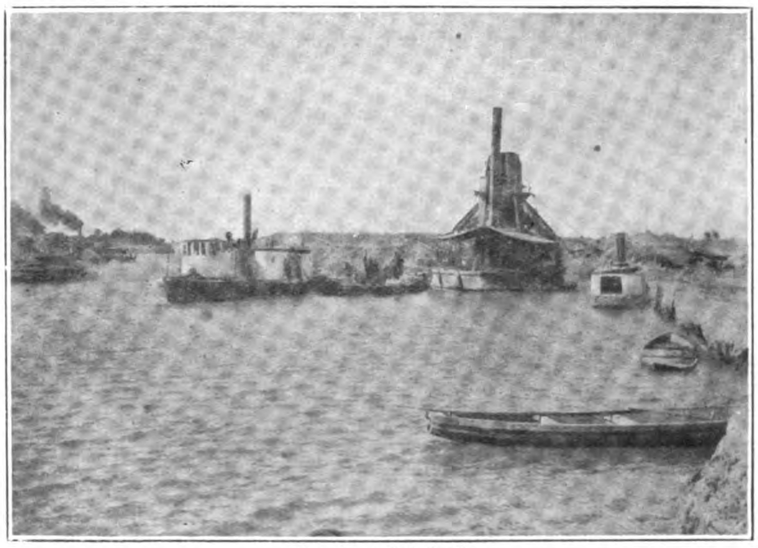
Dredger "Banto"



Dredger "Inaba"



Dredger "Inashiki"



Dredger "Taka"

The Tone River Improvements: Types of Dredges used on the Work

governments were clamorous for immediate improvement of these conditions, and urged national subsidies. The government decided to allow, therefore, subsidies for fundamental important work on the branch or upper streams of the rivers in the first period work, and for improvements on the main streams of the rivers in the second period, when they are rivers which flow through important agricultural districts whose protection is important to the national food supply. The home minister has also been authorized to undertake urgent works not already provided for by law when it is a matter of public necessity. In 1917, the first subsidy under this decision was given to work on the Eai and Naruse rivers, located in Miyagi prefecture; the amount being half the total cost of construction. Since 1917, subsidies of half the costs of construction have been granted to works on the Chikuma, Tama, Ota,

All river improvement work in Japan is accordingly a joint work of the local and national authorities. For the time being it is principally directed to putting a stop to the intolerable flood conditions, and the disastrous drifting of sand along the courses of rivers which have already laid waste thousands of acres of fertile agricultural lands.

The Tonegawa which flows to the north of the city of Tokyo from the mountains in Gunma prefecture into the Pacific Ocean at Choshi in Choiba prefecture is one of the most important waterways of eastern Japan. The works planned for the bettering of transportation conditions on this river and for preventing damage from floods are described below.

The Tonegawa with its tributaries and its branches drains a basin of 2,550 sq. miles, embraced in seven prefectures of eastern

Japan. Though the Tonegawa itself is only 205 miles long, the total length of all its tributary streams is 2,800 miles. Flat bottom Japanese boats are able to navigate the main stream for a distanee of 175 miles from the mouth of the river at Choshi in Chiba prefecture on the Pacific Ocean, but only 2/11ths of the length of all the streams are navigable even in these boats.

The river is of the greatest importance to the city of Tokyo for it is along its waters that the produce of the districts to the north and northwest of the city are carried to its markets. The Edogawa (Edo is the old name of Tokyo), a branch of the Tonegawa, connects the capital with the parent stream.

Flowing through low lying plains the surrounding country lies only a few feet above the ordinary high water level of the river. During the rainy seasons in June and September and early in August, when the mountain streams are swollen by the melting snows, the Tonegawa and its branches invariably overflow their banks and cause great damage.

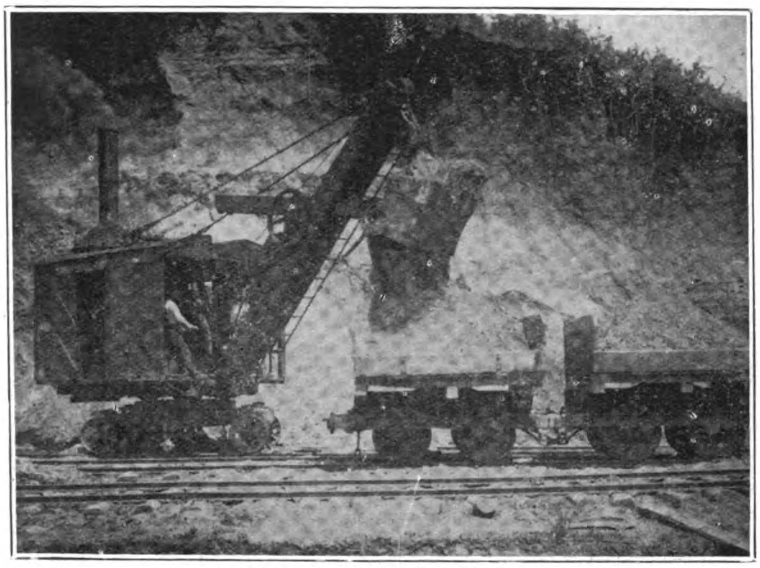
The annual damage caused by floods along the main stream, to agricultural products and the embankment works amounts to more than Y.8,000,000. It is difficult to estimate the damage done indirectly by the tie-up of communications, commerce, and the unsanitary conditions resulting from the floods. Great floods of the Tonegawa are said to occur once in every ten years, at least. But as a matter of fact in recent years they have been much more frequent. Since 1890 there have been eight great floods, causing damages of more than Y.15,000,000. For many years the importance of controlling the flood waters of this river has been recognized, especially as a flood beyond control in the upper stream of the Gongendo river, a branch of the Tamagawa, would cause a direct inundation of Tokyo city.

The plan for controlling the flood waters of the Tonegawa was adopted in 1890, the works to be completed in 24 years. Originally, Y.52,380,444 was appropriated for construction, but because of the rising costs of materials and labor in recent years, an additional Y.11,078,884 was later granted. With these sums improvements in the river bed, embankments, and flow were to be effected at the three most important places along its banks.

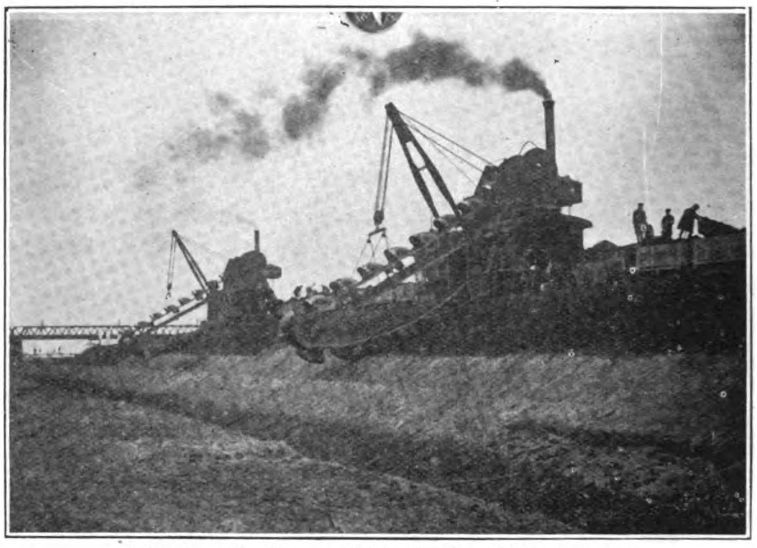
The districts where improvements were necessary are—

1. The Tamagawa: from Shibane-mura, Sawo-gun, Gunma prefecture, to the town of Choshi, Chiba prefecture;
2. The Edogawa: from Sekijuku-machi, Higashi Katsushika-gun, Chiba prefecture, to Gyokuto-machi, same prefecture, a distance of 37½ miles.
3. The Nakagawa: from Matsubuseiyo-machi, Kita Katsushika-gun, Saitama prefecture, to Honda-mura, Minami Katsushika-gun, Tokyo prefecture, a distance of 15 miles.

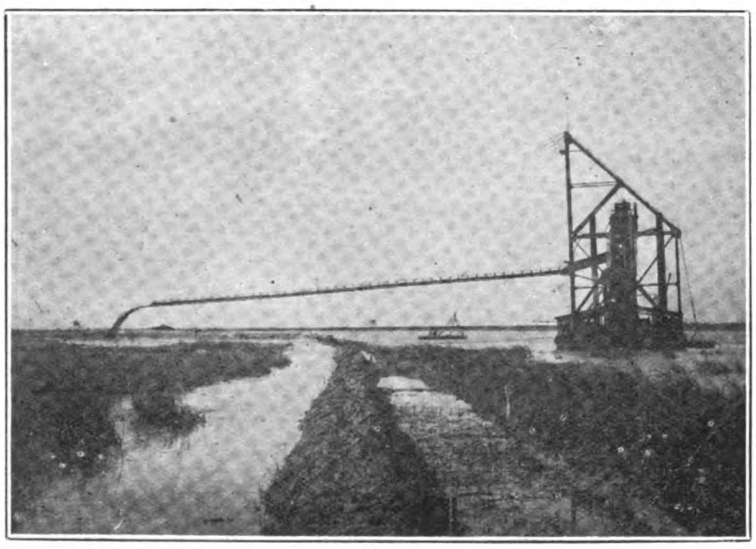
The problem of control was principally one of deeper and wider river beds which would effectively carry away the flood streams before the embankments could be flooded. Consequently it was planned to effect a change in the bed of the Tonegawa between Shibane-mura and Sekijuku where the Edogawa branches from it, so that a flow of 200,000 cu. ft. per second would not endanger the



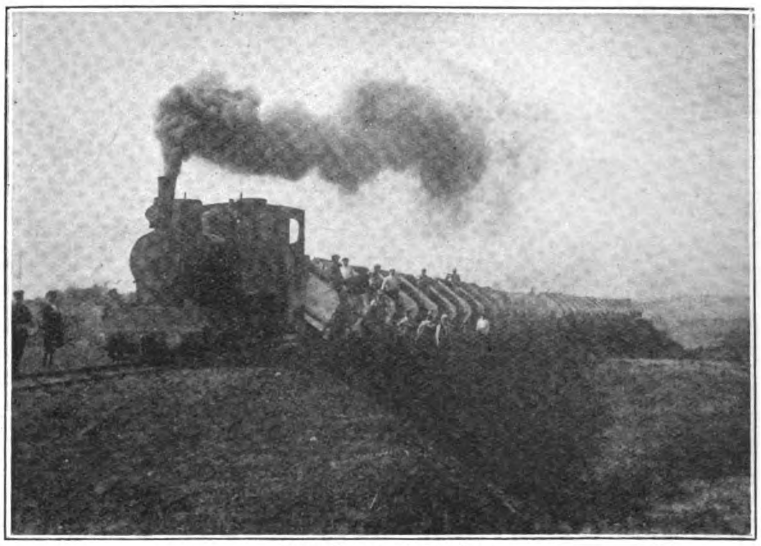
Marion Steam Shovel at Work



Digging Machines, at Nakada, Ibariki Prefecture



Suction Dredge "Chiba"



Dirt Train Unloading

Tone River Improvements: Modern Mechanical Shovels, Diggers, Suction Dredges, etc., employed on the Work

surrounding country. The flow into the Edogawa was to be increased to 80,000 cu. ft. per second. Between the Edogawa and the point where the Kinugawa empties into the Tonegawa the flow was to be increased to 120,000 cu. ft. pei second, and from the Kinugawa mouth to the sea, the flow was to be made 155,000 cu. ft. per second.

In order to effect these changes the main stream of the river had to be widened to 1,800 feet, but ac Akaiwa, for some two miles, an additional 1,200 feet outside the main river bed has been constructed to carry any overflow that the main stream cannot bear during flood times. The bank of the main stream at all points wa. to be 6 feet higher than the highest recorded flood levels, except at Aikawa district where they were to be raised only 5 feet. Where the Watarasegawa meets the Tonegawa a great ditch is being constructed to carry ofl flood waters between Koga and Fujioka, where flood damages have always been particularly severe.

Between the entrance of the Kinugawa and Totte-machi, a distance of 7½ miles, the river was widened to 2,200 feet, and a ditch to carry sudden flood increases is being constructed on either side of the main stream. From Sawara-machi to the sea the width is gradually increased to 3,000 feet at the mouth of the river at Choshi.

For financial and engineering reasons the work was divided into periods.

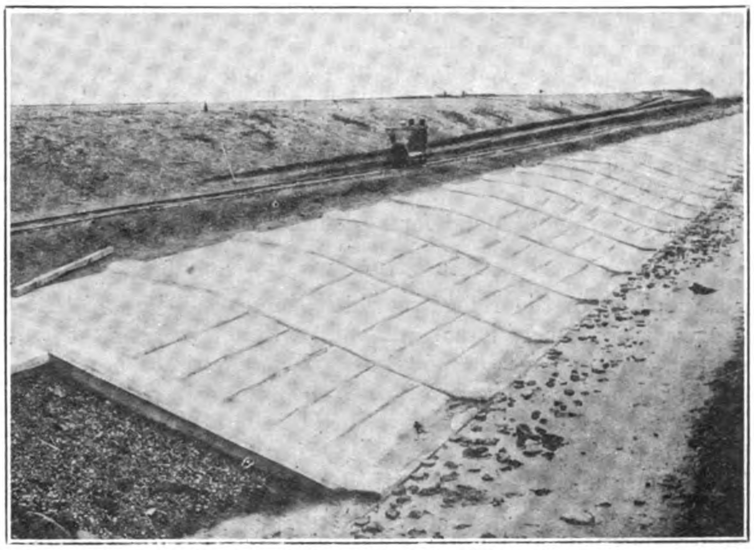
First period: From Sawara-machi, Katori-gun, Chiba prefecture, to the sea (at Choshi), 26¾ miles.

Second period: From Sawara-machi to Totte-machi, Kita Soma-gun, Ibaraki prefecture, 32½ miles.

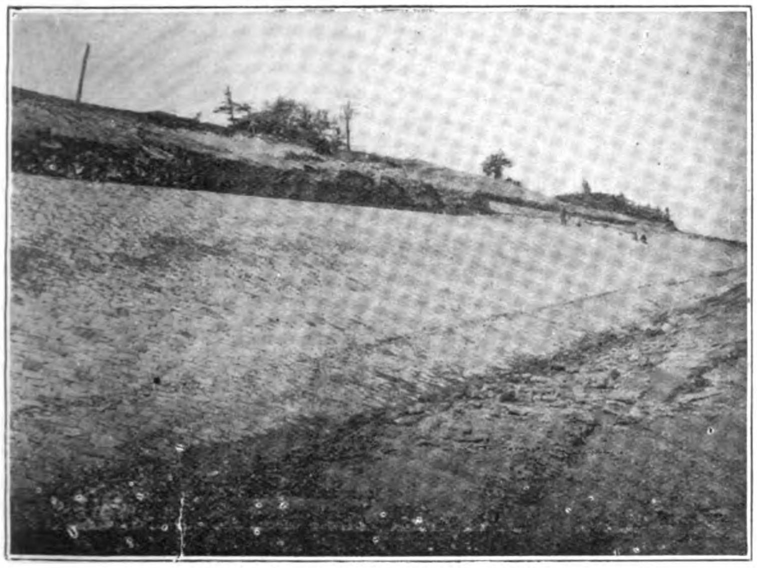
Third period: From Totte-machi to Shobane-mura, Sado-gun, Gunma prefecture, 68¾ miles.

At Sawara-machi, the Tonegawa suddenly turns to the north for about 2½ miles, and there the river bed is extremely narrow and shallow, so much so in fact that the flood tide of the river cannot pass up stream. Consequently it has always flowed back to the Yokotone river and through it pours into the lagoons, Kasumiga Ura, Kita Ura, and Sakanami Ura, causing serious damage on its way. This was the first period work, and construction was completed in 1909. A new channel has been dug by straightening the sharp turns in the river, and by deepening and widening its bed.

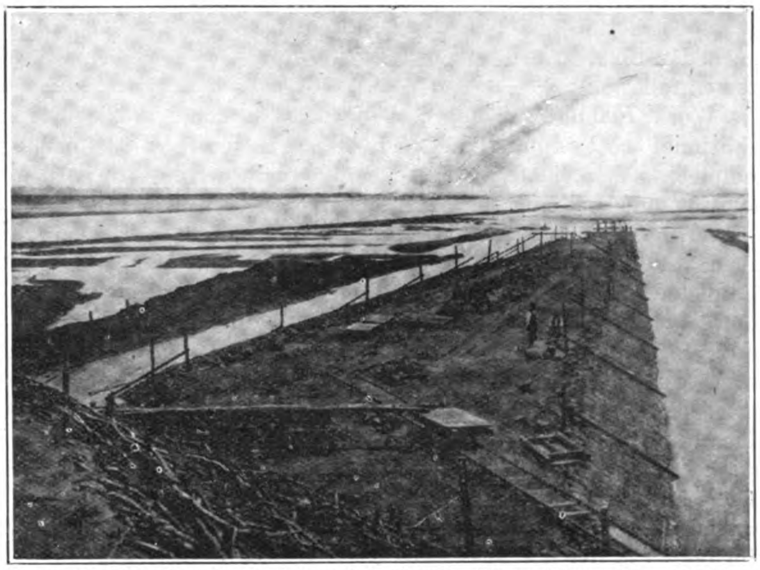
Fukugawa Water Gate under Construction (March 1921)



Embankment at Gyotoku New Water Channel



Embankment at Fusa (May 1921)



Protection Work at the Junction of the Kinu and Tone Rivers (Apr. 1919)

Tone River Improvements

## SECOND PERIOD.

Between Totte and Sawara the width of the river was to be increased to 1,800 feet, but between the two towns of Munokawa and Nunose the river is so narrow that it was impossible to widen it. The bed was accordingly dredged and a very deep channel constructed so that a maximum flow of water would carry off all the floods. Between Takaoka and Sawara the river has always been changing its bed, and it was determined to remedy this by constructing a new artificial channel in a straight line between the two towns, which would cross the bed of the old river.

The Shogengawa, one of the branches of the Tonegawa, was controlled by building a water gate at its outlet. This prevents

any back flowing, and at the same time periodic floods of the banks of the lagoons, Inbanuma and Teganuma, are done away with by the absolute control of the stream by the water gate. The Yokotone river was also controlled by a water gate, so that the inflow of water to the Kasumiga Ura lagoon was stopped.

### Third Period.

Between Shibane and Totte, the Gongendogawa is to be shut off from the Tonegawa and water pipes will be placed there to carry off the water supply to Tokyo. The Kinugawa meets the Tonegawa at an angle of 90 degrees, and to better its flow it will be deepened. The Yokotonegawa which meets the Tonegawa opposite the town of Sawara is to be controlled by a 36 feet wide water gate, preventing flood waters from entering lagoons. Communication between the Tonegawa and the lagoons will not be interfered with by this water-gate, as locks are being built to handle the traffic. The outlets of the lagoons, which meet the Tonegawa to the south of the Omigawa, are all to be closed, and an artificial channel will be constructed to a point on the Tonegawa at Tachibana-mura, thus effecting a lowering of the water level of the lagoons and release many acres of valuable land for agricultural purposes.

### The Edogawa

Navigation of the Edogawa which connects Tokyo with the Tonegawa is extremely important and so that it may not be interrupted even in times of flood, a new channel is to be dug at Sanno in Goko-mura, The entrance to the new channel will be 930 feet wide, and the flow will be controlled by eight water gates, each 25 feet wide. A ditch 30 feet wide is being constructed along the right bank of the river, and this will be used to carry off any flood waters. From Gyotoku the channel is very tortuous, and this is being straightened out. From Sekijuku this river is to be 840 feet wide, until it reaches the river mouth where it is to be 1,320 feet wide.

Construction of these works is almost completed, and will be finished in 1923. At the end of 1921, the actual state of construction was as follows :

Work Planned: Total cost of construction, Y.52,380,448: additional cost approved, Y.11,078,884: total Y.63 459,332; completed, Y.48,938,698; 75 per cent: quantity of earth used for building new embankments: total, 10,554,007 *tsubo*; completed, 9,612,673 *tsubo*, including 6,186,695 *tsubo* of earth dredged: 88 per cent., dredging and excavating, area: total 16,895,962 *tsubo*; completed 15,854,864 *tsubo*; 90 per cent. Length of embankments completed, 275 miles; embankments for regulating flood streams: total, 137,155 *ken*; completed, 69,883 *ken*; 60 per cent. Special water gates: total 20; completed, 14. Bridges: for carrying water pipe, over main stream, etc.: total, 190; completed, 186 places. Land purchased total scheme, 7,609 *cho*: actually purchased, 6,606 *cho*. Buildings to be removed covering 199,758 *tsubo*; completed, 235,078 *tsubo*. Although work done exceeds estimate, there still remain some buildings to be removed in Matsuod and Ichikawa districts. Cost of construction to March 31, 1922: Y.48,938,698.32.

In carrying out the improvements many millions of yen have been expended in the most modern excavating machinery, all of which will later be available for use on other river works in other parts of Japan. The department of home affairs has furnished The Far Eastern Review with the following inventory of equipment now in use (exclusive of machine shop equipments):—

| | Capacity | Number. |
|---|---|---|
| Locomotives .. | 20 tons | 23 |
| Steam shovels .. | 200 *tsubo* (in 10 hours) | 18 |
| Dump cars .. | 18 cu. ft. | 1,765 |
| Dredgers .. .. | 400 *tsubo* (10 hours) | 2 (illustrated) |
| " .. .. | 200 " | 6 |
| " .. .. | 100 " | 5 |
| " .. .. | 70 " | 1 |
| " .. .. | 50 " | 1 |
| " .. .. | 40 " | 1 |
| Dredgers .. .. | 25 *tsubo* (10 hours) | 1 Total 17 dredgers |
| Tugs .. .. .. | 43 h.p. | 1 |
| " .. .. | 20 h.p. | 3 |
| " .. .. | 14 h.p. | 3 |
| Earth carrying flat boats .. | 10 *tsubo* | 16 (steel) |
| " .. | — | 508 (wood) |
| Railroad .. .. | 60-lb. rails | 23 miles |
| " .. .. | 30 " | 108 " |
| " .. .. | 12 " | 85 " |
| " .. .. | 9 " | 99 " |
| Cars for transporting earth .. | 9 sq. ft. | 3,549 |
| " .. | 7 sq. ft. | 3,650 |
| " .. | " | 5 (iron) |
| Rock drills .. .. | 5 h.p. | 3 |
| Travelling steam cranes .. | 8 h.p. | 17 |
| " .. | 5 h.p. | 1 |
| " .. | 3 h.p. | 5 |
| Centrifugal pumps | 900 gallons per second, | 7 |
| " | 550 " | 3 |
| " | 400 " | 11 |
| Steam pile drivers weight of poise | 0.74 tons | 1 |
| " | 0.6 tons | 1 |
| " | 0.5 tons | 1 |
| Concrete mixers .. | 17 cu. ft. | 2 |
| " .. | 11 " | 7 |
| " .. | 6 " | 1 |
| Superintendent's launches .. .. | 20 h.p. | 1 |
| " .. .. | 10 | 2 |
| " .. .. | 9 | 2 |
| " .. .. | 6 | 4 |
| " .. .. | 5 | 2 |

*Tsubo*=36 sq. ft.: *Ken*=6 feet.

## Far Eastern Timbers (*concluded from page* 140)

The matter is also complicated by reason of the fact that a bamboo specimen is divided into sections, by divisions at right angles to its axis.

It would, of course, be very much better to have even very rough and approximate figures concerning this interesting Far Eastern wood than to have none at all. No doubt, in the course of time, some such figures will be available.

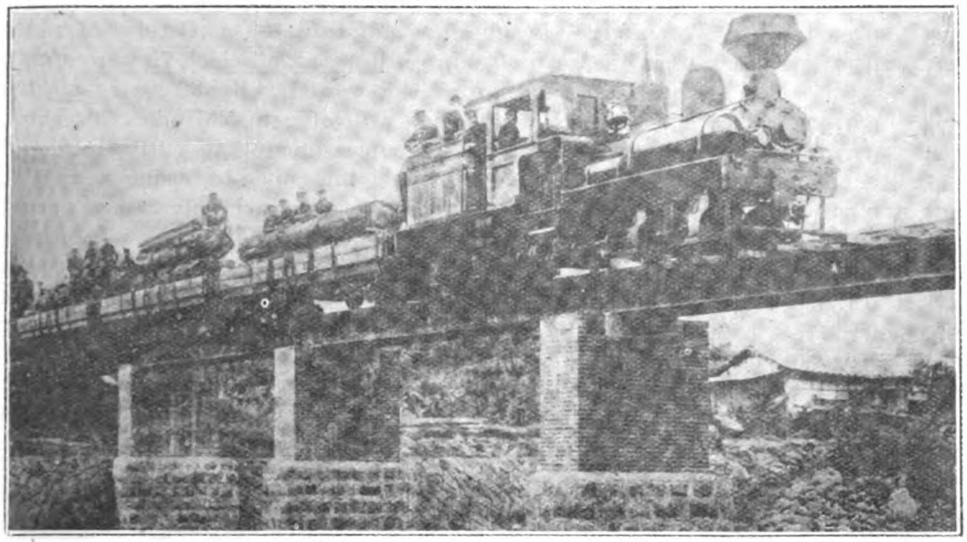
Concerning the woods of China, it may be added that every encouragement should be given to schemes for reaforestations. Apparently, in the struggle for survival carried on for centuries by the inhabitants of China. More and more land has been used for agricultural purposes and the trees of the country have not only had to provide fuel but they have been cleared in order to make room for land under cultivation. This process is apparently continuing at such a rate as to cause the utmost concern to those scientists who have carefully considered the matter.

The fact that such a great proportion of the timber used by engineers in China are imported suggests that it is time that some attention is given to the subject of providing native timber.

We cannot altogether separate this problem from the general question of the development of the natural resources of China. If coal were available all over the country less wood would be consumed as fuel.

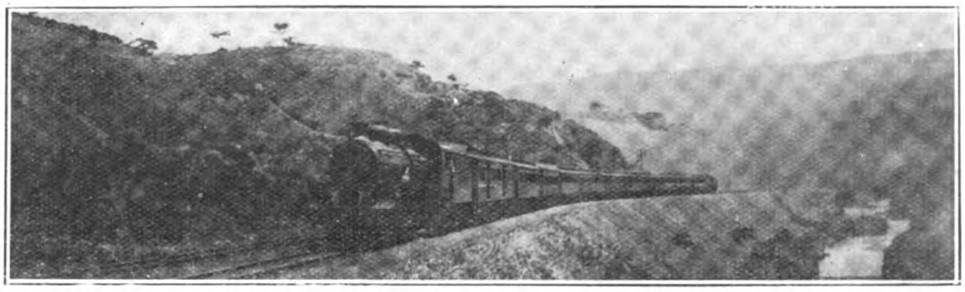
At present, it seems that a great deal of timber is imported from South Eastern Asia and America. There are fairly complete records of the physical properties of the timber from America. These are to found in American publications. It is hoped that the figures given above concerning the physical properties of Far Eastern woods will lead to the publication of further date obtained in other parts of the Far East.

# Private Railways and Tramways in Japan



Logging Railway in Formosa: Shay Geared Locomotive

ACCORDING to a report of the department of railways dated October 1, 1922, the number of private railways open to business in Japan was 156, with a total mileage of 2,256 miles. Steam railways were 131, with mileage of 1,892 miles. Electric railways, including three electric cable lines were 25 in number, with a total of 204 miles. The balance of ten railways were mixed steam and electric power, with one line operating hand-pushed cars.



The Limited Express of the Imperial Government Railways in the Hakone Pass

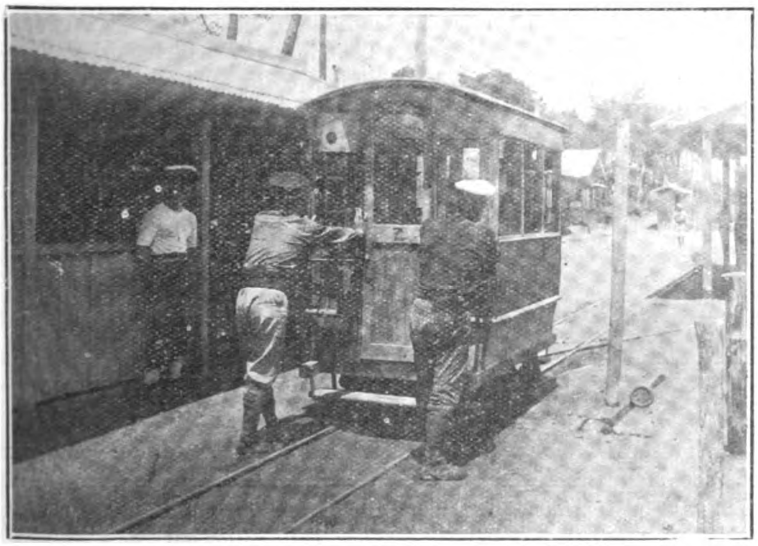
The capital of these companies amounted to Y.388,967,951, of which Y.235,735,451 represented the steam railways, and Y.79,-942,500 that of the electric railways, and Y.71,490,000, the capitalization of the other ten lines. Costs of construction for all these lines was Y.213,018,989, of which Y.149,937,857 went into the steam lines.

There were 93 railway companies licensed to begin construction of 66 steam lines and 27 electric lines with a total mileage of 1,070 miles. Estimated costs of construction are Y.113,014,865, of which Y.58,520,947 represents the costs of the steam lines, and Y.48,847,283 that of the electric lines.

Besides these companies licensed to construct, there were 119 companies who had obtained licenses to lay railway lines over a total of 1,627 miles. Of these lines 65 are steam railways, with a mileage of 1,008 miles. There are 44 electric lines, with a mileage of 554 miles, there are also seven electric cable lines, and two underground railways licensed also. Besides these lines two others to be operated by gasoline motor car have been licensed. Their mileage is 5.2 miles, and costs of construction are estimated Y.220,000.

Working results: The per mile per day income of 99 private railway companies in Japan, having a 3-ft. 6-in. gauge, amounted to Y.0.63571 during 1921, and in 1920 to Y.0.5843. The income of the 46 railways having a 2-ft. 6-in. gauge in 1921 was Y.0.27244, slightly below that of 1920, Y.0.27263. The 3-ft. 6-in. gauge railways increased their income 8.7 per cent., but that of the 2-ft. 6-in. gauge lines decreased by about one-tenth of one per cent.

The narrow gauge lines show a total revenue decrease of 39.2 per cent. for the year 1921, but this is offset by a decrease in operating expenses amounting to 11.5 per cent. The 3-ft. 6-in. gauge lines increased total profits by 22.3 per cent. in 1921.



Typical "Push Car" Tram Line in Japan: There are 11 companies operating 51 miles of such lines in Japan

The Horse Car is still found in Japan's Rural Districts: 49 companies operated 146 miles of these lines

The following table shows details of income, and expense of these two classes of railways; per day per mile:—

1. *3-ft. 6-in. Gauge Lines.*

| | 1921 | 1920 |
|---|---|---|
| Income .. .. .. .. .. | Y.0.61777 | Y.0.58430 |
| Itemized: | | |
| Passenger traffic .. .. .. .. | 0.39373 | 0.38031 |
| Freight Traffic .. .. .. .. .. | 0.21331 | 0.17150 |
| Miscellaneous income from railway operation .. .. .. .. .. | 0.01073 | 0.01273 |
| Miscellaneous income .. .. .. .. | 0.01794 | 0.01976 |
| Total Income .. .. .. .. | Y.0.63571 | Y.0.58430 |
| Expenses | 1921 | 1920 |
| Upkeep of line .. .. .. .. .. | Y.0.06412 | Y.0.05652 |
| Costs of rolling stock .. .. .. .. | 0.13488 | 0.15620 |
| Operation of trains .. .. .. .. | 0.07977 | 0.07715 |
| Taxes .. .. .. .. .. .. .. | 0.03701 | 0.03030 |
| General costs, business expenses, etc. . | 0.03346 | — |
| Total Expenses .. .. .. .. | Y.0.34924 | Y.0.35006 |
| Profit .. .. .. .. .. .. | Y.0.28647 | Y.0.23424 |
| Percentage of business expenses compared to business income .. .. .. | 54.9% | 59.9% |
| Average cost of construction of one mile opened to business .. .. | Y.93,404.00 | Y.83,058.00 |
| Percentage of profit compared to cost of construction .. .. .. | 11.3% | 9.9% |

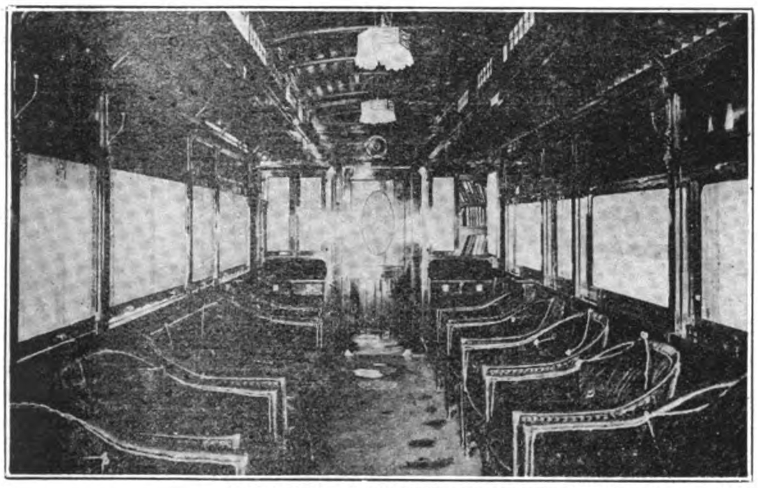
2. *Gauge 2-ft. 6-in. (46 companies).*

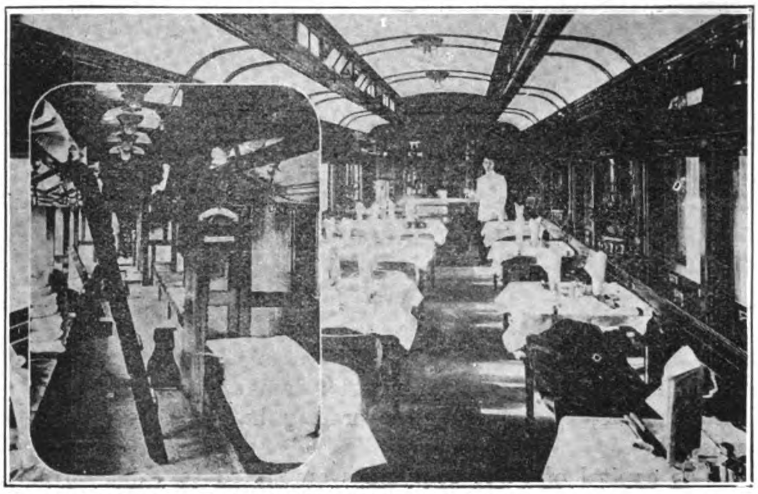
| | 1921 | 1920 |
|---|---|---|
| Income .. .. .. .. .. .. | Y.0.26244 | Y.0.25948 |
| Passenger traffic .. .. .. .. | 0.17582 | 0.17156 |
| Freight traffic .. .. .. .. | 0.08688 | 0.08612 |
| Miscellaneous income from railway operation .. .. .. .. | 0.00504 | 0.00180 |
| Miscellaneous Income .. .. .. | 0.00470 | 0.01315 |
| Total Income .. .. .. | Y.0.27244 | Y.0.27263 |
| Expenses | | |
| Upkeep of Line .. .. .. .. | Y.0.03707 | Y.0.03738 |
| Costs of rolling stock .. .. .. | 0.07951 | 0.10550 |
| Operation of trains .. .. .. .. | 0.03192 | 0.03917 |
| Taxes .. .. .. .. .. .. | 0.01380 | 0.01759 |
| General Business expenses .. .. | 0.01770 | 0.01163 |
| Total Expenses .. .. .. | Y.0.18700 | Y.0.21927 |
| Percentage of business expenses compared to business income | 68.7% | 77.5% |
| Average cost of construction per mile opened to business .. | Y.47,321.00 | Y.43,144.00 |
| Percentage of profit compared to cost of construction .. .. | 6.8% | |

*Tramways. (Light Gauge Railways).*—On October 1, 1922 there were 97 electric tramways licensed, of which 70 were opened to business. Mileage in operation was 851 miles 33 chains, and the lines not yet open to business will operate 536 miles 30 chains. The capitalization of these companies amounts to Y.916,568,581, of which Y.848,524,581 is that of the lines open to business.

Of 32 steam tramway companies licensed, only 27 had opened lines to business, a total of 264 miles 66 chains. New franchises will add 129 miles 11 chains, and of this total 65 miles and 78 chains have been licensed for construction. The capitalization of the companies open to business is Y.15,536,360, and of those not yet open to business Y.1,270,000, a total of Y.16,806,360.

The mileage of the lines operated by gasoline motors open to business was 37 miles 37 chains, owned by six companies. There are nine more companies licensed to construct 112 miles 19 chains.





**TRAVEL DE LUXE ON THE LIMITED EXPRESS OF THE IMPERIAL GOVERNMENT RAILWAYS**

**The Observation Car**

**Sleeping and Dining Car, attached to all Express Trains**

The capital of this group of companies amounts to Y.4,825,000, and Y.855,000 represents that of the companies now in operation.

This same report shows that on October 1, 1922, there were 49 companies licensed to operate horse tramways, of which 32 were open to business. Lines opened to business operated 146 miles 75 chains of track. Another 135 miles 13 cdains are licensed for construction, and 19 miles 13 chains to begin work. The capital of all these companies is Y.18,588,350, of which Y.16,422,000 represents that of the companies open to business.

**Central Railway Station at Kyoto**

Tram lines operated by hand pushed cars are still in existence. At the date of the report there were 11 in operation, and 16 licensed. There were 51 miles 40 chains of lines open to business, and 22 miles 2 chains licensed to begin work, and 19 miles 66 chains licensed to construct. The capital of these companies amounts to Y.1,831,-059, of which Y.1,360,159 is that of the companies open to business.

# Coal Mining in Japan; Past and Present

## Past

NO record of the first use of coal in Japan exists. Tradition dates it in the fifteenth century, and it is known that in 1702, coal was in general use among the people of Chikuzen and Nagato provinces in the island of Kyushu. It was in common use for cooking and heating the bath.

In 1721 the great Miiké, coal field was discovered in Hiranomura, Miiké-gun, Chikugo province, Kyushu ; and the Takashima field was found towards the end of the eighteenth century. In the Tempo era (1830-1843) a field of anthracite coal was uncovered in Shimosujima, Amakusan, Kyushu, and in the same era many of the most valuable fields still worked were discovered in Iwaki province and in the Hokkaido. The domestic use of coal was naturally very limited, especially as the daimyo controlled the use and production by sumptuary laws. Interest in coal as a fuel was stimulated in the Meiwa era (1765-1773), when means of using coal in the manufacture of salt was discovered ; markets for transactions in coal was opened in the central districts of Japan, and the island of Shikoku, where the coal commission business is still centered. The first recorded coal selling business—coal broker—is found in the Tempo era.

When the king of Holland in 1885 presented the Shogunate with a steamship, tke government, at once, prohibited the sale of coal to private persons because practically all the lump coal then mined was needed for the operation of this vessel. The annual production of coal at that time was limited by the law of the daimyo of Chikuzen to 100,000,000 *kin* (about 52,000 tons). Mining method were most primitive, because of the complete absence of machinery for excavation and lack of engineeiing knowledge, it was only possible to cut the outcrop seam by horizontal shallow pits. The only vertical shat in 1855 was at the Onoura pit in the Miiké field. This shaft was 40 feet deep, and had a horizontal extension of 230 feet.

Foreign mining methods were introduced in 1867 at the Takashima Mine. The results obtained caused a revolution of thought among the coal mine owners, but the disturbances of the Meiji restoration for some years retarded the development of modern methods. In 1869 the new government issued an order that license to mine coal should be granted to all persons applying for them, but until the diamiate governments were abolished in 1873, no progress was made in developing the coal resources of the country. As soon as the diamiate restrictions were done away with a great increase of interest in coal mining began, and for a time the business of mining coal became so brisk that a panic was almost brought about by its too rapid and unconsidered expansion.

The new government as successor to the daimyo governments assumed ownership of the Miiké and Takashima mines. It at once put the Takashima Mine under the direction of a foreign engineer, and the Onoura pit of the Miiké field was equipped under foreign direction with the most improved and efficient machinery.

The new law caused a remarkable development of coal mining between 1873 and 1892, by private capital. The government released its control of the Miiké and Takashima mine after a very short period of operation, and private enterprise opened and exploited new fields, still worked, at Tagawa, Babazan, Meo, Takao, Toyokuni, Akaike, Kaho, Tadakuma, and Katsuno in Chikugo. The first mining guild was organized in Chikuho during these years.

In 1873 the government began a mineral survey of the Hokkaido under the supervision of an American engineer, and in 1889 a loan of Y.1,500,000 was made by the government to the owners of the Horonai and Ashinuma mines for development purposes. In 1889 the Hokkaido Tanko Kisen K. K. was established with a capital of Y.6,500,000, purchasing the Horonai, Ikuharubetsu and Sorachi mines from the government, and later absorbing the Yubari coal mine.

In the Iwaki district such mines as the Shiramizu, Ishizawa, Onigasawa, Kumakake and Tayazawa were opened, and in 1883 the Iwaki Tanko K. K. was organized to absorb the Onoda Tanko K. K. in this district.

As the result of the opening of all these new mines, the production of coal rapidly increased, and it reached 3,000,000 tons. This was an increase of 1,500 per cent. compared with 1874.

These years of expansion were also years of improvement of equipment. In 1871, the Takashima mine drove a vertical shaft 130 feet deep. The first machine operated by steam power used in a Japanese coal mine was installed in a Chikuho mine in 1881, and at once great haste was made by all other miners to follow this example. Shaft winches were operated by steam machines and a great revolution in the coal mining industry at once followed. Colliery railways were introduced in 1880 ; the fiist being laid between Temiya and Horonai in the Hokkaido. In 1887 a light railway was constiucted between Onoda and Onahama in Iwashiro province, and the port of Moji for shipment of coal from Kyushu was opened opposite the city of Shimonoseki on the Kyushu shore. In 1891 the railway between Wakamatsu and Naokata was completed, and the harbor of Wakamatsu was dredged to accommodate deep draft vessels. Piers for handling coal shipments were also constructed, so that this harbor became Japan's most important coal shipping port.

As the industry expanded, and the needs of the homestic market were met, interest in Japanese coals began to show itself in China, so that exports to Hongkong and Shanghai had begun before the Chinese-Japanese war. The general advance in all industries which followed that war increased demand for coal in the domestic industries, and the highest point of prosperity ever known by the coal miners, until the European war, was reached in 1898-1899. Most of the coal mining enterprises in Kyushu were begun during the period after the Chinese-Japanese war. Like other of Japan's industries, the prosperity of the coal mining industry has been greatly advanced by the Russo-Japanese war and the great war.

## Present

The latest figures available for a study of coal mining in Japan are those published by the department of agriculture and commerce for the fiscal year ended March 31, 1921. According to them in that year there were 731 coal mines which were in active operation over an area of 419,484,815 *tsubo* (*tsubo*=36 sq. ft.), while there were 1,066 mines licensed to open mine area of 363,393,126 *tsubo*. This is a marked decrease when compared with operating mines in 1919, when there were 789 mines in operation, covering an area of 424,913,811 *tsubo*. The decline in manufacturing consequent on the panic of April, 1920, adequately accounts for this falling off. Until the beginning of 120 there was a very marked advance in the increase of coal production, but in the latter half of zhat year, many mines were obliged to stop work, either temporarily, or as has turned out in many cases, permanently.

The annual production of coal in Japan, excluding Formosa and Chosen, was on the increase year after year until the industrial depression of 1920 gave the industry a serious setback. The

figures of production given in the following table are from the official government reports :—

| Year | Quantity | Value |
|---|---|---|
| 1877 .. .. .. .. .. | 499,106 tons | Y. 1,036,490 |
| 1887 .. .. .. .. .. | 1,746,296 | 3,077,010 |
| 1897 .. .. .. .. .. | 5,188,157 | 18,993,843 |
| 1902 .. .. .. .. .. | 9,701,682 | 32,240,580 |
| 1907 .. .. .. .. .. | 13,803,969 | 59,961,264 |
| 1911 .. .. .. .. .. | 17,632,710 | 55,006,501 |
| 1912 .. .. .. .. .. | 19,639,655 | 61,412,837 |
| 1913 .. .. .. .. .. | 21,315,962 | 70,956,121 |
| 1914 .. .. .. .. .. | 22,293,419 | 80,350,387 |
| 1915 .. .. .. .. .. | 20,490,747 | 65,068,894 |
| 1916 .. .. .. .. .. | 22,901,580 | 80,625,582 |
| 1917 .. .. .. .. .. | 26,361,420 | 140,009,591 |
| 1918 .. .. .. .. .. | 28,029,425 | 286,032,498 |
| 1919 .. .. .. .. .. | 31,271,093 | 442,540,941 |
| 1920 .. .. .. .. .. | 29,245,384 | 418,073,754 |
| 1921 .. .. .. .. .. | 26,220,617 | 227,674,056 |
| 1922 (Jan.-Sept.) .. .. | 18,295,535 | —— |
| 1922 (whole year estimated) .. | 24,462,144 | |

Production in 1922 during the first nine months of the year increased 1,145,765 tons, about 6.7 per cent. when compared to the same months of 1921. The production of the leading coal mines in Japan amounts to about 85 per cent. of the entire production of the empire, excluding Formosa and Chosen, neither of these countries having sufficient supplies for its own use.

Coal production in Chosen and Formosa up to the end of the fiscal year ended March 31, 1921 is given in the following table.

| | *Chosen* | | *Formosa* | |
|---|---|---|---|---|
| Year | Quantity | Value | Quantity | Value |
| 1911 .. | 121,304 tons | Y. 539,497 | 252,898 tons | Y. 936,635 |
| 1912 .. | 127,870 | 557,802 | 276,246 | 976,584 |
| 1913 .. | 127,989 | 570,158 | 319,371 | 1,222,158 |
| 1914 .. | 183,262 | 510,752 | 342,787 | 1,311,129 |
| 1915 .. | 229,121 | 997,746 | 379,368 | 1,456,478 |
| 1916 .. | 190,760 | 819,221 | 509,887 | 1,905,696 |
| 1917 .. | 195,140 | 1,149,332 | 673,008 | 2,930,271 |
| 1918 .. | 188,623 | 1,515,873 | 801,520 | 5,501,363 |
| 1919 .. | 219,554 | 2,124,831 | 1,086,607 | 8,825,002 |
| 1920 .. | 289,036 | 3,917,153 | 1,139,368 | 9,148,809 |

Since the first exports of coal were made to South China, Japanese coal has been in ever increasing demand in the Far East, particularly for bunker coal, stove coal, and locomotive use. Exports, and import,—made principally from Manchuria, are given in the following table for the past three years :—

| | *Exports* | | *Imports* | |
|---|---|---|---|---|
| Year | Quantity | Value | Quantity | Value |
| 1919 | .. 2,000,679 tons | Y.37,723,540 | 699,646 tons | Y.18,588,181 |
| 1920 | .. 2,129,530 | 45,200,117 | 797,155 | 19,917,538 |
| 1921 | .. 2,387,709 | 37,814,960 | 777,255 | 14,092,993 |
| 1922 (Jan.-Nov.) | — | 20,967,000 | — | 14,843,000 |

(Figures of Department of Finance.)

Singapore and the Malay states are to-day the centre of competition for Japan's coal export trade. Coal mined in Africa and in India in addition to the domestic coal competes with Japan's exporters in these markets. During the past year, due, to the release of the prohibition on the export of coal from India, competition in the markets of the Far East was very severe, and the price of coal declined steeply, which accounts largely for the very low value of the exports last year.

The business depression continuing strongly to affect the coal mining industry, the miners in the Hokkaido and Kyushu districts entered into agreements to limit outputs during 1922 by an average of 15 per cent. of their total productive capacities. Average normal annual production is 29,00,000 tons but through this limitation of production production in 1922 was brought down to (estimated) 24,000,000 tons. The limitation was abolished in October, but it is not expected that the production for the year will be materially increased therefrom.

The limitation in production did, however, effect a gradual rise in price. The shipping price at Wakamatsu for No. 1 Kyushu lump, and of Hokkaido No. 1 lump, at Otaru and Muroran, ranged from Y.13.00 to Y.14,00, per ton, in the summer of 1921, but in 1922 rose to Y.17.00 to Y.18.00, with the approach of the winter season. Shipping and manufacturing companies, however, have failed to show any increase in demand, and the limitation of armaments has recently begun to show its effects on the coal market too, by decreasing the demand from the navy department. Generally speaking, it is believed that the market for Japanese coal, both at home and abroad, is now being materially threatened by the growing development of water power, and the substitution of petroleum for coal fuel. Coal operators look forward to an anxious period until such time as the manufacturing industries of the country have become more settled.

## Railways in the F.M.S.

(*Concluded from page 133*)

depth has been reached. A test load of 100 tons of kentledge, in addition to the weight of the concrete cylinder, was then applied, and no cylinder was passed as satisfactory until it had stood forty-eight hours without settlement under the total load, which is equivalent to five tons per square foot, and considerably greater than the ultimate load to be borne by the foundations.

At the beginning of this year a through fast weekly service was inaugurated between Penang and Bangkok in Siam, bringing the latter town within thirty-four hours of Penang and within sixty hours of Singapore. This service has been so successful that it is more than probable that it will be run twice a week in the near future.

The permanent way is composed of flat-footed rails spiked on to hardwood sleepers. The standard weight of rail for trunk lines is 80-lb. to the yard, and for the less important lines 60-lb. to the yard, both of British standard section. Throughout practically its whole length the track is ballasted witd stone ballast. A great deal of trouble has been experienced from time to time owing to wash-outs and floods consequent upon the deforestation of the country which its development entailed. The general raising of other areas from silt from tin mines has also necessitated a systematic raising of the line and bridges in order to keep above flood level. There are no remarkable bridges in the country, such long bridges as there are being multiples of 100-ft. or 150-ft. spans. Locally bridges as there are being multiples of 100-ft. or 150-ft. spans. Burnt bricks are used in the construction of culverts and bridge abutments, the bridges themselves being obtained from England.

The standard locomotive is of the " Pacific " type, and weighs, engine only, 55 tons. The present maximum axle load is 12 tons, but the future maximum now allowed for in specifications is 16 tons. A few " Mallet " type articulated locomotives are also in use. The fuel for these locomotives is now obtained from the Malayan collieries near Rawang, but previous to the development of this coalfield, Bakau wood, cut from the Bakau swamps, was entirely used. All the passenger vehicles are bogie stock, corridor type. The standard goods wagon is a 10-ton four-wheeled vehicle, but there are, of course, special vehicles in use.

Probably in no other country in the world has railway development been so rapid as in the Federated Malay States, and a most remarkable fact is that the money to construct this fine system of railways has been obtained from the revenues of the Federated Malay States as a whole.—*The Engineer.*

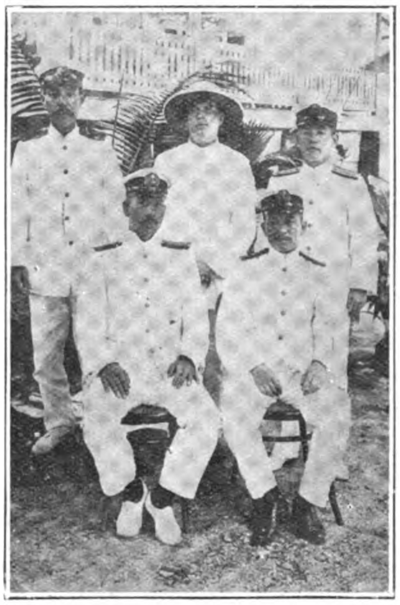
# The Marshall Islands

## Progress under Japanese Rule; Native Requirements Broadening with the Advance of Civilization

*By Thos. J. McMahon, F.R.G.S.*

AT a recent conference of the league of nations, Japan was praised for the humane government of the natives of the Pacific Islands now under her care by the powers of mandate. The writer has had the op- portunity of witnessing the efforts of the Japanese administration in the Marshall Islands.

This group of islands, or more properly atolls, lies to the north of the equator, and adjoins the British colony of the Gilbert and Ellice islands. The Marshalls are little more than 150 square miles, they possess a moderate tropic climate, and the present chief resource is copra, or coconut.



Administrative officials of the Marshall Islands and Mr. Thos J. McMahon

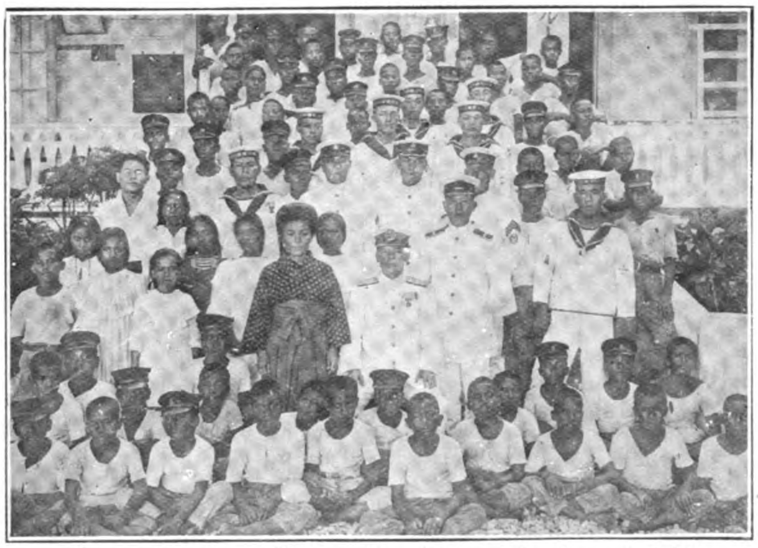
### German Misrule

Formerly the Marshalls were German owned, and the natives did not receive fair treatment, they dwindled away from some thirty thousands to a mere nine thousand. Under Japanese administration the islanders are assuming a new and more active life. They are awakening in their new civilization to a sense of importance; they are no longer a poor, and miserable race. In ten years time under the present conditions they will be a progressive people, healthy in body and mind, and the population will have considerably increased.

The Marshall islanders are undoubtedly developing a charming national character, three parts native, and one part Japanese. They are polite, and no official or stranger is passed without the low, sweeping, graceful bow of Japan. They never use the offensive word "Jap," it is distinctly "Japanese" at all times. At first they were not contented with the Japanese administration, but to-day they realize they are well cared for, and progressive.

### Schools and Hospitals

When in 1914 the Japanese took over the management of the Marshall Islands at the request of the allies, German laws and conditions were promptly replaced by those of Japanese. Every effort was made to stimulate trade and coconut production. A fine wireless plant was installed at Jaluit, the capital. A school, with Japanese teachers, men and women, was opened in the capital, boys and girls from every atoll were brought to the school, and a high standard of education begun and maintained, the Japanese language was made compulsory. The Marshall children are bright and intelligent and they quickly progressed under their teachers. Encouraged by this educational success the administration began at once the planning of higher grade schools, of rewarding pupils by making assured positions both administrative and commercial.



A Group of Japanese officers, petty officers and sailors at Jaluit, Marshall Islands. The lady is the Japanese School Mistress. The little boys in front are Marshall Islanders and school boys under Japanese teachers. The Japanese are in occupation of the islands for the Allies and have governed them well

The Japanese administration did not stop at this, they have accomplished much, and which is worthy of all praise, in tending the health and comfort of the natives. There is a large general hospital in Jaluit, with Japanese doctors, orderlies and trained nurses. The natives are encouraged to come from all parts of the group and be medically treated, and free of any charges. On any day of the week may be seen hundreds of natives, men, women and children around the hospital, all receiving kindness and medical skill.

### Brighter Social Life

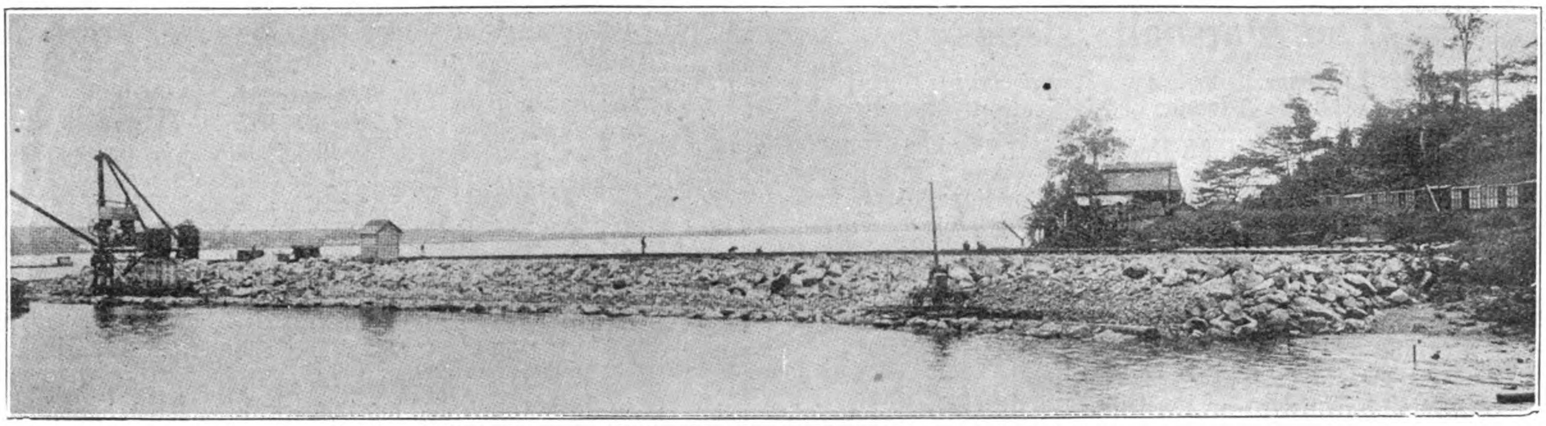
And more the Japanese administration has been and is very thorough in helping the native people to a brighter social life. The civilization of the people is most marked. Native houses are supplied with Japanese maps, pictures, almanacs, and books; colored portraits of the Japanese imperial family adorn the walls. Native women do up their hair as do Japanese ladies, they comb and scent it with combs and pomades made in Japan; their wardrobe is not complete without a Japanese fan, and a smart kimono. The Marshall Island chief carries a Japanese walking stick, his suits are made by Japanese tailors, or he wears a bright kimono. Japanese umbrellas are very common in the Marshalls. Indeed, in the last few years there has been generally a thorough domesticl social and national change in the Marshal, Islands.

### Industrial Encouragement

One of the first acts of the Japanese administration in taking over the Marshalls was to issue regulations that all waste lands on the atolls should be planted with the valuable coconut palm. The natives thought this was beyond their power, they complained they had not the numbers, or the labor to complete such a task. The administration insisted, and to-day many acres, once idle and wasted are soon to be fruitful, and the natives recognize how wise were the regulations. In ten years time the output of coconut in the Marshalls will be three times greater than what it was when the Japanese took over the group. The natives are pleased with results.

The possibilites of new industries in the Marshalls have not been overlooked. It is said that as time goes on, and administrative funds allow the natives will be encouraged in Panama hat making, in the manufacture of string, and rope from coconut fibre, in making dyes, in making mats, fans and other articles.

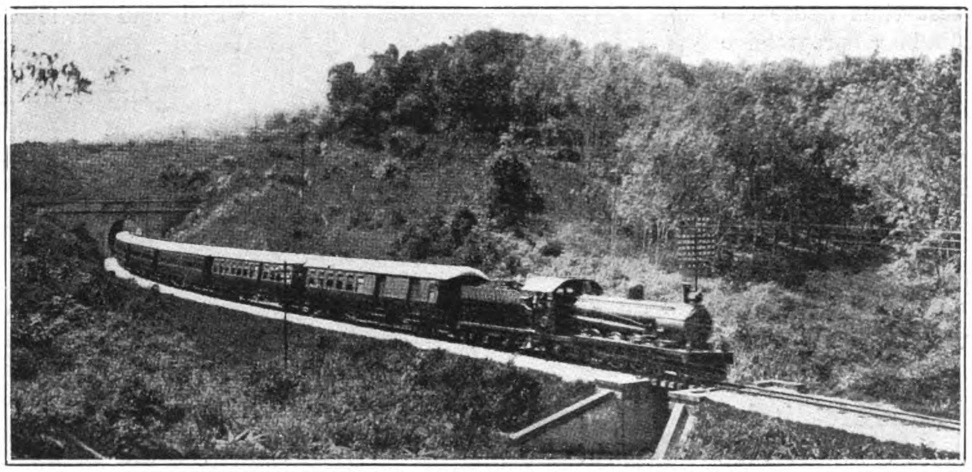
Such are the conditions obtaining in the Marshall Islands these days; passed over to Japanese protection they will be some day a commercial territory of importance. The natives are no longer "black barbarians" without hopes or ambitions." Stimulated by the example of the industrious Japanese they will be proud and prosperous, their lagoons will no longer be empty, but busy waterways of commercial activity.



Johore Causeway. South (Woodlands) End of Causeway in Progress

# Railways in the F.M.S.

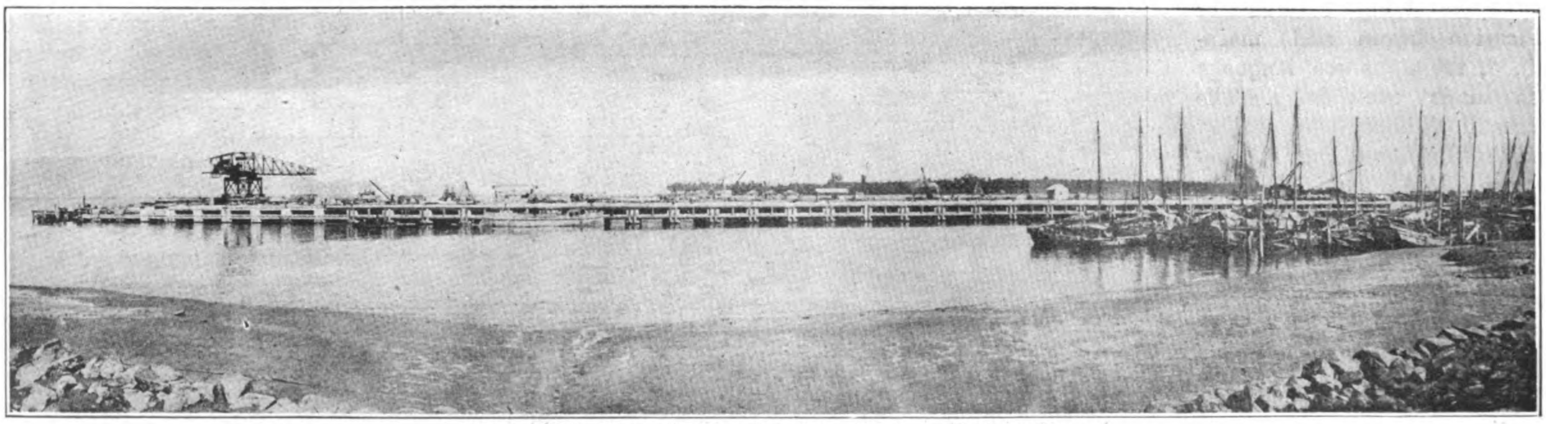
THE Federated Malay States Railways' system serves not only the Federated Malay States proper but also the Straits Settlements and the Unfederated States of Kedah, Perlis, Kelantan and Johore. Of the 1,020 miles of line open for traffic, the Federated Malay States government owns all but 120 miles running through Johore state. The entire system is operated by the Federated Malay States Railways, the Johore line being leased to it by the Johore government. The first length of line laid was from Taiping to Port Weld, in Perak, a distance of eight miles. This line was built by Perak state, and was opened for traffic on June 1st, 1885. In the following year the first line in the state of Selangor was opened from Kuala Lumpur to Klang, a distance of 21½ miles.



Train of New Boat-Type Carriages Approaching Seremban.

Steady progress was maintained in both states, and in 1901 the first general manager and chief engineer was appointed to control both the Perak and Selangor State Railways. The mileage open for traffic by the end of 1901 had increased to 244, of which 97 were in Selangor and 147 were in Perak. By the end of 1903 the mileage open for traffic had increased to 340, the two systems had been linked up, and through communication was established from Penang in the north to Seremban in Negri Sembilan. It is interesting to recall that the first through passenger train from Perak was one conveying his highness the sultan of Perak and suite from Kuala Kangsar to Kuala Lumpur on the occasion of the second and last conference of chiefs of the Federated Malay States.

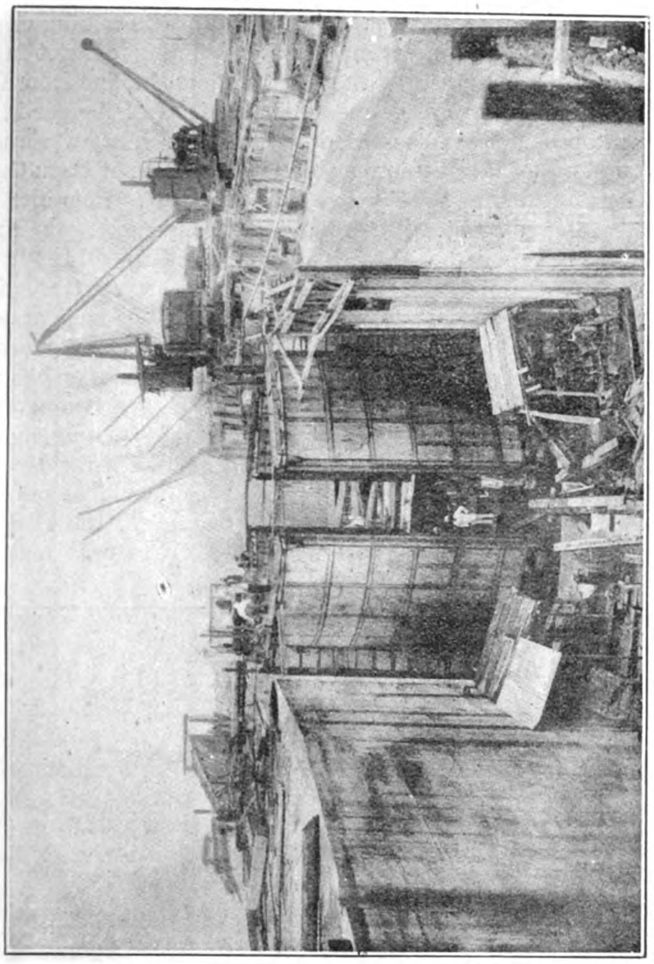
During 1904 the main line was carried further south towards Malacca and Johore state. An agreement was also completed with the government of the latter for the construction of a line from the Federated Malay States frontier to Johore Bahru opposite Singapore island, and the construction of this line was started from the southern end in December, 1904, and from the northern end in March, 1905. This line ran through jungle for practically its whole length, and when the survey started in March, 1904, great difficulty was experienced owing to the total lack of communications over 100 of the 120 miles the line was to cover. Except in the vicinity of Johore Bahru itself, roads were unknown. The first portion of this line to be opened was a section of 16 miles



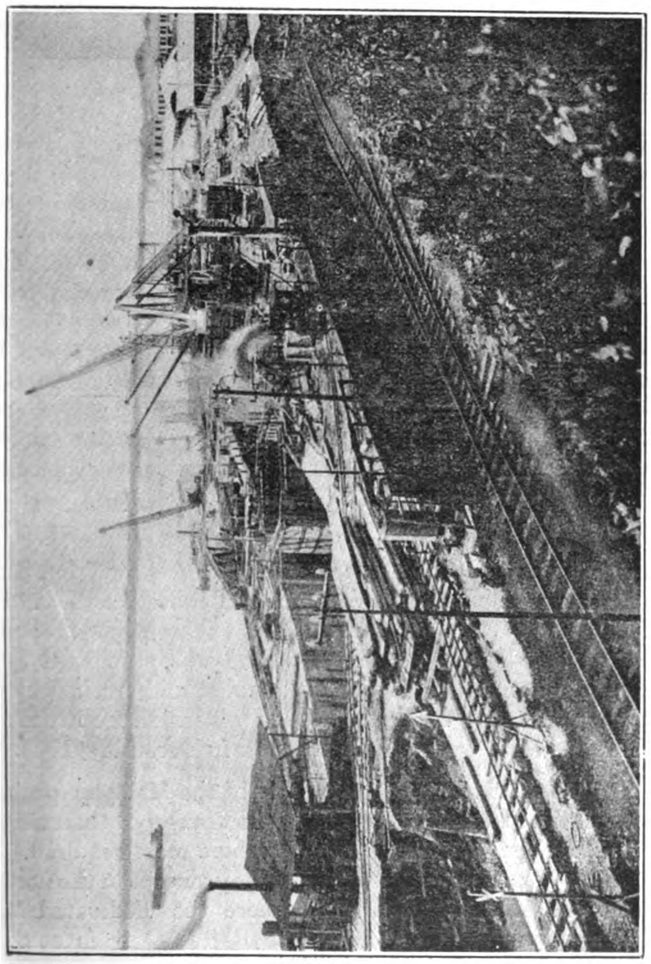
Prai. Side View of Jetty taken from Southern Reclamation

# F.M.S. RAILWAY IMPROVEMENTS 1922-23

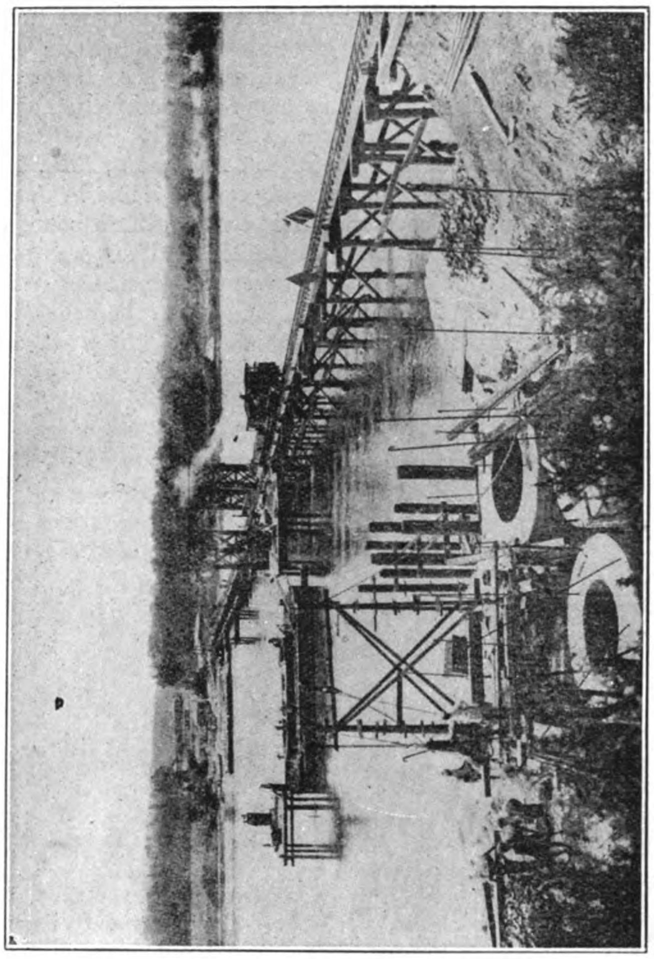
## THE JOHORE CAUSEWAY



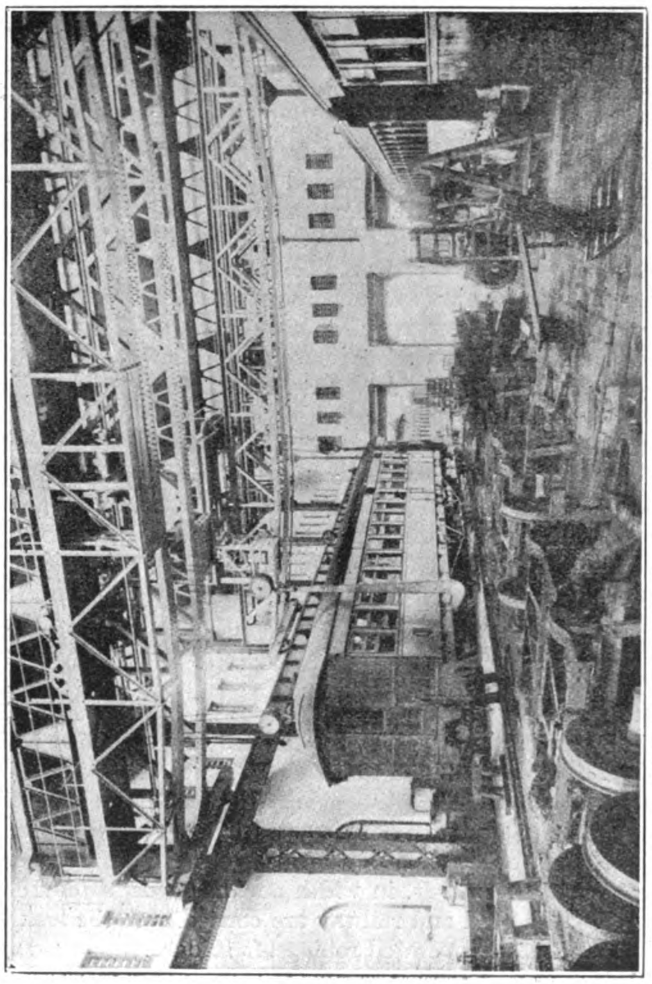
Johore Bahru. View of Lock, Looking West



Johore Bahru. General View of Lock and Commencement of Causeway



Kelantan Bridge: Foreground, North Abutment, then Pier No. 1: Cofferdam for Pier No. 2: then Sand Bag Island for Pier No. 3

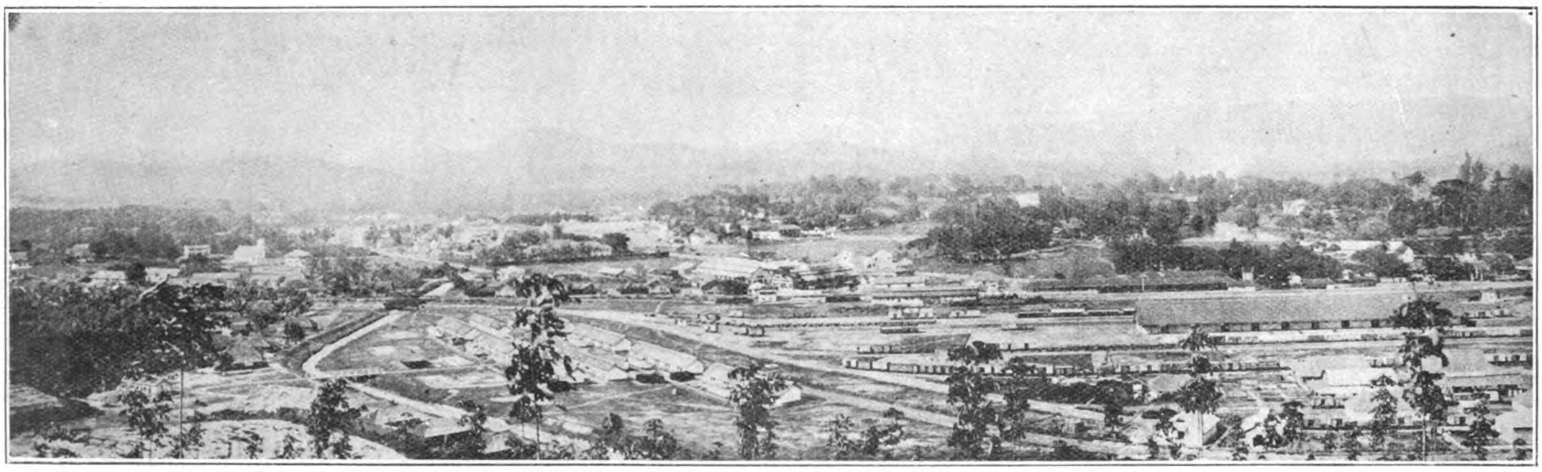


Central Workshops, Kuala Lumpur: Overhead Cranes in Carriage Shop

from the Negri Sembilan border to Segamat on March 1st, 1908. By August, 1908, 70 miles were ready for traffic, but were not opened, as the Johore government wished to have the whole of the remaining portion of the line opened at the same time. This was done on July 1st, 1909, and through communication was thereby established between Penang in the north and Johore Bahru in the south. Following close upon this came the completion of a wagon ferry across the Straits separating Singapore island from the mainland, which was put into service on January 1st, 1910.

The Singapore government had already opened a line in January, 1903, running from Woodlands on the northern shore of Singapore island to Singapore itself, 19½ miles, and this was purchased by the Federated Malay States government in 1913. With the inclusion, in 1912, of the Johore State Railway in the Federated Malay States administration, and the extension of the main line through Kedah to Alor Star, the capital of that state, in 1915, and subsequently through Perlis to the Siamese frontier at Padang Besar in March, 1918, the Malay peninsula found itself with a well-equipped railway worked by one administration, offering transport facilities from end to end of the peninsula and a service for both goods and passenger traffic, which, it is asserted, is not surpassed by that of any other colony or protectorate.

Sight has not been lost of opportunities for linking up coast towns and for opening feeder lines. As far back as 1893 the port of Teluk Anson in Perak as linked up to the main line at Tapah-road, serving an important rubber-growing and tin-mining centre. The Kinta valley—the most important tin-mining district in the world—was further tapped by the construction of a line from Ipoh (Perak) to Tronoh, 16 miles, opened in 1905. In Selanger in the same year a branch line was opened to serve the railway workshops, on the outskirts of Kuala Lumpur, and the quarries at Batu Caves, where there are unlimited supplies of road metal. This also is a rubber-growing district. Tin mines at Ampang, near Kuala Lumpur, were supplied with a line constructed in 1914. In the following year an important branch line was opened for traffic from the Malayan collieries at Batu Arang, joining the main line at Kuang, seven miles away. This branch has since been extended for seven miles towards the west coast. Port Swettenham, on the west coast, five miles beyond Klang, to which point the first Selangor line was built in 1886, was connected up in January, 1889, and shipping has grown rapidly, since Port Swettenham offered facilities which the older port of Klang, served only by river, could never offer. Ships of the most prominent goods lines trading to the East can be seen here at any time discharging machinery, railway material,



General View of Seremban: Showing New Goods Shed, Hump Yard and Station

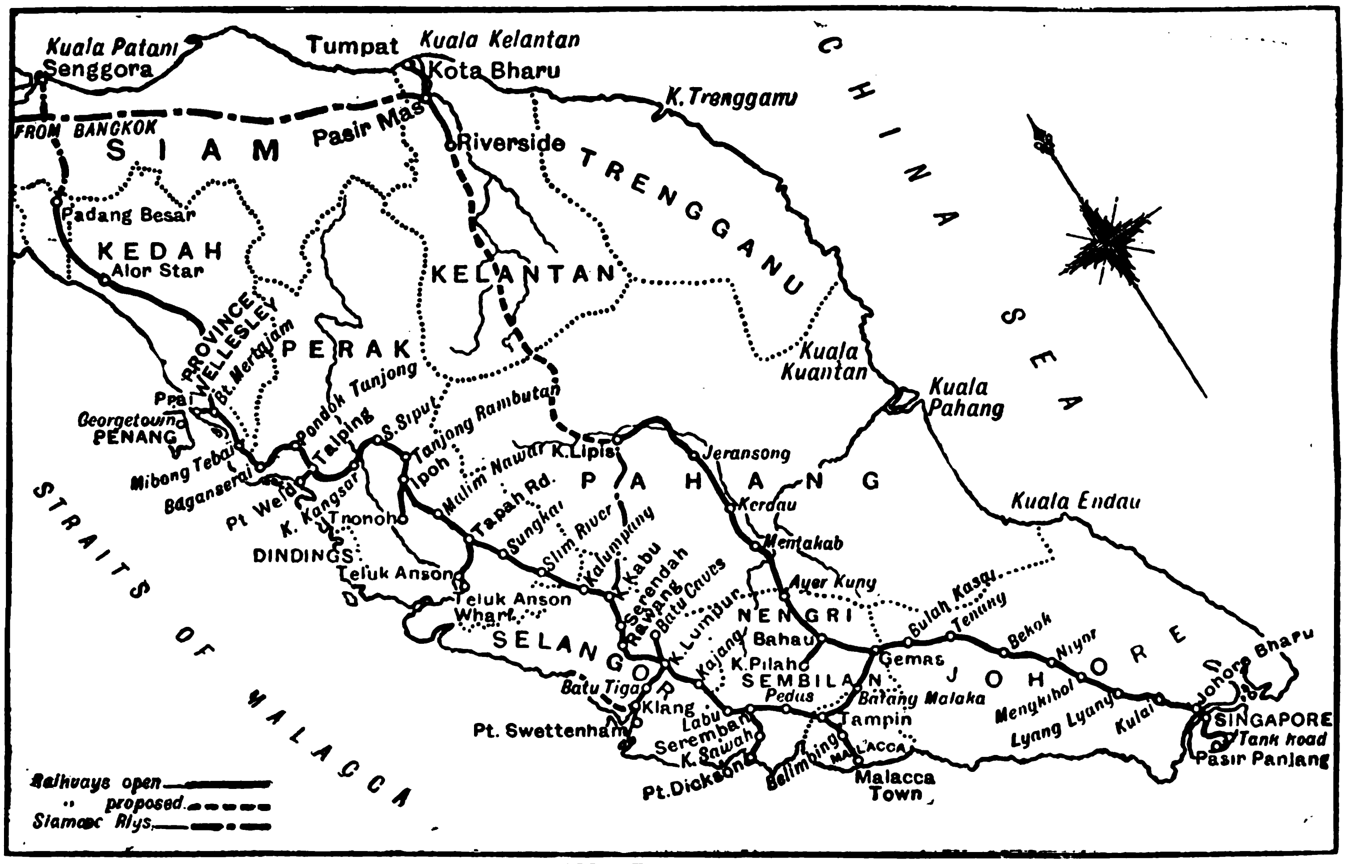
Goods traffic across the Straits from Johore Bahru on the mainland to Singapore island is carried by wagon ferries, transshipment thus being obviated. Passengers are taken over by a passenger launch, but a causeway across the Straits is at present being constructed, and, when that is completed, trains will be run right through to the centre of Singapore itself. In addition to two lines of rails this causeway will also carry a road. The distance across is 3,480-ft. For various reasons, however, including that of the enhanced cost of materials, it was decided to construct a causeway, which consists of a large bank of granite rubble extending across the Straits from Johore Bahru station on the mainland to a point about 350-ft. north-east of Woodlands on the Singapore side. The total length of the structure is about 3,480-ft. The bank is situated in a considerable depth of water, the average being 47-ft. at low water. It has a width at the top of 60-ft., which affords room for a double line of railway, and a 26-ft. 6-in. roadway for vehicular traffic, which is protected on the outer or water side by a concrete parapet wall, and is divided from the railway by substantial fencing.

As the work when completed will entirely close the Straits, a passageway through the causeway for the use of vessels had to be provided for. It is anticipated that there will be slight differences of the levels of the water on either side of the bank, and provision has been made for a lock with double gates capable of dealing with heads of water on either side of the lock. The latter measures 170-ft. between cills, is 32-ft. in width and has a depth of 10-ft. at low water. The road and railway are carried over the lock by means of an electrically operated rolling lift bridge.

foodstuffs and quantities of other articles required for a rapidly developing country, or loading cases of rubber or tin ore, the two principal exports of this peninsula. The wharves admit of ocean-going boats coming alongside, while there is ample accommodation in the roads for boats discharging into tongkangs or lighters. Large warehouses have been constructed close to the wharves for the storage of rubber, rice, etc., and there is a regular service of goods trains to all parts of the peninsula and Siam. Passenger boats, both local and those trading to Europe, also call at the port, meeting the need of the thickly populated central portion of the peninsula which forms the hinterland. From Klang, a line has also been constructed to serve an important agricultural district along the Selangor coast. This line extends for thirty miles, and was completed in 1914.

In Negri Sembilan and Malacca, branch lines run from Seremban to Port Dickson and from Tampin to the old and historical port of Malacca. The Seremban to Port Dickson line (24½ miles) originally belonged to a private firm, and was purchased by the Federated Malay States Railway department and worked by that department from July 28th, 1908. The extension from the main line to Malacca town was opened for traffic in December, 1905.

A glance at the accompanying map of the Malayan peninsula will show that the west coast is much more developed than the east, and naturally the first lines were built where most required. The east coast is not at present served by railway, except in the northern portion of the state of Kelantan, where the Federated Malay States' system joins the Siamese State Railways again at Sungei




F.M.S. Railway Map

Gobok. Southwards through Kelantan a line is being built to run through Pahang and Negri Sembilan and join the west coast line at Gemas on the Negri Sembilan—Johore state boundary. In the north this new line was opened southwards from Tumpat for 32 miles south to Riverside in 1914. At the southern end, 146 miles from Gemas have been completed, and are being operated through the states of Negri Sembilan and Pahang as far as Quala Lipis. This line has one branch serving agricultural districts from Bahau to Kuala Pilah, 13 miles, opened in 1910. The line between Riverside and Kuala Lipis is still under construction. The total length of line opened for traffic at the end of 1921 was 1,020 miles, and 53 additional miles were actually under construction. The railway is mostly single line and of metre gauge throughout, corresponding with the Siamese Railways.

The workshops referred to above near Kuala Lumpur deal with the maintenance and repair of locomotives and rolling stock. Locomotives are usually manufactured in England and erected at the central workshops, but the goods and passenger stock is manufactured there from local timber. These workshops are fully equipped with the modern machinery essential to such an establishment.

Sleeping saloons and dining cars have been running on the night mail trains between Kuala Lumpur and Johore Bahru since 1911. In 1920 similar accommodation was provided on the through trains between Kuala Lumpur and Prai (Penang). Both the sleeping saloons and the dining cars are built at the railway workshops, and will, it is claimed, stand comparison with the stock of any railway in the world. The cabins in the sleeping saloons are roomy, and are furnished with electric light and fans, while each car is fitted with a shower bath. The restaurant cars are likewise electrically lit and have electric fans. The latest development in this direction is the provision of a buffet car, which has recently been completed. At Ipoh and Kuala Lumpur, railway hotels adjoin the stations.

The Federated Malay States Railways are equipped to handle every description of present-day traffic, and, in addition to their own wharves at Port Swettenham, have an extensive scheme on hand for the development of Prai, on the mainland opposite Penang, as a port.

The works consist of (*a*) a reinforced concrete jetty, 1,100-ft. in length; (*b*) a coal wharf, 900-ft. in length; (*c*) the widening and reconstruction of an existing wharf, 600-ft. in length; (*d*) a lighter basin with 16-ft. depth ot low water for small vessels; (*e*) the dredging of the channel and approaches to a width of 500-ft. and a depth of 30-ft. below low water; and (*f*) the reclamation of adjacent swamps and foreshore to the extent of 170 acres. Of the foregoing, the first is, perhaps, the most important and interesting. The jetty, which extends seawards from the end of the old wharf, is built on rows of concrete cylinders, seven in each row, spaced 25-ft. apart longitudinally and 22-ft. apart transversely. It has a total width of 142-ft., the coping level being 4-ft. above high water of ordinary spring tides. The cylinders are built up in rings in a blockyard and are allowed to nature for three months before being used. The rings weigh from 10 to 14 tons each, and require special plant for handling and setting them. Each cylinder has for its base a cutting edge ring 3-ft. 6-in. in depth, 11-ft. 6-in. in external and 9-ft. 4-in. in internal diameter. On the top of the ring is a further ring, which tapers from 11-ft. 6-in. to 8-ft. 6-in. in external diameter and to 5-ft. in internal diameter. The top of the latter ring is castellated, something after the fashion of a dog clutch, so as to fit into and key with a ring of the same dimensions as those just quoted, 5-ft. deep, which is similarly castellated both top and bottom so as not only to key with the cutting ring member, but with a similar ring placed immediately above it. The required length of cylinder is made up by adding a succession of exactly similar rings up to 1-ft. 6-in. or so below low water. A final compensating ring, made to ascertained dimensions, then brings the top of the cylinder to the required level, and on the top is then placed a special cap, which is capable of slight adjustment in alignment, and which brings the total height up to 2-ft. above low water level. A reinforced concrete superstructure for the deck of the jetty is built on the tops of the caps.

The cylinders are sunk in steel guide sleeves, which are fixed to a temporary staging, by grabbing out the mud from the hole in the centre and causing the cylinders to sink by adding cast iron kentledge rings, weighing five tons each, as required until the required

(*Concluded on page 128*)

# Far Eastern Timbers

## II

(*Concluded from January*)

## Some Facts Concerning Their Properties and Commercial Value

*By C. A. Middleton Smith, M.S.C., M.I. Mech. E.*

(Taikoo Professor and Director of the Engineering Workshops and Laboratories of the University of Hongkong)

### Some Comparative Figures

THERE appear to be three woods in Borneo which give a higher coefficient of bending strength than that recorded from Mai-Takien. In 1919, the writer made a complete series of tests on ten of the more important Borneo timbers and the coefficient of bending varied as follows :—8.06 for Selangan Batu (Philippine name Yacal) ; for Billian (Philippine name Tambuliam) 7.29 ; for Mirabau (Philippine name Ipil) 6.77, after which we might take Mai-Takien (Siamese wood) at 5.38 tons per sq. in.

Mai-Yang gave results resembling those obtained for the Borneo wood Red Seriah (Philippine name Red Lauan). The figuies for the coefficient of bending strength are Mai-Yang 2.99 and Red Seriah 3.54.

In this connection, it may be of some interest to notice that foreman arranged the Philippine woods in two columns in order of tensile and transverse strength. To some extent, his order for tensile strength agrees with the order obtained by the writer for the coefficient of bending for the Borneo woods. He puts at the top, however, a wood named Dungon for which the writer has been unable to trace any values, nor has he been able to obtain specimens for testing. Foreman places Yacal (British Borneo name Selangan Batu) second, Ipil (British Borneo name Mirabau), third ; he leaves out entirely Tambuliam (British Borneo name Billian). He mentions a number of woods which are not listed in Dr. Foxworthy's Bulletin No. 1 government of British North Borneo department of forestry.

He places Yacal nineth on the list of woods arranged in order to transverse strength and he places Lauan (British Borneo name Seriah) above cedar both for tensile and transverse strength.

Unfortunately, it is not explained exactly what is meant by transverse strength ; and in any case, no actual figures are given.

We can, however, compare the coefficient of bending strength and the crushing strength of these woods with those given by Professor Unwin who made a large number of tests in London on specimens of wood sent from various parts.

TABLE I.

BENDING STRENGTH OF FAR EASTERN TIMBERS TESTED AT THE UNIVERSITY OF HONGKONG

| Name of Wood | Country of Origin | Coeff. of Bending Strength Tons per sq. in. |
|---|---|---|
| Selangan Batu | British North Borneo | 8.06 |
| Billian | ,, | 7.29 |
| Mirabow | ,, | 6.77 |
| Mai Takien | Siam | 5.38 |
| Camphor | British North Borneo | 4.93 |
| Greenting | ,, | 4.92 |
| Oba Sulu | ,, | 4.92 |
| Orat Mata | ,, | 4.57 |
| Kruen | ,, | 4.45 |
| Kacha | ,, | 4.24 |
| Red Serayah | ,, | 3.54 |
| May Yang | Siam | 2.99 |
| Black butt | Queensland | 5.79 |
| Spanish oak | St. Vincent | 5.78 |

TABLE II.

VARIOUS TIMBERS ARRANGED IN ORDER OF VALUE OF BENDING STRENGTH

| Name of Wood | Country of Origin | Coeff. of Bending Strength Tons per sq. in. |
|---|---|---|
| Red milkwood | Natal | 9.52 |
| Mora wood | British Guiana | 9.42 |
| Naseberry bullet | Jamaica | 9.16 |
| Billy Web | Honduras | 9.10 |
| Green heart | British Guiana | 8.97 |
| Ironwood | Middle Conser | 8.85 |
| Sneeze wood | Natal | 8.62 |
| Bullet wood | British Guiana | 8.58 |
| White iron wood | Natal | 8.56 |
| Mountain guava | Jamaica | 8.29 |
| Wallah wood | British Guiana | 8.13 |
| Locust | ,, | 8.13 |
| SELANGAN BATU | BRITISH NORTH BORNEO | 8.06 |
| Black iron wood | Natal | 7.84 |
| Locust wood | Montserrat | 7.67 |
| Blood wood | Queensland | 7.57 |
| Stink wood | Middle Conser | 7.51 |
| Mammee | Jamaica | 7.43 |
| Assegai | East Conser | 7.30 |
| BILLIAN | BRITISH NORTH BORNEO | 7.29 |
| Sneeze wood | Cape Colony | 7.22 |
| Saffraan | ,, | 7.21 |
| Iron bark | Queensland | 7.05 |
| Crows-ash | ,, | 7.03 |
| White pear wood | Natal | 6.95 |
| Mammee sapota | Jamaica | 6.95 |
| Mora | British Guiana | 6.87 |
| Prime | Jamaica | 6.85 |
| White pear | Middle Conser | 6.78 |
| MIRABOW | BRITISH NORTH BORNEO | 6.77 |
| Assegia | Middle Conser | 6.75 |
| Rose wood | Jamica | 6.72 |
| Hackia | British Guiana | 6.72 |
| Olive wood | Cape Colony | 6.65 |
| Satin wood | Jamaica | 6.62 |
| Vlier | Middle Conser | 6.62 |
| Milla | Ceylon | 6.59 |
| Cashaw wood | Jamaica | 6.43 |
| Spotted gum | Queensland | 6.42 |
| White pear | East Conser | 6.42 |
| Blue gun | West ,, | 6.27 |
| Satin wood | Ceylon | 6.15 |
| Cherry bullet | Jamaica | 6.12 |
| Albizzia | India | 6.11 |
| Flat crown | Natal | 6.06 |
| Light brown cironballi | British Guiana | 5.98 |
| Purple heart | Honduras | 5.93 |
| Souari | British Guiana | 5.87 |
| Kafir plum | Cape Colony | 5.85 |
| Panah Ka | Ceylon | 5.78 |
| Hog meat | Jamaica | 5.69 |

| Name of Wood | Country of Origin | Coeff. of Bending Strength Tons per sq. in. |
|---|---|---|
| Black butt | Queensland | 5.79 |
| Spanish oak | St. Vincent | 5.78 |
| Keur | Middle Conser | 5:68 |
| Fallow wood | Queensland | 5.48 |
| Black iron wood | East Conser | 5.46 |
| Blackwood | Tasmania | 5.45 |
| Bastard cabbage | Jamaica | 5.44 |
| Red Els | Middle Conser | 5.40 |
| Saffraan | East ,, | 5.40 |
| Black maya | Honduras | 5.30 |
| Cluster pine | West Consei | 5.39 |
| Mai Takien | Siam | 5.38 |
| Stanus yacca | Jamaica | 5.25 |
| Pyiurna | India | 5.22 |
| Hog gum | Jamaica | 5.14 |
| Santa Maria | Honduras | 5.14 |
| Stanus Yacca | Jamaica | 5.13 |
| Kerse Hont | Middle Conser | 5.05 |
| Upright or real yellow | ,, ,, | 5.02 |
| Cape beach | ,, ,, | 4.96 |
| Camphor | British North Borneo | 4.93 |
| GREETING | BRITISH NORTH BORNEO | 4.92 |
| Oba sulu | ,, | 4.92 |
| Lignum vitae | Jamica | 4.88 |
| Granadella | Honduras | 4.74 |
| Stringy bark | Tasmania | 4.72 |
| Stone pine | Cape Colony | 4.58 |
| Orat mata | British North Borneo | 4.57 |
| Locust wood | Honduras | 4.54 |
| Black poison wood | ,, | 4.52 |
| Salm wood | ,, | 4.51 |
| Seaside mahoe | Jamaica | 4.45 |
| KRUEN | BRITISH NORTH BORNEO | 4.45 |
| Turtle bone | Honduras | 4.43 |
| Saffron wood | Cape Colony | 4.41 |
| Blue mountain yacca | Jamaica | 4.31 |
| Kubucalli | British Guiana | 4.26 |
| Vurnanukia | Ceylon | 4.25 |
| KACHA | BRITISH NORTH BORNEO | 4.24 |
| Seaside grape | Jamaica | 4.13 |
| Myrthe | Tasmania | 4.06 |
| Upright or real yellow | East Conser | 4.04 |
| Common yellow wood | ,, ,, | 4.03 |
| Yellow sandeis | Jamica | 4.02 |
| Habing | Honduras | 3.97 |
| Gurukina | Ceylon | 3.90 |
| Red wood | Honduras | 3.81 |
| John crow wood | ,, | 3.75 |
| Dog wood | ,, | 3.74 |
| Common yellow wood | West Conser | 3.70 |
| Clanwilliam cedar | ,, ,, | 3.69 |
| Blue gum | Queensland | 3.57 |
| RED SERAYAH | BRITISH NORTH BORNEO | 3.54 |
| Sopu | Ceylon | 3.45 |
| Bullet wood | Honduras | 3.40 |
| Simarupa | British Guiana | 3.36 |
| Mountain mahoe | Jamaica | 3.24 |
| Whiteels | Middle Conser | 3.12 |
| Yoke wood | Jamaica | 3.04 |
| Red cedar | Montserrat | 3.02 |
| MAI YANG | SIAM | 2.99 |
| Wannika | Jamaica | 2.93 |
| Spanish elm | ,, | 2.73 |
| Prickly yellow | ,, | 2.70 |
| Hardpear | Middle Conser | 2.67 |
| Calabash | Jamaica | 2.62 |
| Kauri | Auckland N. 2 | 2.16 |

### Compression Tests

In 1919, the writer made a number of tests on China fir with the object of finding out the mean crushing stress in tons per sq. in. Some of the specimens were soaked in water. The specimens were obtained from timber suitable for piling. They were three inches in diameter and some of the specimens tested were six inches long while others were fifteen inches long.

A total of forty-eight specimens were tested. The highest figure recorded for the mean crushing stress was 2.62 tons per sq. in. and the lowest 1.29 tons per sq. in., the mean average figure was 1.8 tons per sq. in. (4,032-lbs. per sq. in.)

From each pile three specimes were cut and the results obtained with any three of the specimens from one pile were very uniform considering that the material was timber. Thus specimens Nos. 19, 20 and 20 gave results of 1.75, 1.67 and 1.60 tons per sq. in. or a mean value of 1.67 tons rer sq. in. (3,741-lbs. per sq. in.)

The "wet" specimens were soaked in water for 24 hours except two groups which were soaked in water for fifteen days.

The "wet" specimens gave results which compare unfavourably with the dry specimens of the same type. Thus from one pile three dry specimens gave a mean value of 2.18 tons per sq. in. while three wet specimens gave a mean value of 1.82 tons per sq. in. All of the dry specimens gave a higher value for the mean crushing strength than any wet specimens.

As was expected the specimens six inches long carry a heavier load than the 15-in. specimen although the difference was only about ten per cent. A fair average of figure for the mean crushing stress of China fir is 1.8 tons per sq. in. On the whole the results obtained were uniform.

Now we come to consider the crushing strength of the Siamese woods, Mai-Takien and Mai-Yang. Mai-Takien gave a mean average value of crushing stress 2.89 tons per sq. in. and Mai-Yang 1.69. We will compare all of the Far Eastern timbers for crushing strength. The following table gives the results obtained in the university of Hongkong.

TABLE III.

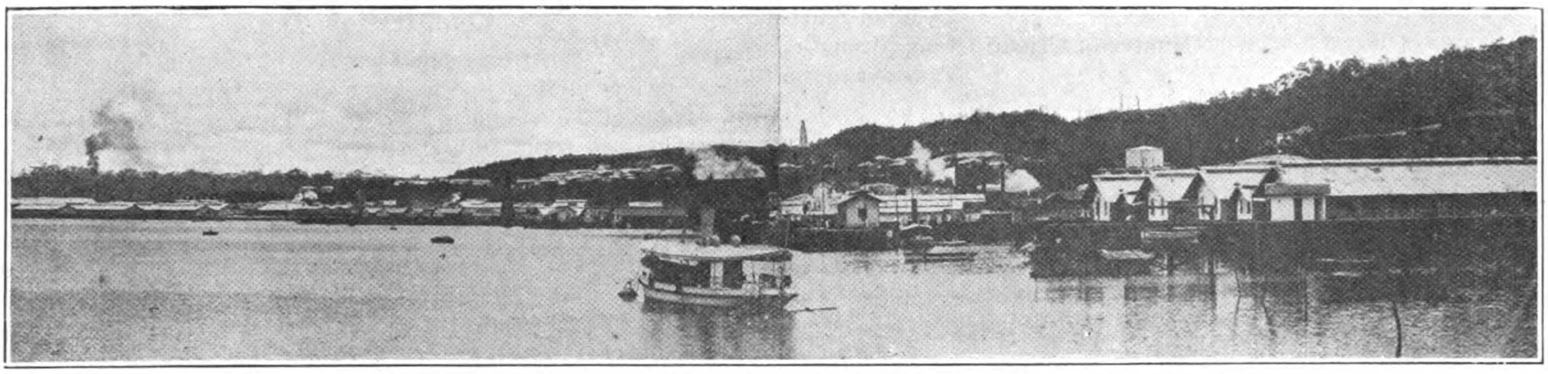
CRUSHING STRENGTH OF FAR EASTERN TIMBERS TESTED IN THE UNIVERSITY OF HONGKONG

| Name of Wood | Country of Origin | Mean Crushing strength lbs. per sq. in. | Mean Crushing strength Tons per sq. in. |
|---|---|---|---|
| Billian | British N. Borneo | 11,177 | 4.99 |
| Selangan Batu | ,, | 8,713 | 3.89 |
| Mirabow | ,, | 7,997 | 3.57 |
| Mai Takien | Siam | 6,470 | 2.89 |
| Camphor | British N. Borneo | 5,532 | 2.47 |
| Oba Sulu | ,, | 5,398 | 2.41 |
| Kruen | ,, | 4,860 | 2.17 |
| China Fir | South China | 4,030 | 1.80 |
| Mai Yang | Siam | 3,783 | 1.69 |

For the purpose of comparison, the following table is given. It was compiled by the U. S. Forests Service.

| Group. | Compressive strength (parallel to grain), lb. per sq. in. | Woods included in Group |
|---|---|---|
| I | 4,200 to 6,000 | Eucalyptus corynocalyx, osage orange, honey locust, mockernut hickory, pignut hickory, emcalyptus globulus and tereticornia, shagobark hickory, shellbark hickory, eucalyptus viminalis |
| II | 3,600 to 4,200 | White, green and blue ash, slippery elm, eucalyptus rostrata, rock elm, sugar maple longleaf pine, beech, yellow oak, yellow and sweet birch, red maple, Douglas fir, red oak, white oak, red wood in compression. |

(*Continued on page 140*)



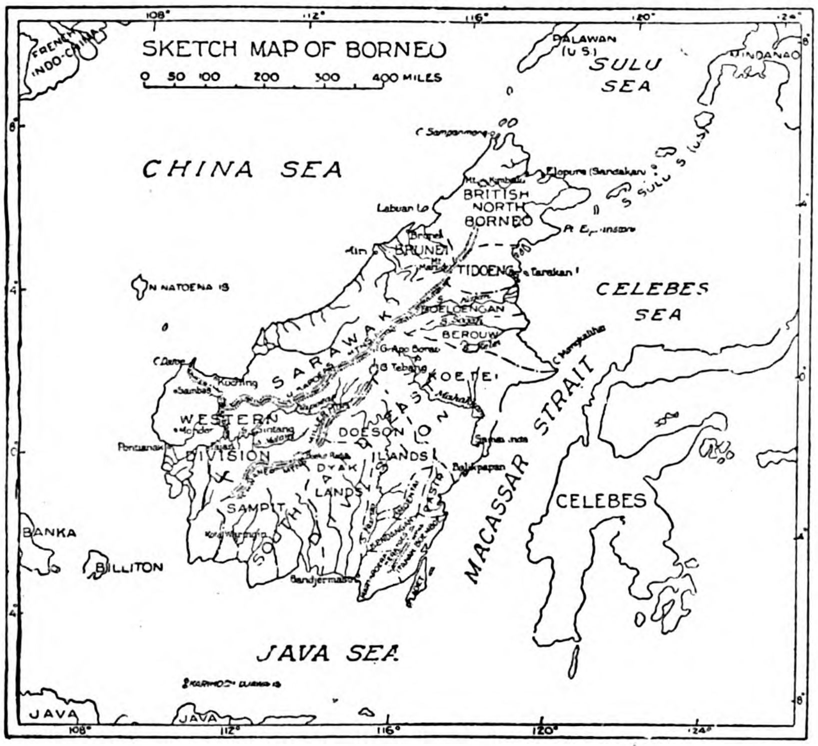
Royal Dutch Petroleum Works at Balik-Papan, Dutch Borneo, View from the Harbor

# *Petroleum in Borneo

*By Arthur H. Redfield*

HISTORY OF DEVELOPMENT.—For centuries the natives of Sumatra, Java, and Borneo have used mineral oils, obtained from surface seepages, for various domestic purposes and especially as a remedy for skin diseases. In 1853 Motley noted seepages on the island of Labuan, in the British Borneo and ten years later Menten found seepages on Tarakan Island, off the east coast of Dutch Borneo.

In 1866 a shallow well was drilled on Labuan Island, which gave a small flow of oil for at least thirteen years. Collingwood in 1867 described a petroleum spring in British North Borneo and stated that others were known. About 1887 there were three small producing wells on the Klias peninsula, opposite the town of Brunei.




The first geologic investigation of the Dutch East Indian oil fields was made in 1883 when the geologists G. P. A. Renaud and R. Fennema were sent by the bureau of mines at Batavia to examine the prospective fields of Lower Langkat, in the east coast residency of Sumatra. The oil fields of Java were investigated in the next decade by R. D. M. Verbeek and R. Fennema. The coal and oil occurrences of Koetei, in the south and east coast residency of Borneo were first described by J. A. Hooze in 1888.

The pioneer in the exploitation of petroleum in Borneo was the Dutch mining engineer, J. H. Menten, who in 1863 explored Tarakan island and later the Koetei region. Menten obtained in 1888 the Louise concession at the mouth of Mahakkam river, in Koetei, and in 1891 the Mathilde concession at Balikpapan. In 1897 he commenced drilling in the Sanga Sanga field. Oil was struck at 190-ft.

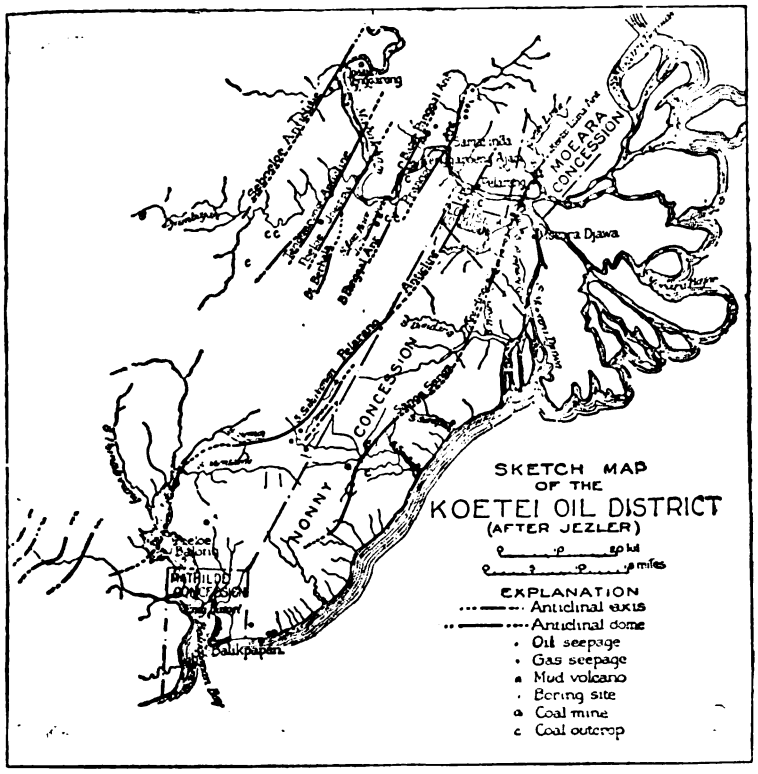
The Menten concessions were transferred in 1898 to the Nederlandsch-Indische Industrie en Handel Maatschappij, which was founded that year, under the control of the Shell Transport and Trading Co., of London. The amalgamation of the Shell Transport & Trading Co., on January 1, 1907, with the Koninklijke Nederlandsche Maatschappij tot Exploitatie van Petroleumbronnen in Nederlandsch Indie (Royal Dutch Company for the working of petroleum wells in Netherlands India) brought the Nederlandsch-Indische Industrie en Handel Maatschappij under the control of the new Royal Dutch-Shell group.

Commercial drilling in Borneo began at Sanga Sanga in 1899. Thirty-four wells were drilled of which 25 were productive. A production of 700 metric tons a day was soon obtained. A refinery with a capacity of 2,000 metric tons a day was built at Balikpapan.

The exploration for oil extended to British North Borneo, where the Bombay-Burmah Trading Co. obtained the Korszki concession, and drilled with varying success in British North Borneo, Brunei, Sarawak, and on Labuan Island. The firm of Buiju also drilled on Labuan without success.

PRODUCTION.—In spite of the development of new fields in Ceram and in Sumatra, the island of Borneo has contributed since 1910 an increasing proportion of the total output of crude petroleum in the Dutch East Indies. In 1910 Dutch Borneo produced 42 per cent. of the total production of the Dutch East Indies; in 1920 its percentage had risen to 61.5 per cent. Taken together, British and Dutch Borneo in 1920 yielded 63.8 per cent. of all petroleum won in the entire archipelago.

*Published by permission, the director, U. S. geological survey. This paper is one of a series of critical reviews which the author is making of geologic and geographic literature pertaining to foreign oil fields.—*Editor.*




The production of crude petroleum in British and Dutch Borneo in comparison with the total production of the East Indian archipelago is shown by the following table :—

TABLE I.

Production of Crude Oil in Borneo and the East Indies.

| | Dutch Borneo* Metric Tons. | British Borneo, Metric Tons. | East Indies (incl. British Borneo), Metric Tons. |
|---|---|---|---|
| 1910 .. | 633,472 | — | 1,500,245 |
| 1911 .. | 814,707 | — | 1,670,568 |
| 1912 .. | 672,438 | 5,534† | 1,524,939 |
| 1913 .. | 766,687 | 30,562† | 1,564,785 |
| 1914 .. | 866,718 | 65,185† | 1,634,405 |
| 1915 .. | 893,890 | 67,000† | 1,710,443 |
| 1916 .. | 957,395 | 90,067† | 1,820,251 |
| 1917 .. | 869,262 | 77,604† | 1,870,214 |
| 1918 .. | 999,426 | 72,511† | 1,836,712 |
| 1919 .. | 1,372,006† | 85,695† | 2,245,562 |
| 1920 .. | 1,455,228 | 146,729† | 2,512,049 |

## General Features of Borneo

Political Divisions.—Politically, the control of the island of Borneo is divided between Great Britain and the Netherlands.

The British portions of Borneo constitute a little over one-fourth of its entire area. These consist of the rajahship of Sarawak, a protectorate of Great Britain ; the sultanate of Brunei, under the administration of a British resident ; British North Borneo, under the jurisdiction of the chartered British North Borneo Company ; and the island of Labuan, which is incorporated with the Straits Settlements. The governor of the Straits Settlements is *ex officio* high commissioner of Brunei and British agent for British North Borneo and Sarawak.

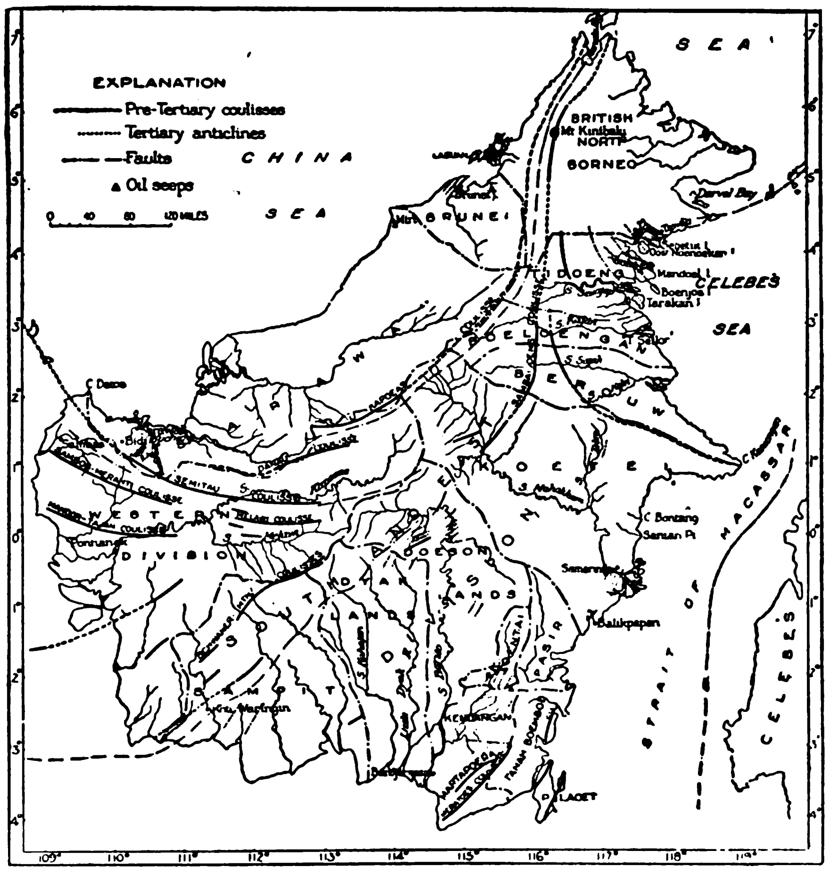
Dutch Borneo is divided politically into the residency of the western division (Wester Afdeeling), and residency of the south and east division (Zuid- en Ooster Afdeeling). Both residencies are subdivided into a number of native sultanates and principalities, each under the supervision of a Dutch assistant resident or a *contrôleur*.

Physiography.—From a central mountain mass a series of mountainous divides branch radially, separating the island of Borneo into western, southern, northern, and eastern basins. The central mountain mass of Borneo, lying between 1° 20′ and 2° 20′ north latitude, extends northeast-southwest. Its highest peaks are Goenoeng ‡ Tebang and Goenoeng Apo Borau. The radiating divides consist of short isolated ranges or ridges, which follow one another in the direction of the assumed tectonic lines of the island. The Schwaner mountains are a typical example. These isolated mountain ridges, surrounded by low undulating country, are characteristic of Borneo, both in the principal and subordinate ranges and their numerous spurs. This unusual type of upland forms the entire watershed between Koetei and South Borneo.

The hills which surround the mountain ridges form aggregates of small, rounded or extended hills, many of which are very steep. Their average height does not exceed 200 or 300-ft., except close to the divides where they are higher and give the country a more mountainous appearance. Isolated outliers of the hill-country appear in the plains.

The hill-land is succeeded by low-lying plains, which, especially in South Borneo, are of great extent. The dry plains are succeeded in turn by swamp-land at the deltas of the large rivers and along the coast.

Area Geology.—The known geology of the island of Borneo is complicated. According to the Abendanon map, only three areas of Dutch Borneo, widely separated, have been thoroughly investigated geologically. One comprises the greater part of the




Tectonic Map of Borneo

western division of Borneo, which was explored by Molengraaff in 1893-1894. The second lies southeast of a line running from Bandjermasin to Cape Santang. The third area occupies the two prominent peninsulas which mark the northeast coast of Dutch

*Jaarboek van het Mijnwezen in Ned. Oost-Indië, Batavia.

†Annual reports, Royal Dutch Company.

‡Goenoeng (pronounced " goonoong ") in Malay means " mountain."

Borneo. About three-fourths of the remainder of the Dutch possessions is known through reconnaissances only, and several extensive areas are geologically unexplored.

The observations which have been made of the British portions are for the most part disconnected and uncorrelated. In the absence of a detailed geologic survey of any part of British Borneo, the isolated observations leave many problems unsolved. Fortunately the more complete knowledge of the Dutch area is of considerable help in interpreting the geology of the British provinces of Borneo.

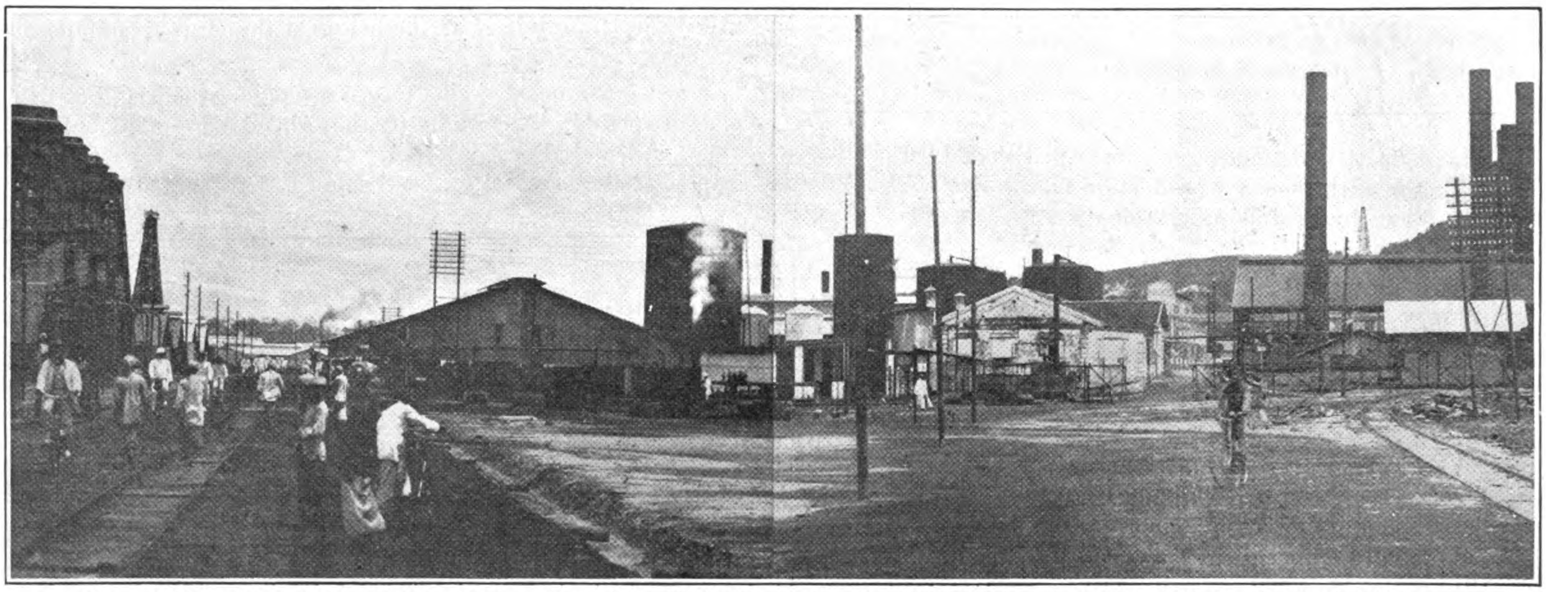
The core of the axial mountain range, which separates Dutch from British Borneo, consists of granites, gabbros, and intensely folded schists. These rocks have been referred to the Archean, but their precise age is undetermined, and some of the schists may be metamorphosed sediments of a much later geologic date. The ligneous rocks probably belong to more tha one period.

The "old slates" consisting of bluish phyllites and siliceous slates of undifferentiated Paleozoic or perhaps Mesozoic (?) age flank the principal granitic and crystalline axis of the island. The Upper Kapoeas chain, which extends almost east and west between weatern Borneo and Sarawak, consists of these rocks.

rocks have not been recognized *in situ* in British Borneo. In the western division of Dutch Borneo the Cenomanian stage (Middle Cretaceous) occurs to the east of Sintang. The Cretaceous formations of the western division extend in an irregular bifurcated belt in a generally easterly direction from the upper Sekajan (or Kapoeas) valley to the foot of the Müller range. Cenomanian limestones and crystalline schists, which are considered to be metamorphosed Cenomanian sediments, form the core of the Meratoes mountains. The Alino and Waringin shales of South and East Borneo are referred to Senonian stage of the Upper Cretaceous ; but older rocks are in all probability included. These flank on both sides the metamorphosed Cenomanian rocks of the Meratoes mountains.

Mesozoic (?) granites and contact-metamorphic rocks form the south slopes of the Schwaner mountains. Granite massifs of Mesozoic age may be traced from Mandor to Tajan on Soengei * Kapoeas.

Volcanic rocks appear chiefly in the Müller mountains. In the western portion of the range, andesites, quartz-andesites, and porphyrites predominate. The central portion consists of terraced table mountains, separated by deep valleys. The table



**View of Main Plant of the Royal Dutch Petroleum Co. at Balik-Papan, Showing the Buildings devoted to Refining the Crude Oil into Benzine, Kerosene and Fuel Oil. Capacity, 2,000 tons per day**

Phyllites occur on the upper Berouw or Kelei river and the lower Kajan or Boeloengan river, and granites on the upper Segah and Kelei Rivers, where they form the cores of the so-called "Sambalioeng coulisses."

A zone of limestones, 20 to 40 miles in width, extends in the foothills of British Borneo from longitude 112° east (Greenwich) nearly to Marudu bay. These were regarded by Posewitz as belonging to the Carboniferous, but the identification of the fossils upon which this reference is based is by no means complete. It is probable that some indeed if not all of the so-called "Carboniferous limestones" of Posewitz and Tenison Woods, is of Mesozoic age.

Immediately south of Kapoeas range the "Danau formation" occurs, faulted down against the Paleozoic slates. Fossils, especially *Radiolaria*, found in the "Danau formation" indicate that it belongs to the Jurassic, but it is possible that older Mesozoic beds are included in it. No corresponding radiolarian beds have so far been described as occurring in British Borneo.

Fossils of the Lias epoch (Lower Jurassic) were found in a shale formation in the Sambas district of the western division of Dutch Borneo, immediately south of Sarawak. The Liassic shales are overlain by a sandstone and shale series, containing fossils characteristic of the Dogger epoch (Middle Jurassic). At the western end of Sarawak fossils of the Middle Oölite (Upper Jurassic) have been found in a limestone formation. Cretaceous

mountains consist of thick beds of tuff, in places alternating with horizontal or almost horizontal flows of andesite or basalt. In the eastern part of the Müller mountains acid rocks, chiefly rhyolites, quartz-andesites, and mica-quartz-andesites, predominate. A line of porphyrite cones extends in an almost east-and-west direction on the gently sloping sandstone plateau which forms the northern slope of the Schwaner mountains. A zone of andesite and dolerite hills, about 11 miles wide, bearing about N. 80° E. occurs in the extensive granite area of Sambas.

In Dutch Borneo, Tertiary sediments occupy the middle portions of the Kapoeas river and Melawi river valleys. The greater part of the south and east division of Borneo is underlain by Tertiary sediments, intruded locally by Tertiary and younger igneous rocks. Quaternary deposits occupy the coastal areas of the south and west coasts and river valleys of south-eatern Borneo.

The Tertiary region of British Borneo forms a coastal zone, about 60 to 100 kilometres (36 to 62 miles) wide.

TECTONICS.—*General Discussion.*—Two well-defined faults bound on the north and south a "West Borneo horst" ot pre-Tertiary phyllites, slates, and crystalline rocks. This horst constituted, in the opinion of Van Es, a buttress against which crustal movements were exerted with little effect upon it other than slightly increasing its elevation.

**Soengei* in Malay means "river."

On the northwest coast, in British Borneo, and along the east and south coasts of Dutch Borneo are areas of Tertiary sediments which have been considerably affected by Tertiary folding movements.

It is evident from the stronger folding which the Lower Miocene, Oligocene, and Eocene beds of the south and east division show as compared with the Upper Miocene and Pliocene beds that a period of folding took place between the deposition of the Lower and Upper Miocene. This is particularly evident in the vicinity of Balikpapan Bay. The Miocene folding was followed after an interval by an Upper Pliocene folding along the same axes. In contrast, a large part of the Tertiary of the western division of Borneo was left almost undisturbed by both the Miocene and the Upper Pliocene folding.

PRE-TERTIARY STRUCTURE.—The structure of Borneo shows an intimate relation to that of its neighboring islands. The inner geanticlinal arc of the Philippine islands extends southwards through the Borneo Horst, in a broad curve nearl yparallel to the west coast of British Borneo from the northernmost point of the island. From central Borneo the direction changes gradually first to the west and then to the northwest to Cape Datoe, and continues in the North Natoena islands.

The existence of the geanticlinal arc is evidenced in Borneo by the occurrence of a series of coulisses. As has been explained in a previous paper,* the name "coulisse" is applied to one of a series of structural ridges arranged *en èchelon* on the earth's surface, like the wings of the stage (French, *coulisse*) in a theatre. Such features are formed by folding of the stratifield rocks and the intrusion of masses of igneous rocks, followed by erosion. These echeloned ridges form a prominent part of the physiography not only of the Dutch East Indies, but of the Malay peninsula, Burma, French Indo-China, and the Philippine islands as well.

The coulisses of Borneo show in their arrangement a phenomenon which has been noted in less degree in Java and Sumatra and in greater degree in the Philippine islands, namely a branching out or virgation of their members. Though in the north of Borneo all coulisses appear to be compressed into a narrow zone and to follow generally a north-northeast direction, in the south they radiate fanwise. The most easterly members curve to the southeast and turn in the direction of Celebes, and probably are continued in the mountain ranges of that island. The northern portions of the Meratoes and Poeloe † Laoet coulisses trend north and south, but the southern portions curve to the southwest, and continue in the coulisse of the Karimoen Djawa island, and probably certain of the coulisses of eastern Sumatra. The central series of coulisses, to which the Schwaner mountains belong, trend from southward to southwestward, to westward, and finally to northwestward, and continue in the Banka-Malacca horst. The Mandor-Tajan, the Sambas-Meranti, the Semitau, and Danau coulisses have the same curvature but with a shorter radius, and may be following through the Anambas and Natoena islands to the eastern coastal range of Annam. The Upper Kapoeas coulisse is the innermost of these arcs and has in consequence the shortest radius.

TERTIARY ANTICLINES.—Tertiary anticlines have been noted in several widely separated localities of Borneo. Our present knowledge of the geology of the island is not sufficiently advanced to permit any exact correlation of their axes. Their close parallelism with main tectonic lines of the island is notable.

A group of anticlines whose axes trend northeastward has been noted on the peninsula of Brunei. A second series, apparently a continuation of the first, crosses the island of Labuan and the Klias peninsula opposite Brunei. For anticlines, whose axes trend northeastward, occur to the southeast and east of Kota Waringin. The anticlinal axes parallel the Schwaner mountain coulisse and the Schwaner mountain fault. Similar groups of Tertiary anticlines cross the upper valleys of Kahajan and Barito rivers, paralleling with their axes the tectonic lines of the Schwaner mountains.

The Meratoes and Poeloe Laoet coulisses in southeastern Borneo are paralleled north of Bandjermasin by a series of Tertiary anticlines whose axes bear north-northeastward to northward. This trend is continued by the Balikpapan anticline, by a group of four anticlines which cross Mahakkam river above and below Samarinda, and by two anticlines in the upper valley of Soengei Telen.

The anticlinal axes which cross Tarakan and Sebetik islands to the mainland and continue into British territory trend from southeast to northwest. This trend is parallel to the observed and assumed trend of the coulisses of this region.

FAULTS.—The two principal faults of the island of Borneo which bound the West Borneo Horst are longitudinal with regard to the main tectonic lines of the archipelago. The first of these, the Upper Kapoeas fault, bounds the Upper Kapoeas mountains on the south side and separates the Paleozoic phyllites of which the mountain range is composed from the Mesozoic rocks of the Danau coulisse. The second fault line, with which volcanic rocks are associated, bounds the Schwaner mountains on the south. Between the two main faults lies a parallel dislocation upon which the mountains have been formed by eruption.

Two faults, longitudinal to the main axis of the island in one extremity, and transverse in the other, have been assumed. Macassar strait is believed by Van Es to conceal a fault-line which runs northward from Java Sea and curves northeastward into Celebes sea. A second fault has been traced from Pt. Elphinstone, through the Sulu islands of the Philippine archipelago into Mindanao! Though transverse at its southern end to the principal coulisses and faults of Borneo, in the Philippine islands it is longitudinal with respect to the main tectonic axes of Malaysia in general.

VULCANISM.—Probably as a consequence of the fault movements described above, igneous eruptions have occurred along certain faults. These date probably to Miocene time, when the folding in other parts of the island was strongest.

OIL-BEARING AREAS.—There are at present three important oil-producing areas on the island of Borneo. The first is the Koetei district, extending from the mouth of Mahakkam river southwards toward Balikpapan bay. The second is the Tarakan district, situated on Tarakan island off the east coast, about 80 miles south of the British-Dutch frontier. The third is the Miri district, on the west coast of Sarawak, about 150 miles south of Brunei bay.

THE KOETEI OIL DISTRICT.—*Location and Extent.*—The Koetei oil district lies in the Landschap of Koetei, the southernmost of the subordinate divisions of the Afdeeling of Koetei and the northeast coast, residency of the south and east coasts, Dutch Borneo. It includes the Sanga Sanga field in the Louise concession; the Sambodja field in the Nonny concession, and the Moeara field in the concession of the same name

PHYSIOGRAPHY.—The Mahakkam or Koetei river, flowing eastward, divides at a point about 25 miles from the coast into three distributaries, the Moeara‡ Djawa to the south, the Moeara Bajor to the southeast, and the Moeara Berau to the north. East of Moeara Djawa and Moeara Berau there is a broad swampy delta, overgrown by mangroves, and inhabited by a few natives. West of those rivers a peneplain, whose hill-ridges do not exceed 200

*Redfield, Arthur H., "The Djambi Oil Field of Sumatra," Eng. and Min. Jour., Vol. 112, No. 24, pp. 939-943, New York, December 10, 1921.

†*Poeloe* in Malay means " island."

‡Moeara (prononnced Mooahra) in Malay means " river mouth." Moeara Djawa may be translated " Java Mouth " or " Java Pass."

feet in altitude, extends for a considerable distance. Farther west, beyond Pelarang, the peneplain merges into a low hill-country whose maximum elevations are about 500 feet.

The peneplain west of Moeara Djawa and Moeara Berau, about 12 miles wide, cuts across folded Tertiary sediments which strike about N. 20° E. The principal streams of this region cut the folds at about right angles ; the tributaries run parallel to the folds.

Area Geology.—The coastal region of Koetei is underlain by a zone of folded Tertiary sediments, about 60 miles wide, which consist principally of post-Eocene formations, cheifly Miocene. The occurrence of Eocene rocks, so far as is now known, is restricted to the middle portion of the Mahakkam valley, and their geologic relation to the later Tertiary deposits is not wholly determined.

Aquitanian and Lower Burdigalian (Lower Miocene) bed are exposed in the cores of the eroded antilines. They occur, 4,900 feet thick, in South Koetei, west of Balikapapan bay, and in the Lower Mahakkam valley. In the vieinity of Cape Bontang and Santan point only a small part of these stages not over 820 feet in thickness, is exposed on the surface.

Upper Burdigalian and Vindobonian formations occur flanking the Lower Miocene beds near Balikpapan bay, on the lower Mahakkan, and in Bontang. The Pontian (uppermost Miocene) beds constitute the uppermost beds of the synclines, below the recent accumulations of surface material.

Stratigraphy.—The Tertiary of eastern Koetei consists of a very thick series of sediments, whose oldest members were deposited probably in the transition stage between Lower and Upper Tertiary, while the youngest members border on the Pliocene. They were apparently laid down under delta conditions and changes of facies are numerous.

The Eocene is represented on the middle Mahakkam by the "plateau sandstone." This formation consists at its base of quartz-conglomerates, overlain by quartz-sandstones, shales containing plant impressions, and coal seams. The evidence of fossils, as well as its lithologic similarity to the Eocene formations of southeastern Borneo, places the "plateau sandstone" in the Eocene. This formation is overlain unconformably by orbitoid limestones of Aquitanian (lowest Miocene) age.

For the greater part of Koetei no detailed stratigraphic division of the post-Eocene has been made. Rutten has subdivided the formations of Balikpapan into stages, and Jezler has correlated the formations of the lower Mahakkam with Rutten's subdivisions. But the numerous changes of facies even in the same area make correlation difficult, and for most of Koetei only a rough division of the post-Eocene beds into three major stages is feasible.

The oldest Tertiary sediments appearing on the lower Mahakkam belong to the Aquitanian stage. These formations, named by Jezler the Prangat beds, consist of 1,100 metres (3,600 feet) of limestones, shales, concretionary clays, and orbitoid limestones. They contain at Sanga Sanga traces of natural gas without petroleum.

The Prangat beds of the lower Mahakkam valley are correlated by Jezler with the Pamaloeang beds of Balikpapan bay, described by Rutten. The latter are composed of gray and brown, hard concretionary shales, indistinctly bedded and in places marly ; thin-bedded gray sandstones containing scales of coal between the bedding planes ; Aquitanian (orbitoid) limestones ; and impure limestones with corals. The almost total absence of coal seams is a distinguishing mark of this stage. The thickness of the Pamaloeang beds of Balikpapan bay is about 1,500 metres (4,290 feet).

The Prangat beds are conformably overlain by the Sanga Sanga beds which belong to the Burdigalian stage of the Lower Miocene. The latter are composed of about 1,300 metres (4,260 feet) of sandy clays and shales and impure limestones. The Sanga Sanga beds contain the oil horizons of Sanga Sanga and Sambodja, and correspond to the Poeloe Balang beds which form the oil-bearing formations of Balang island in Balikpapan bay.

In the Poeloe Balang strata, of Burdigalian (Lower Miocene) age, shales are few ; sandstones are numerous. The shales are hard and gray ; the sandstones vary from soft to hard. Extensive limestone and marl beds occur. Numerous seams of black, lustrous coal, breaking with a conchoidal fracture, and without inclusions of mineral resin, occur.

The Moeara Djawa beds of Vindobonian (Upper Miocene) age conformably overlie the Sanga Sanga beds on the lower Mahakkam. These consist of light-gray clays and sandstones, attaining a thickness of about 800 metres (2,640 feet). This stage contains the oil of Moeara Djawa.

The Moeara Djawa beds are considered by Jezler to correspond with the Mentawir beds of Balikpapan bay. These consist of gray sandstones and clay, with interbedded lignites. The associated lignites are somewhat resinous.

The Pontian stage (uppermost Miocene) is represented in the Sanga Sanga field by the Kembang beds, which are composed of 800 metres (2,640 feet) of gray and red sandy clays, ferruginous sandstones, and dull black to brown lignites containing resin. This is the oil-bearing stage of Balikpapan bay.

The Pliocene is not represented in the formations of Koetei. The Tertiary sediments are overlain unconformably in places by Quaternary sediments of varying thickness, up to 400 metres (1,320 feet).

The post-Tertiary deposits of eastern Koetei consist of coralline sands along the coast and on the offshore islands ; clays, shaly clays, sands, and gravels in the river valleys ; and perhaps moor formations in the deep swamps which border the rivers. Local deposits of calcareous tuff occur.

*To be concluded in March Number*

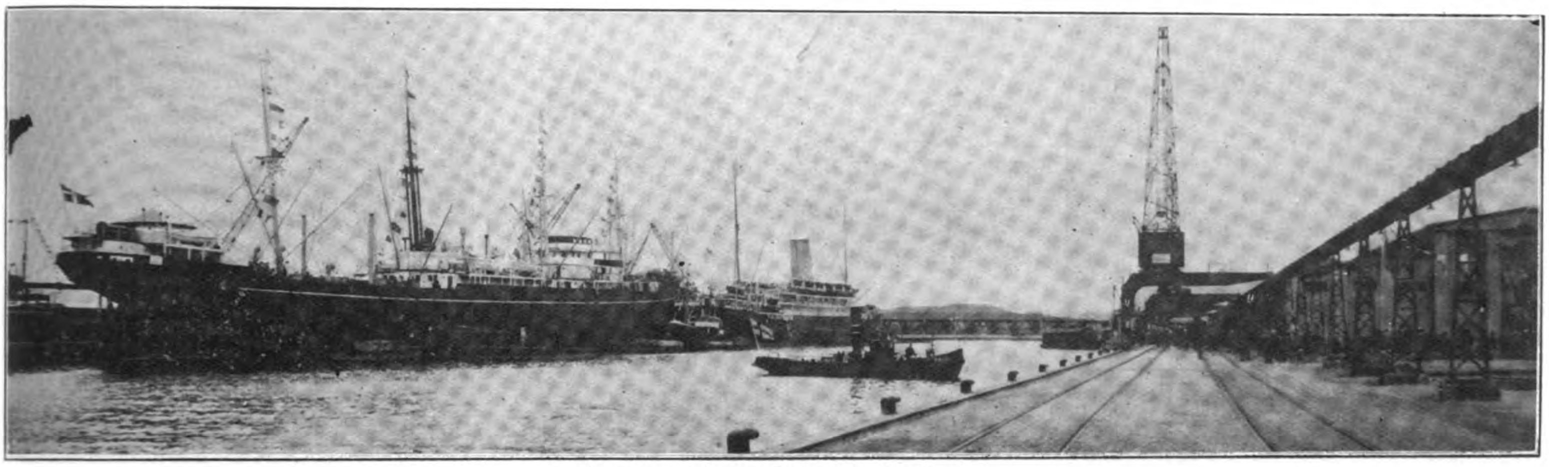
## Far Eastern Timbers (*continued from page 135*)

| Group. | Compressive strength (parallel to grain), lb. per sq. in. | Woods included in Group |
|---|---|---|
| III | 3,400 to 3,600 | Slippery elm, loblolly pine, hackberry, poorer qualities of white and red oaks shortleaf pine, tupelo gum, western hemlock, western larch, black cherry, white elm, cypress, tamarack. |
| IV | 2,400 to 3,400 | Redwood in bending, red gum, sycamore, black ash, white fir, red spruce, eastern hemlock, balsam fir, common catalpa black spruce, sugar pine, white pine, white spruce, western yellow pine, Norway pine, lodgepole pine, chestnut, cedar, aspen, silver maple. |
| V | Below, 2,400 | Basswood, hardy catalpa. |

### The Bamboo

It is very difficult to obtain any information of use to engineers concerning the bamboo. There are about 33 different varieties and the number of uses to which the bamboo is put in China is legion. The engineer seems to employ it only as struts and in places where considerable bending stresses must take place. It may reasonably be asked why no scientific data of use to engineers concerning the physical properties of bamboo has been included in this paper. A little examination of the problem will, however, reveal many difficulties.

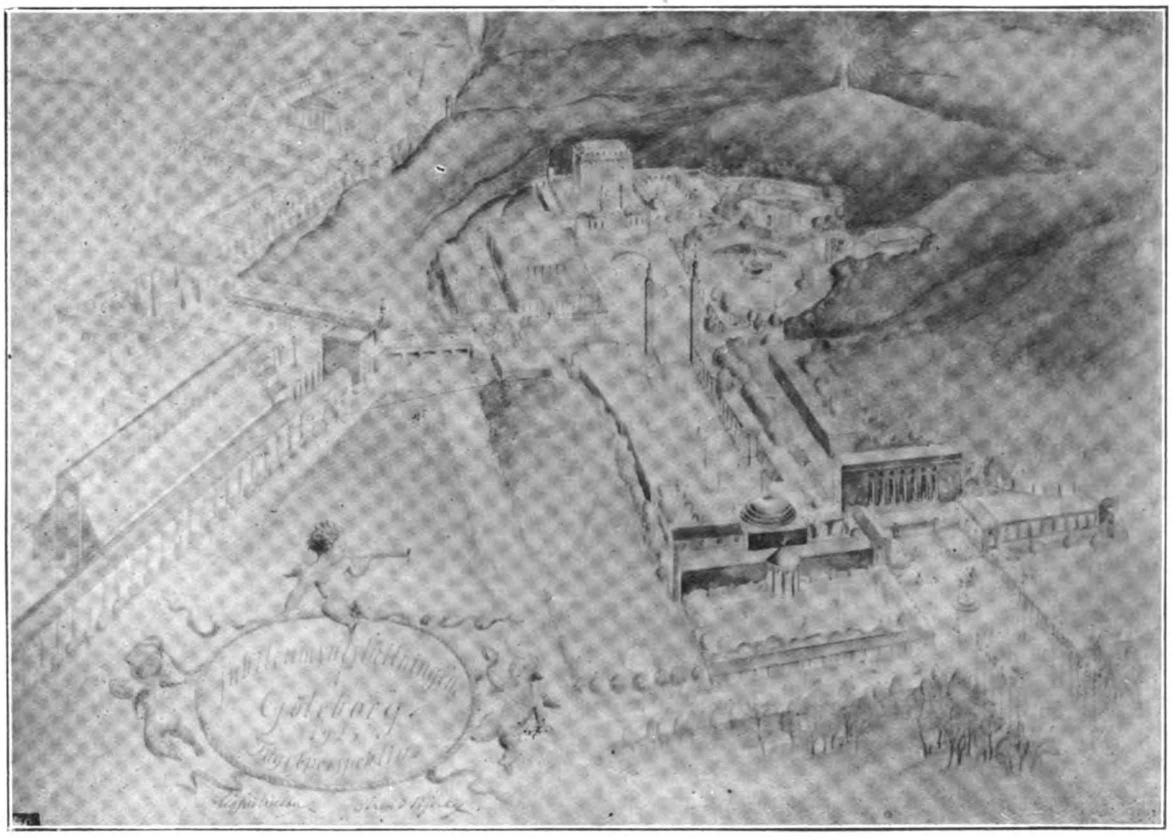
Suppose that we obtain some specimens of bamboo and subject them to the ordinary bending tests. At once, we find difficulties in connection with the measurement of the specimens. The appearance of the bamboo suggests that it is circular, but even if we discover (what is very unlikely) some specimens truly circular on the outside, there would still be the difficulty in determining the interior dimensions of the specimen.



View from Gothenburg Free Harbor

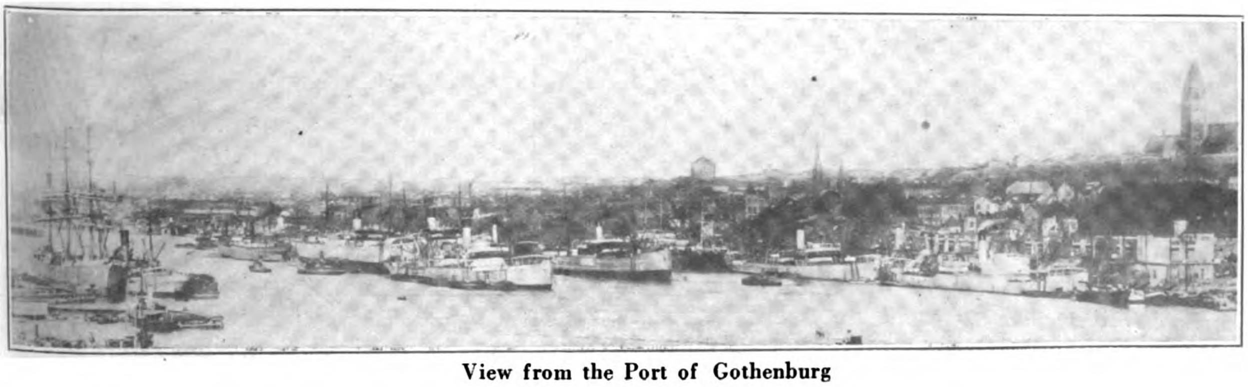
# The Jubilee Exhibition at Gothenburg, Sweden, 1923

SWEDEN, which in the seventeenth century was one of the greatest powers of Europe, stands to-day among the leaders in peaceful cultural and material development. She is a highly organized country and justly famous for her achievements on different spheres of human activity. Her scientists have made important contributions to theoretical science and its practical applications, her educational system is probably the most advanced and efficient in the world. Her trade and industry were early important and Swedish products are to-day known all over the world for their high quality and excellent workmanship. The present world-wide economic depression has, of course, brought on hard times also for Sweden's industrial and commercial life. In the case of Sweden the difficulties have been aggravated by the high value of the Swedish currency, making the Swedish export products very expensive to the foreign buyer.

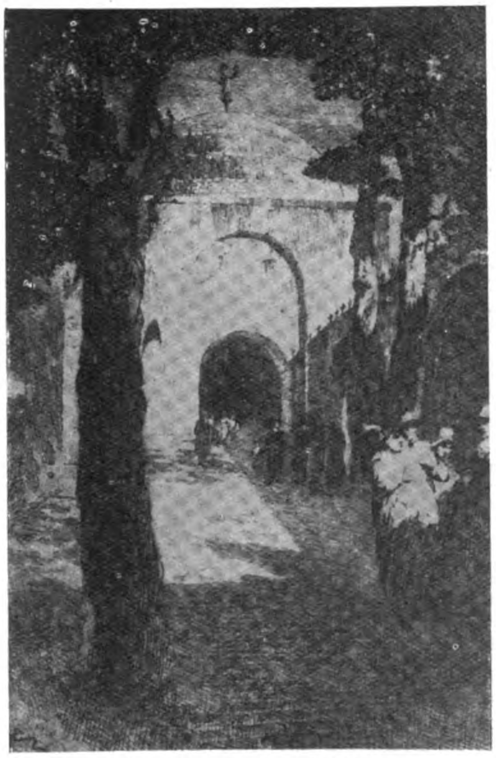


Bird's-eye View of the Exhibition

However the conditions are improving and Sweden has every chance to emerge practically intact in its economic functions from the prevailing crisis.



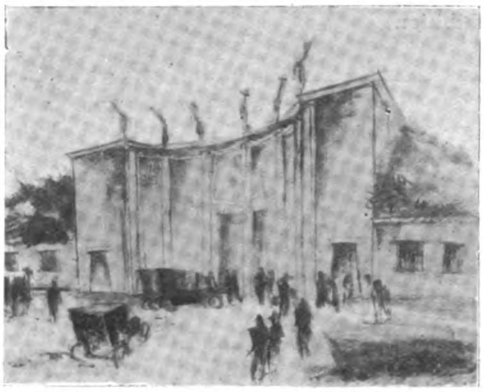
View from the Port of Gothenburg



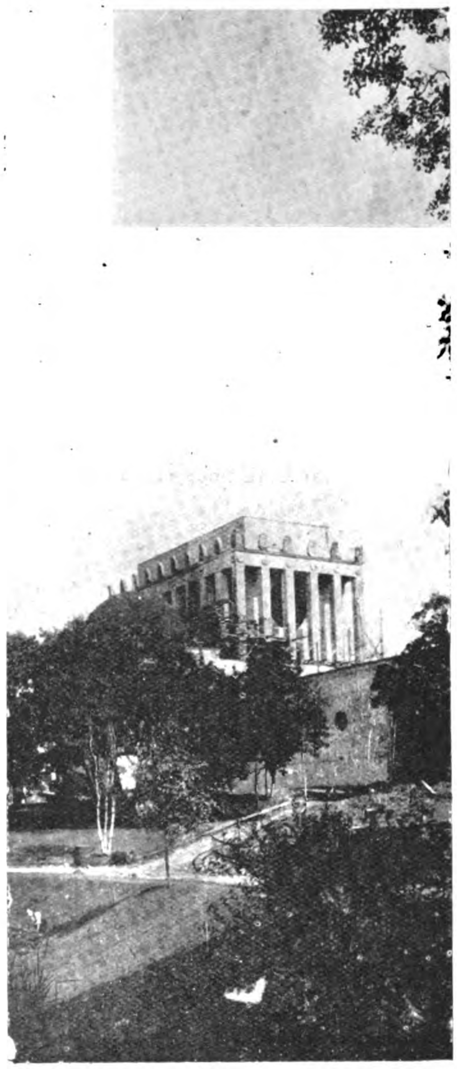
Courtyard in Front of Entrance
(From on etching by Hj. Molin)

One of the leading factors of Sweden's industrial life is the vast natural resources within her boundaries. There are enormous areas of forest-bearing land, iron-mines yelding the best raw material found anywhere, a rich soil suited for extensive agriculture, large stores of waterpower, which have already been utilized to a considerable extent. Roads, railroads and waterways make all places of commercial importance easily accessible. With a population of about 6 millions Sweden has 15,154 kilometres of railways as compared with about 6,000 kilometres in China.

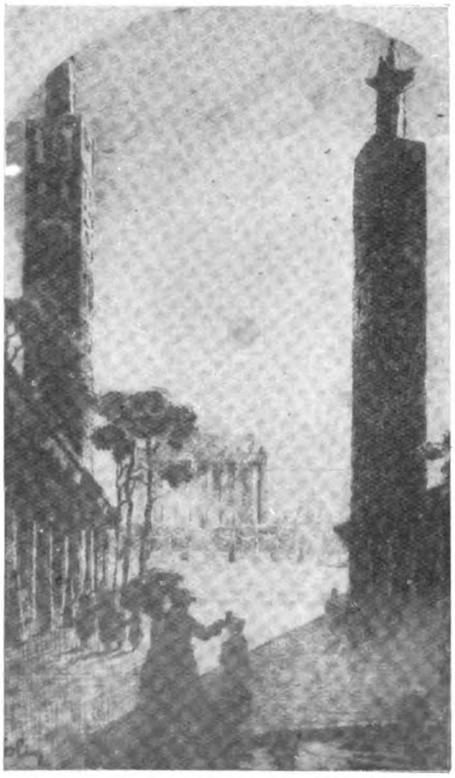
An opportunity to study this interesting country will be given when the city of Gothenburg—the great shipping centre of Sweden—is holding between May 8 and September 30, this year, a historical and industrial exhibition in commemoration of its 300th anniversary. The object of the exhibition is to give a picture of the development of Gothenburg and



Main Entrance to the Automobile Exhibition



The Memorial Hall



View from "Langa Garden." Memorial Hall in Background
(From an etching by Hj. Molin)

Perspective View of the Art Gallery from "Gotaplatsen"
(From an etching by Hj. Molin)

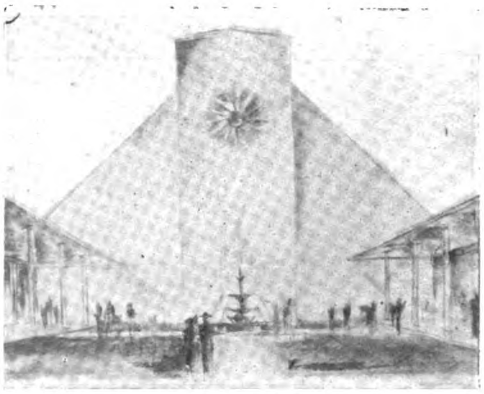
Western Sweden since the foundation of Gothenburg three centuries ago by King Gustavus Adolphus II and further to show what the industries of all Sweden has to offer the world markets.

Below follows a short description of the various exhibitions.

## I. Historical Exhibitions

These comprise a general historical exhibition intended to show the general development of Gothenburg and Western Sweden from the time of the first human settling to modern times. Special exhibitions will picture the historical development of shipping, including shipbuilding, navigation, lighthouse and pilot service, harbors and naval defense. The development from handicraft to modern industrial production, history of domestic and foreign trade, historical development of fishery and of sports will all have separate exhibitions.

(*Concluded on page 95*)

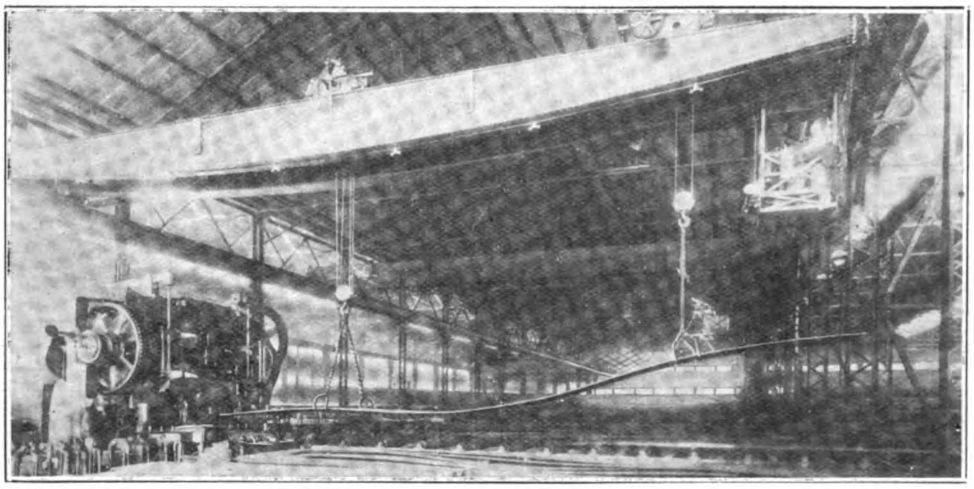


Automobile Exhibition
The Restaurant Court

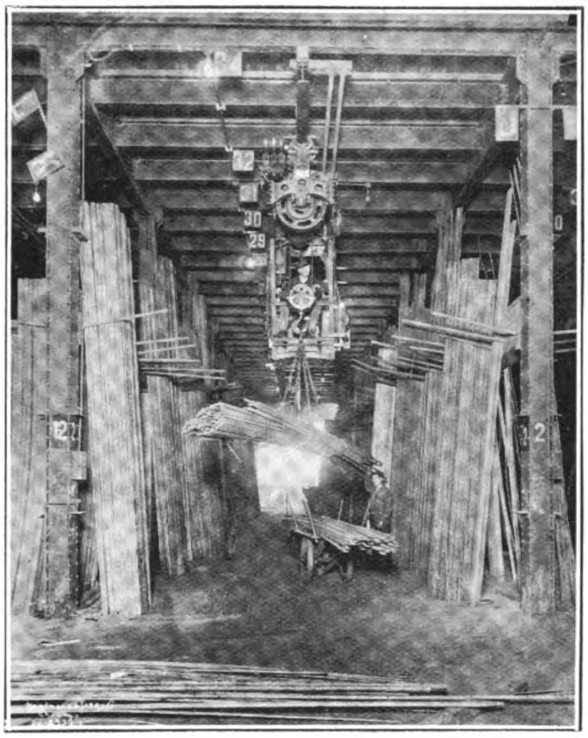
# Ryerson's Steel-Service Plants

## The Record of Eighty Years of Efficiency

THE firm of Joseph T. Ryerson & Son, soon to celebrate its 80th anniversary, ranks among the foremost of the old estbalished concerns of Chicago. As they enter a new era of progress and advancement, it may be interesting to pause a moment and consider the development and growth of over three-quarters of a century.



Mr. Joseph T. Ryerson arrived in Chicago in 1842 as the accredited agent of Wood, Edwards and McKnight, Pittsburgh iron masters. Since the meager railway systems of the day did not extend very far westward, he had to travel from Philadelphia to Columbia, Pa., by railroad, stage coach over the mountains to Pittsburgh, stage to Cleveland, boat to Detroit, rail to Jackson, Michigan, stage to St. Joe and boat to Chicago, making the trip in eight days.



He rented a store just west of the corner of Clark and Water Streets, a small two-story brick building, for $200 per year. A $20,000 stock of iron was soon received from Pittsburgh and the business began.

The next year Mr. Ryerson moved his store to 90 Lake Street, just opposite the old Tremont House, which stood on the southeast corner of Dearborn and Lake Streets. A little later he also established a branch store at Urbana, Illinois.

In 1844 he secured land at 74 Lake Street and erected a two-story building, stocking it with heavy and light hardware in addition to the heavy iron and steel products from Pittsburgh.

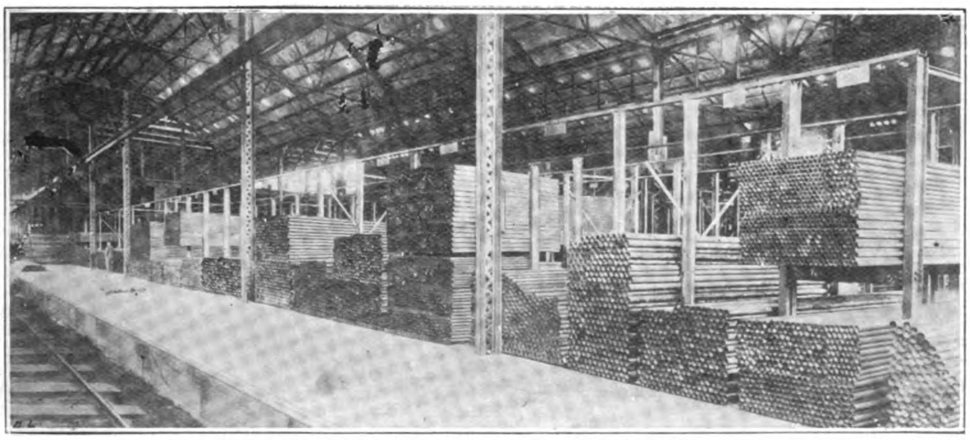
In 1852 purchased a dock lot with 80-foot front on the river at 218-224 South Water Street. His friends at that time told him he was making a mistake to go so far out in the prairie, as this was at least two blocks west of the business centre. In this location his business grew and prospered until October 9th, 1871, when the great Chicago fire reduced his building to ashes and his stock to a conglomerate heap of molten metal. The burned store was rebuilt March 15th, 1872.

About ten years later property was purchased at 18 to 22 Milwaukee Avenue, running through to Clinton Street, and a three-story office and warehouse building was erected. Soon two more stories were added to the building and later a five-story addition was erected on each side of the main building.

In 1908 still larger quarters were necessary, and the first buildings of their present plant were erected. Here they have gradually added to the buildings and property until to-day the Chicago plant occupies a ground area of over 19 acres, with nearly a million square feet of floor space.

In 1914 the Company purchased the W. G. Hagar Iron Co., increased the plant capacity 100 per cent. (present area about 160,000 square feet) and began to serve the great southwest territory direct from St. Louis. In 1915 the New York plant was built (present area approximately 175,000 square feet). In 1917, when war was declared with Germany, the Detroit plant had just been completed. It was offered to the government, but as the war department did not need it at that time, a large stock of steel was laid in and the Detroit plant began to serve the trade in its territory. (Present area about 135,000 square feet.) The warehouse division of the Ferguson Steel & Iron Co. at Buffalo was purchased in 1919, with floor area of 170,-000 square feet.

The firm of Joseph T. Ryerson & Son now serves the entire country from coast to coast from five well placed and complete steel-service plants. Offices in principal cities complete the organization.



Typical Views of Ryerson Steel-Service Plants at Chicago, Detroit, St. Louis, Buffalo and New York

## Large Suction Dredger for Bengal

MESSRS. Wm. Simons & Co., Ltd., Renfrew, launched on October 6, 1922, the large cutter suction pump reclamation dredger *Cowley*, which they have constructed for the government of India, and which will be employed in dredging the shallow rivers in the Bengal province.

The hull of this vessel having four complete bows, is of most unique form, designed specially for opening up new waterways and improving the depth of shallow canals or rivers; the dredger is able to cut a canal or channel about 45-ft. wide at bottom in one cut. Suction frames are led through the three open wells created at the fore part of the ship by the formation of the bows. Each suction frame has two suction orifices, and carries two rotary cutters arranged to work in advance of the suction nozzles for disintegrating clayey material which would otherwise be unsuitable for suction pump dredging. Each pair of cutters is driven by bevel and spur gearing from an independent four-cylinder tandem compound engine. The suction frames are designed to dredge to a depth of 30-ft. under water and are controlled by steam hoist gear and wire rope tackle in such a manner that the frames may be raised or lowered independently or conjointly as required. The two centrifugal dredging pumps are each driven by an independent set of vertical triple-expansion engines. The pumps deliver the material dredging direct through a floating pipe line 600-ft. in length and 42-in. diameter. The pipe line is raised by a terminal pontoon to a height of 25-ft. above water level and the material is finally discharged over the canal bank to a distance of 150-ft. from the centre of the terminal pontoon.

Another feature is that the dredger is fitted with three propellers each driven from a separate set of vertical compound surface condensing engines of sufficient power to obtain a speed of eight knots. The engine room outfit includes independent condensing plant, automatic feed pumps, bilge pumps, service pump, filters, evaporators. Steam is supplied by four Babcock and Wilcox watertube boilers constructed for a working pressure of 180-lbs. per square inch, and fitted with forced draught. An outfit of machine tools is provided capable of dealing with minor repairs. The floating discharge pipe line consists of twelve circular pontoons, each carrying a 42-in. diameter pipe 50-ft. long coupled together by special ball and socket connections.

The vessel has been constructed under the supervision of Messrs. Sir J. H. Biles & Co., Glasgow and London, naval architects to the Indian government.

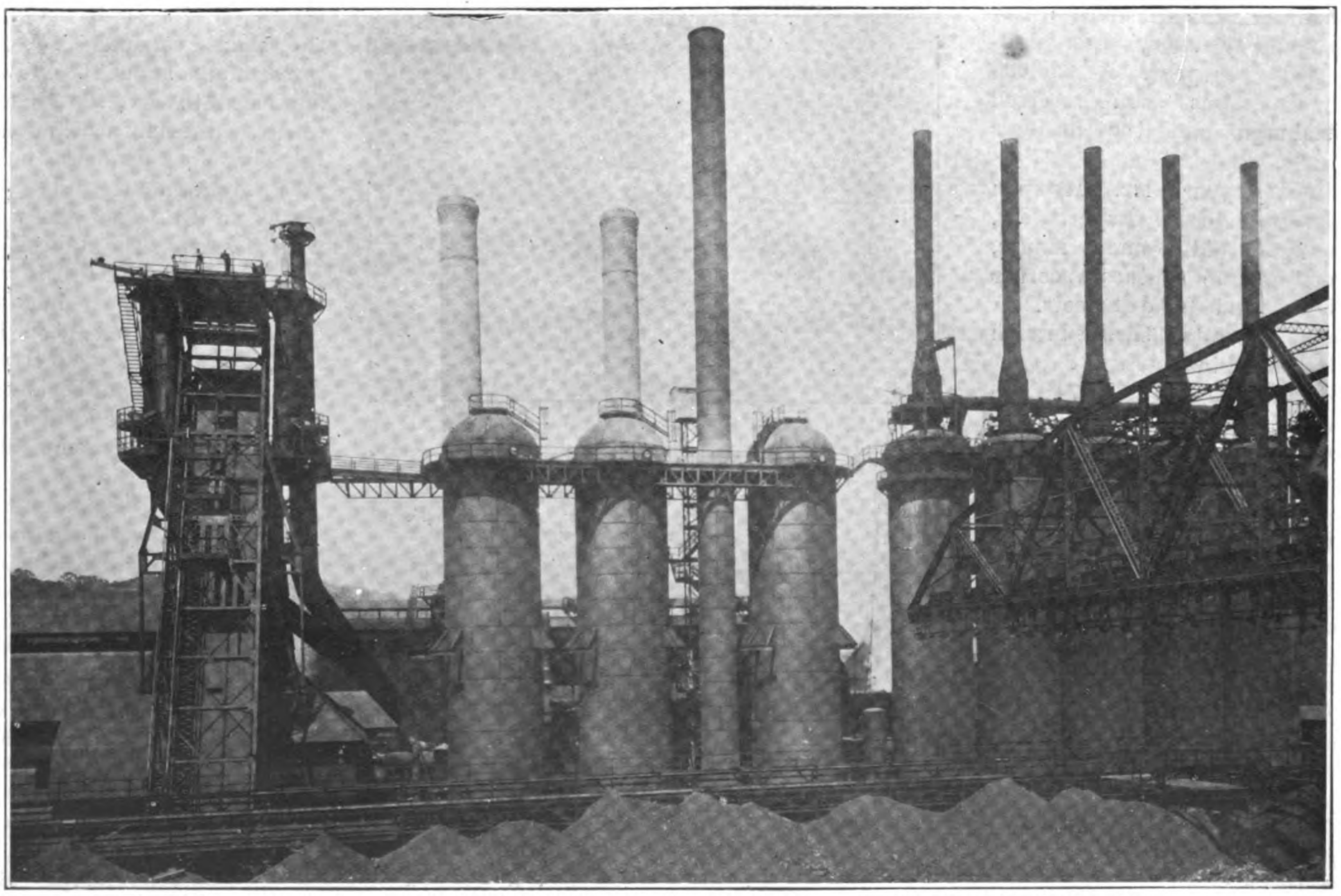
As the vessel left the ways the naming ceremony was performed by Mrs. Brown, wife of the chairman of the company.

## A 600-Ton Blast Furnace

THE No. 3 blast furnace built by the Riter-Conley Company for the Pittsburgh Crucible Steel Company at Midland, Pa., in 1919, is modern in every respect, and capable of producing 600 tons daily.

The following are the principal dimensions:—Hearth 18-ft. 0-in. in diameter, bosh 22-ft. 6-in. in diameter, bosh angle 7 degrees and 30 minutes, stock line 16-ft. 0-in. in diameter, large bell 12-ft. 0-in. in diameter, height of furnace 92-ft. 0-in. from centre line of iron notch to top ring.

Furnace has cast steel hearth jacket with cast iron cooling staves, eight columns, twelve tuyeres and revolving top. Skip incline is of the cantilever type and is entirely free from furnace. Cleaning system consists of a dust catcher, 25-ft. 0-in. in diameter, and 35-ft. 0-in. high, and a dry cleaner for cleaning all gas. There are three stoves 23-ft. 1-in. in diameter and 105-ft. 0-in. high, with 3½-in. checkers, stove stack is 7-ft. 6-in. by 200-ft. 0-in. A passenger elevator affords easy access to top of stoves and furnace. The McClintic-Marshall Products Co. is the foreign department of the Riter-Conley Co.

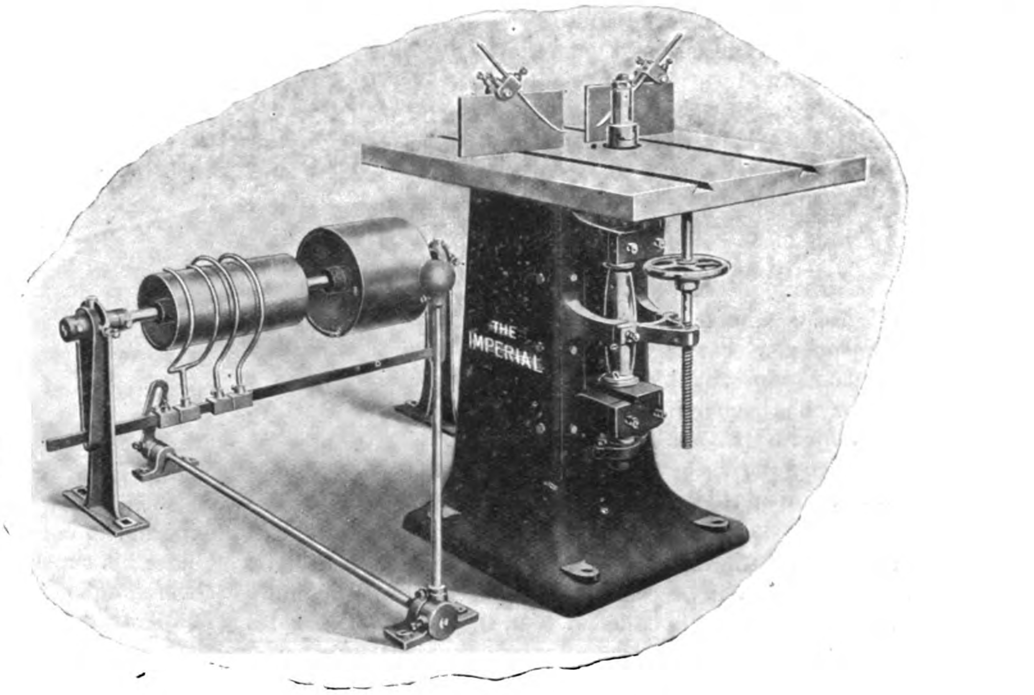


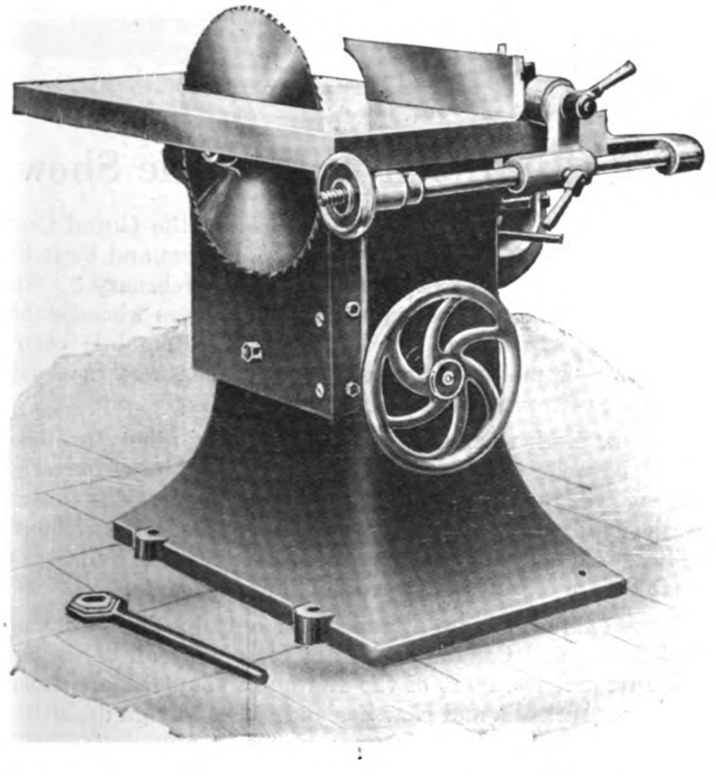
The 600-Ton Blast Furnace of the Pittsburgh Crucible Steel Company, erected by the Riter-Conley Company

# British Woodworking Machinery

THE works of The Mechanical Engineering Co. (Manchester), Ltd., have been in existence forty years engaged solely in manufacturing woodworking machinery, a guarantee that its products possess all modern improvements in design, detail and finish, which expert knowledge only can give to them.

There are many woodworking machines lacking the finer and most important points which would not pass the test of the woodworking engineer. To give an instance of what they mean, attention is invited to their 'TOLEDOV' and 'TRITON' surface planers. These machines will plane a glue joint which is an exceedingly important point to cabinet makers and builders.



Their "IMPROVED" and "RELIANT" saw benches are two more examples of machines that embody the best design, workmanship, and material. The saw spindles revolve in ball bearings provided with the most efficient type of lubrication. The loose pulley is smaller in diameter than the fast and revolves on a separate fixed sleeve without coming in contact with the saw spindle. The advantage of this is that the saw will not unexpectedly revolve, thereby eliminating the risk of accidents to operators. These machines possess other advantages, all of which lift them into the highest class.

This company makes two sizes of spindle moulders, the "EUREKA" with table 30-in. square and the "DIPLOMA" with table 36-in. square. Both these machines are of the reversing type through their countershafts. The quality of each machine is shown in the fact that any standard machine will, without special preparation, stand up satisfactorily to a speed of 6,000 to 7,000 revolutions per minute. The normal speed is about 4,000 revolutions per minute. Of necessity, these machines require special attention as regards lubrication and great attention has been given to this point. Another important feature, due to the extremely high speed, is to have a perfectly balanced spindle. This also has had most careful attention.

No matter what machine is required, the makers claim that the selection can safely be left to them to supply the very best of its kind made in British works. They have endeavored to eliminate all complicated mechanism as far as possible, so that the operator of less than average capability can work the machines satisfactorily. *Lubrication* of every detail in all machines has had a thorough investigation and can be taken as the last word in what has been and is the greatest cause of trouble in machinery.

A brief list of the machines manufactured by this company is given below :—

*Saw Benches.*—Plain, with rise and fall tables. Pendulum crosscut. Horizontal crosscut roller feed. Rope drag feed.

*Surface Planers.*—Medium weight and heavy.

*Spindle Moulders.*—Medium weight and heavy.

*Band Sawing Machines.*—All sizes of wheels.

*Combined Hand and Power Feed Planing and Thicknessing Machines.*—15-in. to 24-in.

*Panel Planing and Thicknessing Machines.*—17-in. to 27-in.

*Band Papering Machines.*—Disc, bobbin, belt, drum.

*Tenoning Machines.*—One size.

*Mortising Machines.*—Hand and power.

*Fret Sawing Machines.*—One size.

*Grinding Machine* for knives and saws, etc.

The Mechanical Engineering Company, Ltd., are desirous of appointing agents in Far Eastern countries.

# Safes Roasted to Test Their Resistance

FIVE hundred salesmen, their eyes focused on one point, gaze with eager interest and suppressed excitement as a white hot steel safe, weighing half a ton, is drawn from a roaring inferno of fire and quickly swung three stories in the air, says the *Popular Science Monthly*. They hold their breaths during the short interval in which the craneman gathers his strength for a powerful jerk at the release rope. Dropping like a fiery meteor with a trail of scintillating sparks, the safe turns over slightly in its flight and crashes, corner first on a pile of broken bricks. Two laborers rush in with a streaming hose and play it on the mass of hot steel, enveloping it in a haze of hissing vapor.

Soon the clouds of steam thin and operators equipped with asbestos gloves approach the safe and open the door. The theoretical conflagration is over and the safe, after subjection to a heat seldom attained in ordinary fires, combined with a fall such as might conceivably take place when floors collapse during the height of a devastating fire, is seen to be still intact, with its contents of inflammable paper showing no signs of the fire it has been through.

### A Special Laboratory

Such is the spectacular demonstration staged periodically for visiting salesmen and executives by a progressive manufacturer of a fire resistive safe. So valuable have these tests become that a special laboratory has been built in Marietta, Ohio, where new models of safes are subjected to similar rigid experiments. Equipment has been added by purchase or by invention that will simulate every known condition that safes must withstand in actual conflagrations.

It was a Methodist minister who, some 14 years ago, conceived the idea that a safe might be constructed that would be not only lighter in weight and greater in capacity than the old style iron safes then commonly in use, but also absolutely proof against destruction by fire. This man realized, as many others never have, that the contents of a building are not included when the term " fireproof " is applied to a structure. For while fabricating materials such as concrete and steel, with which a building is erected may be proof against fire, the furnishings and equipment of buildings are usually of the most inflammable nature.

### Parson's Ideal Successful

After wide research and experimentation the Methodist minister completed a safe that under test proved to be all that he hoped. But though convinced himself, he found that salesmen and prospective purchasers still retained a measure of doubt that those light weight safes could do all that he claimed. So the testing laboratory and the spectacular tests were called into existence.

Previously safes had been tested by placing them in wooden huts and igniting the huts, but such tests were not exact imitations of conditions encountered in real fires. Test conditions could never be duplicated ; results varied with the wind, and there was no way of surrounding the safe with burning gases.

### Details of the Test

The most important apparatus at the present testing laboratory is a huge oven that can be heated to temperatures as high as 2,000 degrees F. by burners supplied with a special grade of high temperature gas delivered through a six-inch main. Air blowers supply the air for proper combustion of the gas.

After the safe to be tested is stuffed with books and loose papers, in simulation of the customary office safe, several sensitive thermometers, called " thermocouples," are placed at selected locations inside the safe and outside in the oven. The safe is then locked, oven door closed, and the burners are lighted.

At the end of five minutes the thermocouples register a temperature of 1,100 degrees ; five minutes more and the heat increased to 1,400 degrees ; at the end of thirty minutes the heat within the oven stands at 1,650 degrees ; and finally, after two hours a top temperature of 1,950 degrees is recorded.

Through mica peepholes in the oven side, the safe appears as a mass of flaming red steel with burning gas enveloping it from top to bottom. In a near-by room observers watch the thermocouple readings and maintain the heat at the predetermined temperature by signaling the oven operators through a system of colored lights.

### Drops with a Crash

After the completion of the heat tests, the safe is withdrawn the oven. A crane hooks it, then lifts it 40 feet in the air, it is released and dropped on a pile of broken bricks. Following this crashing fall, the safe is returned to the oven for a second period under high temperatures. This reheating is supposed to imitate the roasting undergone by the safe after it has fallen through a collapsed floor into a mass of burning debris. After an hour the safe is again withdrawn from the oven and cooled by streams of water.

Not all the safes are tested in the presence of thrilled audiences. The saff at the laboratory is constantly at work on routine tests, the results of which will tend to improve the quality of the product. Every 60 days a number of safes of all sizes are taken at random from stock and subjected to the most strenuous tests.

### Selecting the Limit

The rating is based on an arbitrary satandard selected after an experiment conducted by M. L. Carr, director of the laboratory. Under his supervision, sheaves of printed amongst clients who discovered a paper were placed in an oven and slowly roasted. As the temperature increased, the condition of the paper was noted through the glass front of the oven. At 500 degrees the paper had charred to a point where the writing and printing were illegible. Three hundred degrees was, therefore, selected as the limiting temperature that should be permitted in a safe.

# U.S.A. National Automobile Show

THE annual national shows will be held at the Grand Central Palace, January 6 to 13 and at the Coliseum and First Regiment Armory at Chicago, January 27 to February 3. These exhibitions present the products of manufacturers whose stability is indicated by membership in the national automobile chamber of commerce or motor and accessory manufacturers' association or who have been producing at least one year.

At New York there will be approximately ninety exhibits of cars and between three and four hundred exhibits of accessories. At Chicago the number of cars will be the same, but due to lack of space the exhibits of accessories will be approximately two hundred and fifty. As has been the case for several years the buildings will be unable to accommodate a great many applicants.

These exhibitions are attended not only by dealers from the United States and Canada, but from practically all of the South American countries, most of the European countries and from as far away as Australia and New Zealand. The foreign departments of the manufacturers are always adequately represented and an opportunity is furnished the visitor to talk, not only with the business departments but with the heads of the mechanical, sales, export and service departments.

The management cordially invites visitors from abroad and will gladly furnish the necessary credentials on application.

# Elesco Superheaters

EXPERIENCE in the design and manufacture of steam superheaters has indicated a number of essential points connected with their design, construction and operation. These have formed the basic specification for the Elesco superheater, and may be summarized as follows :—

1. Safety in operation.
2. Accessibility for inspection and repairs.
3. Protection against overheating, insuring maximum life.
4. Maximum superheating efficiency.
5. Improved efficiency of the combined boiler and superheater.
6. Use of high steam velocities in order to maintain clean interior surfaces and maximum heat transfer with minimum drop in steam pressure.
7. Uniformity of superheating, and ease of regulation.
8. Provision for expansion and contraction of all parts.
9. Provision for keeping units clean.
10. Minimum possibility for leaks.
11. Flexibility in adaptation to different designs of boilers.
12. Uniform distribution of the steam through all units under all condition of load positively preventing any by-passing of the steam.

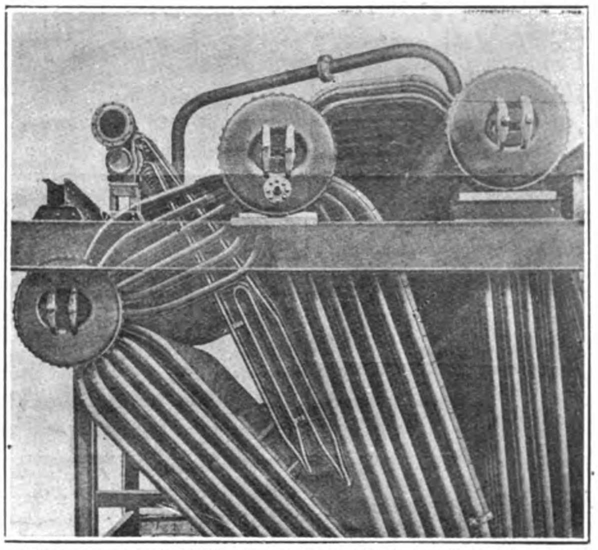


**Fig. A. Typical Arrangement of Elesco Superheater**

## Headers

The headers are made of open hearth steel and are usually located outside of the hot gas path, and in the majority of the designs, outside of the boiler setting proper, so that the headers, as well as unit joints, are accessible for inspection and repairs without entering the boiler setting. The advantage of such an arrangement, particularly under present conditions of labor and supervision, will be readily appreciated. Safety valves conforming to the A.S.M.E. Boiler code are provided and are located near the outlet. Provision is also made for drainage. Superheated steam headers are provided with thermometer wells.

The headers are made with the outlet on the superheated header in an opposite location to the inlet on the saturated header, assuring an even distribution of the steam flow through all units.

Each header is reinforced along its length with a steel bar milled on one side to fit the interior wall of the header. This detail is shown in Fig. 1. This bar adds the necessary material to provide a sufficient grip for the studs and is drilled along its length at points registering with holes in the header, forming the steam passages between units and header.

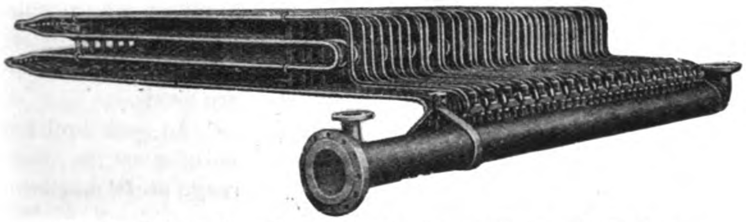


**Fig. 2. Elesco Superheater for Horizonal Water-tube Boiler**

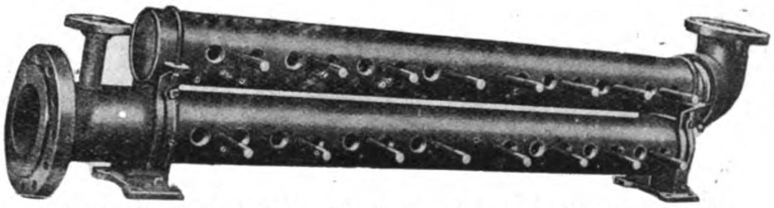


**Fig. 3. Elesco Superheater Headers ready for Application of Units**

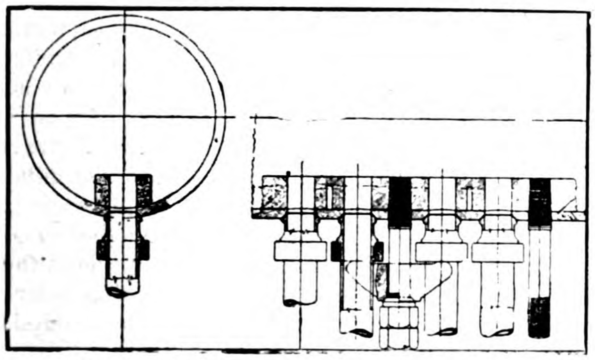


**Fig. 1. Details of Ball Joint Construction Between Header and Units**

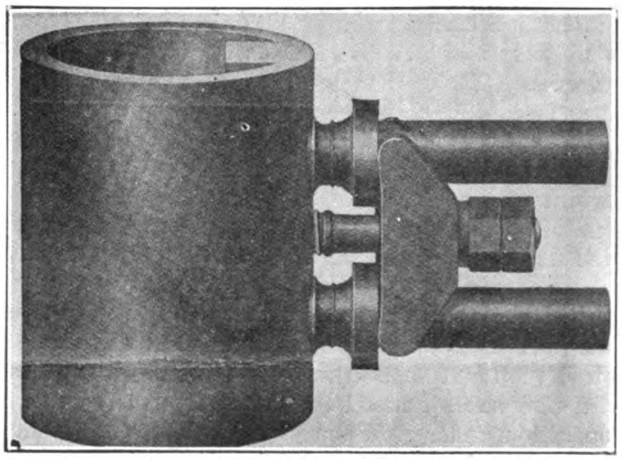


**Fig. 4. Section of Header and Units Showing Ball Joint Construction**

The superheater consists, in general, of two headers, one acting as the distributor for the saturated steam coming from the boiler and the other a collector header for the steam after it has been superheated, and the necessary connecting units in which the actual superheating takes place. A typical arrangement is shown (Fig. A).

## Units

Units are made of heavy cold drawn, seamless steel tubing of the proper diameter to give correct steam areas. The tubing is not covered with any other material and it thus presents a

smooth external surface, offers minimum resistance to the flow of the gases and avoids serious collections of soot that would interfere with the efficiency and uniform operation of the superheater. This construction also brings the steam into intimate contact with the gas-touched heating surface, and gives a low resistance to the flow of heat from the gases to the steam.

The form of the unit is such as to permit free expansion and contraction of all parts. The tubes are bent on specially designed machines that do not weaken them or reduce the steam areas. Ample provision is made to prevent the pipes from warping. In cases where severe moisture and scale conditions are prevalent, the units can be made so that they may be satisfactorily cleaned on the inside. Due to the fact that the units are made of small diameter tubing, it is possible to obtain correct relations between steam areas and heating surface and so distribute the cross sectional area through the superheater as to obtain the most desirable steam velocity without the use of cores. The use of cores in superheater tubes causes a considerable drop in pressure through the superheater, because of the added frictional resistance of the steam and where bad water and foaming occurs, the small space between the cores and the inside of the tubes is quickly stopped by scale-forming material.

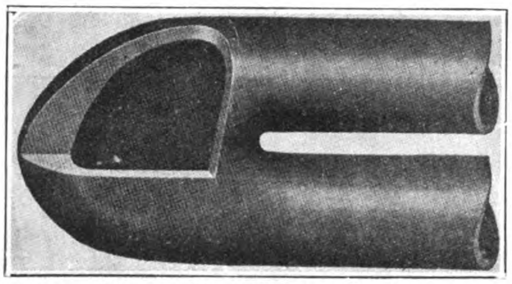


**Fig. 5. Forged Return Bend**

The connection between the units and headers is a metal to metal joint. This joint is made so as to permit the easy removal of the units without special tools, and its use also avoids two holes in the header which would be necessary with rolled joints. Any unit in the superheater can be disconnected without interference with the other units, and the work of disconnecting a unit, which consists merely of loosening a bolt, can be done by the ordinary power plant attendant. The ball end, as shown in Fig. 1, is formed integral with the tube by a special forging process. The ball is then faced and ground, and fits into a ground seat in the header, which is made at an angle of 45 degrees. The clamps and washers are made of forged steel, and the header bolts are made of heat-treated alloy steel, with an elastic limit of not less than 75,000-lbs. per square inch. This joint, while a new departure in stationary superheater resign, has been used by this company in more than one million five hundred thousand superheater units and is the only metal to metal joint that has withstood the extremely hard service of locomotive operation under steam pressure of 200 to 225 pounds and total steam temperature of 650 to 750 deg. Fahrenheit.

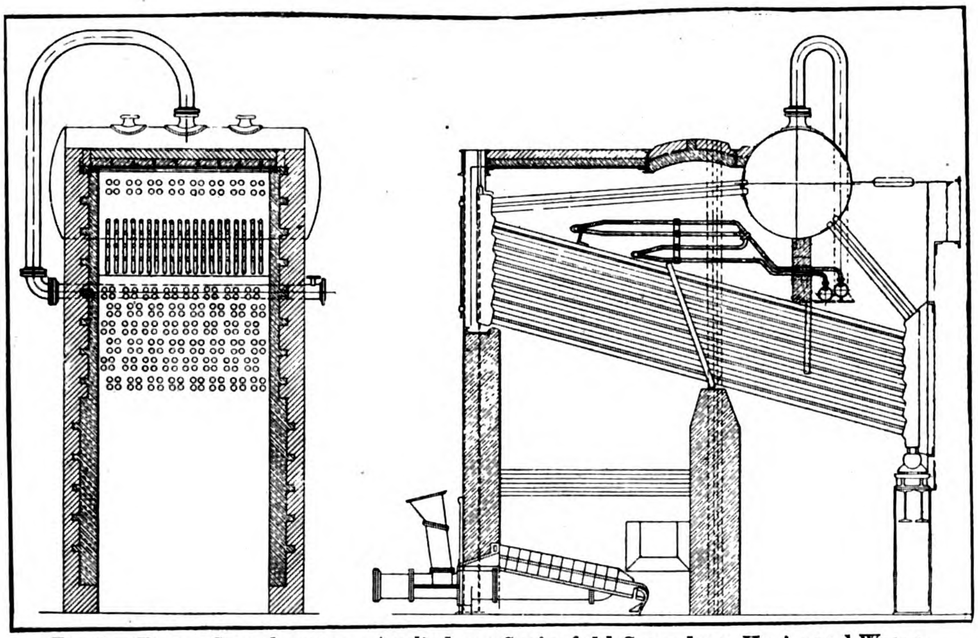


**Fig. 6. Elesco Superheater, as Applied to a Springfield Cross-drum Horizontal Water-tube Boiler**

## Return Bend

In most designs of Elesco superheaters, the loops of the units are forged return bends. These return bends are made on the ends of the units from the metal of the pipe itself by a special mechanical forging process, without the use of electrical or acetylene welding and without the addition of any material or metal. The distribution of the metal as will be seen in Fig. 5 is such that there is an increase in section at the end. The use of the forged return bend in the unit construction of the Elesco superheater results in a continuous pipe, the bend being as strong if not stronger than the body of the pipe. It also affords a sharp return without adding excessive pipe friction and facilitates the convenient and advantageous location of the superheater units.

## Location of the Superheater

The location of the superheater in all boilers is such that the headers and joints are accessible for inspection and repairs, and so that any unit can be easily withdrawn. In all cases the superheater is entirely separate from the boiler proper, being located in a component part of the boiler setting through which the products of combustion pass, in such a manner that the addition of the superheater increases the over-all efficiency of the boiler by lowering the final flue gas temperature for any given set of furnace conditions. The superheater header is suitably protected from the direct action of the hot gases. Headers and units are securely supported and are independent of the brick work wherever this is possible. No additional care of the boiler is necessary on account of the installation of the superheater, and the design and construction are such as to make the cost of maintenance and operation negligible.

With the ball joint construction, hand holes and gaskets for unit joints are entirely eliminated and the number of joints to be maintained is approximately one-fourth of the number required where rolled joints, including the necessary hand holes, are used.

In case boiler repairs may be necessary, units can be removed and replaced without distorting units or headers and without the destruction of metal in any way. Units can be readily detached, removed or replaced without the need of a boiler maker, it being necessary to remove but two nuts to loosen two units.

High steam velocity is used in Elesco superheaters, a feature which tends to maintain clean surfaces on the inside of the units.

Units can be blocked off when necessary simply by relieving the pressure on the boiler and applying a dummy coupling to the unit connections.

## Summary of Advantages

Elesco superheaters are suitable for application to all types of boilers. They provide maximum superheating efficiency and capacity and maximum combined efficiency of the boiler and superheater, as well as uniformity of superheating effect. Their design and construction is such as to provide freedom from leaks, ease of application and accessibility for inspection and repairs, and maximum length of service without renewal.

Superheated steam will accomplish more in power plant fuel economy than any other single factor; the higher the superheat the greater being the economy. The superheaters manufactured by this company, because of the correctness of the principles employed in their design and construction, provide the maximum superheat obtainable. They are, therefore, particularly suitable for modern power plants where the greatest economy, capacity and efficiency are essential. At the same time, their construction is such that they can be built to deliver any amount of superheat required, in cases where the maximum is not desired. They are applicable to all boilers of either the fire tube or water tube type, vertical or horizontal, and they embody the results of the long experience of this company as designers and builders of steam super-heaters for all classes of service.

# Food for Thought on the Question of Waterproofing

"WATERPROOFING"—millions of dollars are wasted annually on construction through inadequate waterproofing. Metal rusts, brick crumbles, and wood deteriorates when not sufficiently protected by a coating to prevent water or dampness from forcing itself through. In fact, there is always present the danger that the building itself may crumble due to the weakened condition of the supports brought on by water damage. Did you ever stop to realize this ? Take for instance a roof of your building. If there is water coming through any spot, it isn't the annoyance of the drops of water coming through the building, it's the walls and ceilings that are ruined, not mentioning the merchandise that may be stored underneath the roof. This loss is far greater than the actual cost of the roof, in excess of the sum that it would have cost to make same waterproof with the product manufactured by the Everseal Manufacturing Company, 41 Union Square, New York, called "Everseal Plastic Roofing."

Everseal plastic roofing is the most durable water-proofing can compound, because it will not chip, crack, bulge or break loose. Most serviceable, because old roofs of any description be recovered at a very small expense. This product comes ready for use and requires no melting, heating or mixing. Everseal plastic roofing sets over the entire roof like a solid coat of rubber, expanding and contracting with the surface it covers. It is very easily applied with a mason's trowel, directly over the old roof which can be used as a base, and eliminates the disadvantage of laps and seams.

Everseal plastic roofing will renew the worst weather beaten surface and maintain its life at a surprisingly low cost. The first cost is the only cost as the surface will never require painting or patching which are a great expense and at best give but temporary service. A comparison of prices will reveal that Everseal plastic roofing will save the property owner from 40 to 60 per cent. as compared with the laying of a new roof.

The initial cost of a tin, iron, steel, shingle, slate, gravel or composition roof is far greater than the initial cost of Everseal plastic roofing. The expense on these other roofs now start as the surface of tin, etc., must be preserved with an outside paint which in time costs a good deal more than the initial price paid for the roof, whereas the cost of Everseal plastic roofing ceases as soon as it is applied to the surface.

The uses of Everseal plastic roofing does not stop after waterproofing the roof. It has always been adopted to waterproof cellars, foundations, walls, cisterns, tanks, silos, or in fact any leak anywhere. Everseal plastic roofing is a combination of natural gums and long asbestos fibre which when applied to the surface will hermetically seal same, preventing any possibility of water or dampness seeping through.

The remarkable feature of Everseal plastic roofing is that no matter how damp or moist the surface is, Everseal will adhere securely to same. In fact, Everseal can be laid during a heavy rain with equal facility and positive results.

A few other uses of Everseal plastic roofing are for joining and setting glass in greenhouses, for caulking boats, lining the entire gutters, flashing the brick or side of a wall and for laying tile or slate.

Consider the economies that can be effected with this truly wonderful waterproofing compound, a product adapted to waterproof anything anywhere.

At last, Everseal plastic roofing has answered that every great demand for a product that will do all kinds of waterproofing.

# Safety Devices for Oerlikon Steam Turbines

THE trustworthiness of the steam turbine is established, but it is now customary to make assurance doubly sure by fitting it with various devices which experience has shown to be desirable. Particular attention has been paid to the design of these devices by the Oerlikon Company, of Switzerland, and in this article we are enabled to describe their construction and working.

If acid vapours enter the boiler and turbine house, or, if as a conseqnence of leaky joints sea-water obtains admission to the condensate, serious corrosion troubles may arise in the turbine. In order to counteract such tendencies, the Oerlikon Company has paid great attention to the thorough drainage of the turbine, both when running and when at a standstill. Fig. 1 illustrates diagrammatically the drainage system adopted. In order to prevent any water from the boiler entering the turbine, a large water separator U is fitted into the steam pipe immediately in front of the main valve A. The steam exist of the separator is divided with a strainer, the butt end and lower portion of which are not perforated. The steam is, therefore, forced to change its direction, and the heavy drops of water are made to fall downwards. The water thus ejected is led away from the separator through the steam trap V. The trap is provided with a ball float, which opens a valve below it when the water has accumulated to a certain degree. A valve W is provided in the pipe in front of the trap and leads the steam into the trap or alternatively into the open. The trap can, therefore, be inspected during ordinary running hours without interfering with the working of the separator. To the open conduit leading from the valve W a second trap can be connected if desired.

Nearly all turbines are nowadays operated by superheated steam, so that after the machine is regular operation no water will be deposited in the main steam pipe. From the low-pressure end of the turbine the condensed water escapes freely as a consequence of the constantly increasing diameter of the stages. Circumstances are similar at the high-pressure end, although the drainage here is less free in view of the fact that the increase in the diameter of the wheels from stage to stage is less rapid.

When the turbine is at a standstill, it is as important to secure perfect drainage as it is when it is running. A second valve X is provided in front of the main valve A, which is also closed when the turbine is shut down. The valve W is also turned into the open position. If, then, the steam pipe in front of the valve X be under pressure and this valve be leaky, the leakage steam will not pass through the valve A into the turbine, but through the valves Y and W into the open. In order to drain away the condensed steam from the turbine casing after shutting down, three drains Z are provided and are opened when the turbine is at a standstill.

Fig. 3 represents a longitudinal section of a large size Oerlikon steam turbine. The rotor is carried in two bearings, one of which is designed to take the thrust. The lubrication system is of the forced pressure type. After leaving the bearings, the lubricating oil is directed into a cooler. The generator is driven through the intermediary of a semi-rigid coupling. The runner wheels are

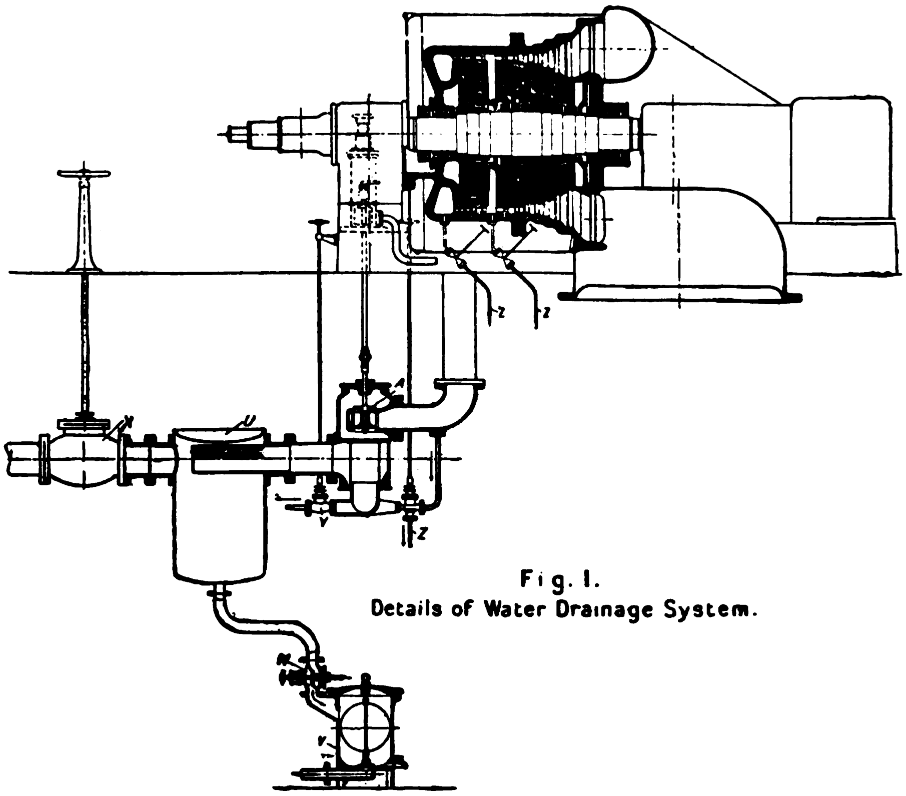


Fig. I.
Details of Water Drainage System.

designed as discs of equal sectional strength. The clearances between the casing and the runner wheels and between the runner wheels and the diaphragms are liberal, amounting to from $\frac{1}{8}$ to $\frac{1}{4}$-in.

Fig. 2 illustrates the governing device. The livesteam passes through the main valve A to the regulating valve B. The latter is governed by oil under pressure delivered from a power cylinder or servo-motor, the action of which is controlled by a spring governor. The admission of steam into the turbine is regulated by throttling it in accordance with the load. If the full admission pressure be reached, and the load increases still further, the overload valve C is opened automatically, and admits an additional supply of live steam whereby the guaranteed overload is obtained.

The oil under pressure for the bearings, as well as for the governing system, is supplied by a " toothed " oil pump D, directly coupled to the governor spindle E and therefore running at relatively low speed. It is claimed that this type of pump is particularly reliable. The oil on leaving the bearings and the governing system, passes first through the base plate F and then runs through a stainer G.—which can be changed whilst the turbine is in service—into the coller H. Although all precautions are taken, it is possible that by coincidence, or as a consequence of improper manipulation, the action of the oil pump may fail, as, for instance, by the packing in the conduits being damaged. To guard against the effects of such an accident, the Oerlikon turbine is fitted with a safety device designed to become operative upon a failure of the oil supply. The main valve A is closed by the action of the spring J, and is opened by the oil admitted beneath the piston K under a pressure of approximately 60-lb. per square inch. The strength of the spring J is such that the main valve is totally closed as soon as the oil pressure drops to 22-lb. If, then, the oil pressure should fail for one reason or another, the admission of steam is stopped before the bearings are endangered.

If desired the Oerlikon Company supplies a signalling device, which draws the attention of the attendant to any adverse condition of the oil supply. If the set is designed to work in parallel with other machines on the same supply system, an automatic electric switching-off device can be supplied. The spring J keeps the main valve in the closed position, with a force of about half a ton. To shut down the turbine the three-way cock L is turned round through 90 deg. The oil then flows away from beneath the piston K, into the base plate F, and allows the spring to close the valve.

As is now generally customary, the Oerlikon turbine is provided with a safety device to guard against over-running. The governor M is mounted on a shaft E, driven by worm gearing N from the turbine shaft. Although the regulating valve B is moved by oil under a fairly high pressure, the governor is called upon only to operate the small controlling piston P. Even if the wear in the gearing N became such as to bring the governor shaft E to a standstill, and so cause the governor to lose all control over the machine, the turbine would not " run away." The oil pump D being coupled to the governor shaft, would stop with it, and as consequence of the resultant dropping of the oil pressure the turbine would be shut down by the action of the spring J, as explained above. In order, however, to prevent under all circumstances an excess speed being reached, the Oerlikon Company provides in addition a powerful emergency governor Q—see Fig. 3—fitted to the end of the turbine shaft. This emergency governor instantly shuts off the steam supply when the speed of the turbine exceeds the normal by approximately 15 per cent. Its action results in the oil control piston R being operated in such a manner that the pressure of the oil is transferred from the under to the upper side of the main valve piston K. The main valve is thus closed by a force of approximately one ton, due to the

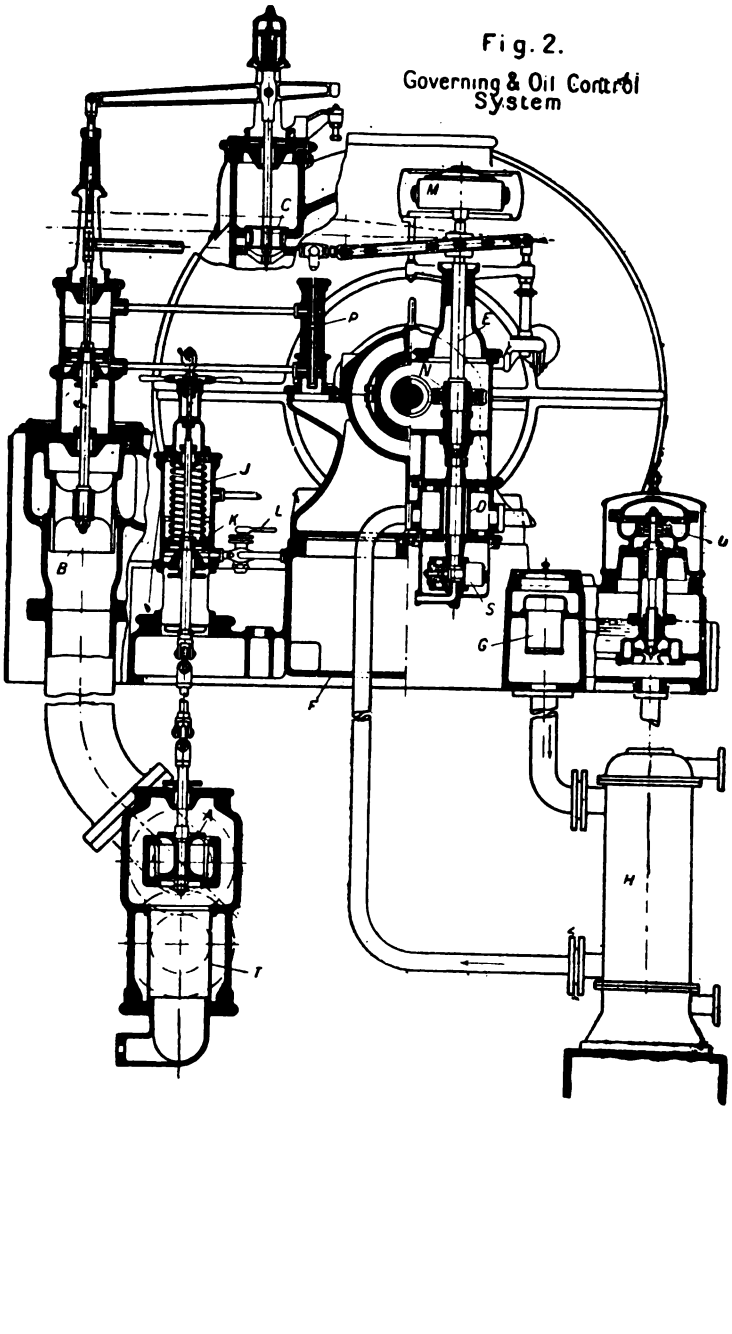


Fig. 2.
Governing & Oil Control System

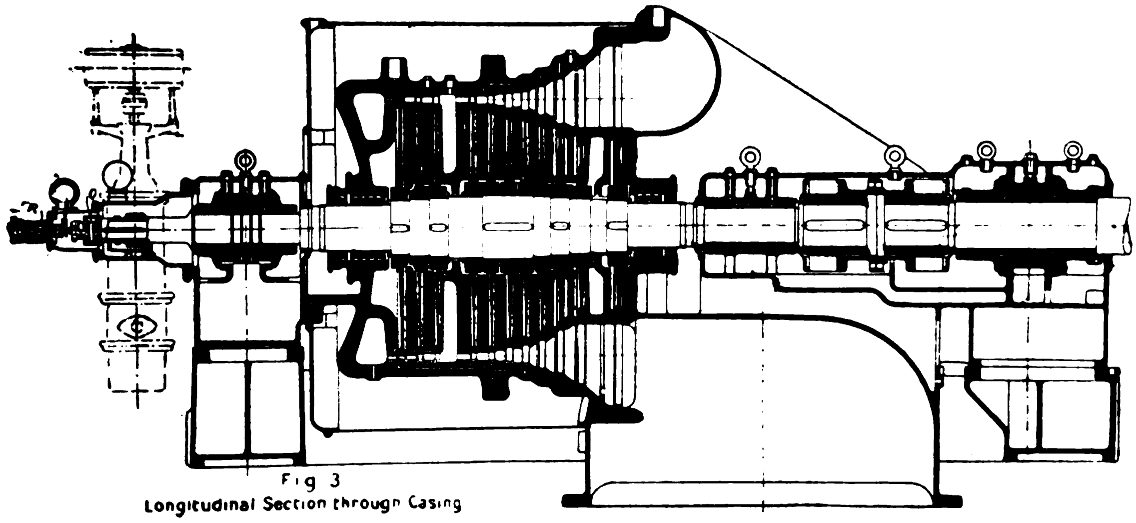


Fig 3
Longitudinal Section through Casing

also arranged to replace, in case of need, the gear oil pump D. Turbines of small capacity are, for reason of cost, made in a simpler form, but all Oerlikon turbines are provided with safety devices ensuring against accidents caused by excess speed, axial shifting of the rotor, and failure of the oil pressure. It is only in the case of auxiliary turbines operating condenser machinery and of very small turbines that the device ensuring safety in the event of a failure in the oil pressure is not regularly supplied, though this can also be provided in such cases if required.

oil pressure, supplemented by a force of half a ton due to the spring. It is thus hardly possible for an accident to happen by reason of the governing forces being too small to close the main valve. As an additional emergency governor the device S—Fig. 2—is mounted on the governor shaft. This operates the main valve should an excess speed of approximately 20 per cent. be reached. Although all precautions are thus taken to prevent the turbine reaching a speed materially greater than the normal, the materials used, we understand, are such and are so proportioned that it could run at about 80 per cent. above the normal speed without damage resulting to any part.

In the case of turbines used for driving generators of large output capacity and high speed, the emergency governor Q is arranged in such a way, that the same will already come into operation at the normal speed. The position of this governor is indicated by a special Tachometer—See Fig. 3. Nevertheless the steam admission is only cut off if the speed exceeds the normal by about 15 per cent. as stated above. With this arrangement it is an easy matter for the driver to check at any time the readiness of the emergency governor to operate.

A new safety device has recently been provided on Oerlikon turbines which, it is stated, has not yet been applied in connection with other turbine systems. This device protects the machine against the consequences of axial motion of the turbine rotor. It is well known that if the boilers are not properly fed, or if the load varies frequently and widely, water may pass over from the boilers into the turbine. This may give rise to water hammer, which in turn may result in the generation of enormous axial pressures on the rotor and on the thrust bearing. The axial pressure from this cause has been known to destroy the thrust bearing. If destruction occurs the rotor would be pressed by the steam towards the low-pressure end, until the runner wheels came into contact with the diaphragms. Obviously at the high speed at which the turbine runs, serious damage both to the runner and guide wheels would be caused by this action, and would result in the machine being put out of commission for some considerable time. Such an accident could also occur if far some reason the admission of oil to the thrust bearings were stopped. In order to safeguard the turbine against damage of this natuie, the Oerlikon turbine is provided with a device which instantly closes the main steam valve on the rotor shifting axially by a small amount, say 1.5 mm. = $\frac{1}{16}$ in. With the provision of this device, the most serious damage to be expected is a certain amount of side wear on the thrust bearing.

In front of the main steam valve A a strainer T is fixed so that foreign bodies cannot enter the turbine with the steam. The strainer can easily be removed and cleaned.

Turbines of laige capacity are provided by the Oerlikon Company with a stand-by steam-driven oil pump U—Fig. 2.—which is brought into action when starting up the plant, and which is

## Governor and Governing Diagram

The manner in which the Oerlikon turbine fitted with the safety devices herein described is started up and closed down may now be dealt with in detail. In Fig. 4 are given two diagrammatic sectional views through tde turbine, taken as regards the lower, through the bearing pedestal, at the high-pressuie end, and as regards the upper, through the high-pressure steam inlet passage immediately in front of the first nozzles. All the valves are shown in the positions occupied when the machine is at standstill.

Before starting up the turbine, the attendant sees that the steam inlet valve A and the three-way cock L on the oil supply

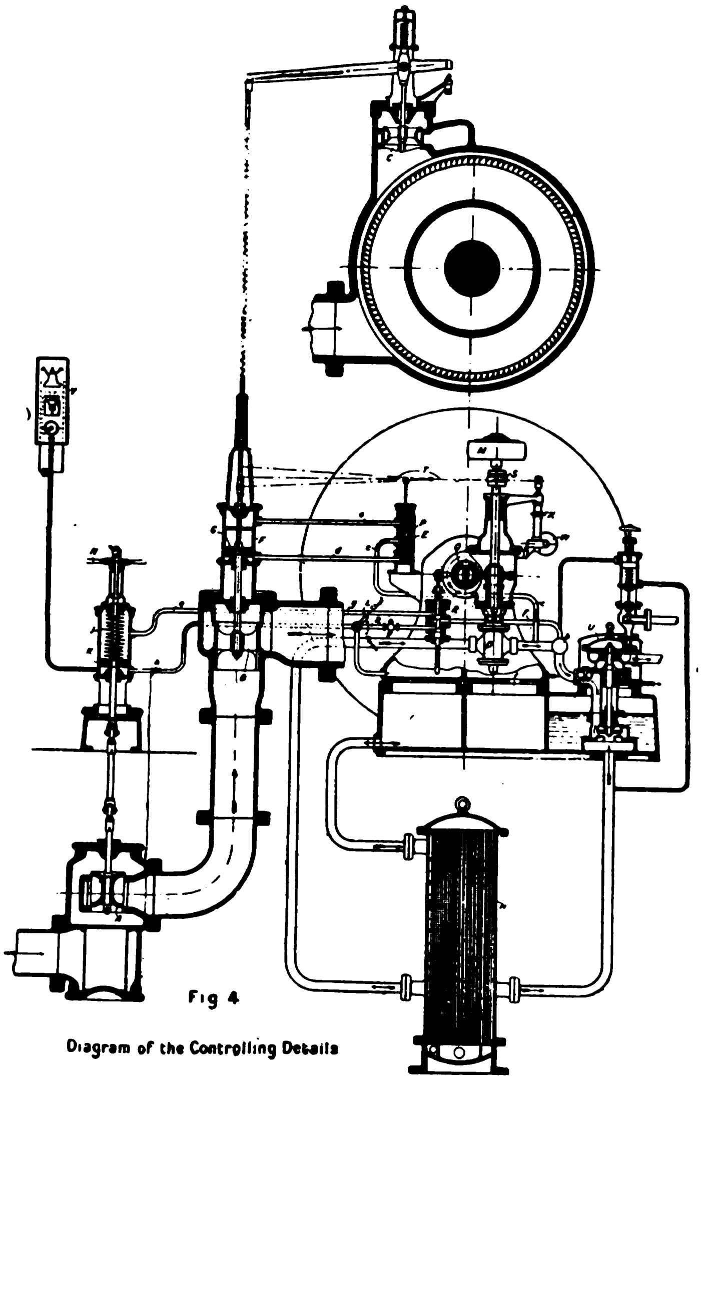


Fig 4
Diagram of the Controlling Details

pipe A are closed. The circulation of the oil to the bearings and controlling parts of the turbine is started by means of the auxiliary steam pump U. The supply of oil is drawn from the cooler H and is forced through the pipe B to the bearings of the turbine and generator. Simultaneously, the oil is led through the pipe C to the controlling cylinder E and thence through the pipe D to the regulating cylinder F. The piston G is thus pressed upwards, so that the regulating valve B and the overload valve C are opened fully.

In order to warm up the turbine the main valve A is now very gradually opened by turning the hand wheel N just sufficiently to allow enough steam for the purpose to pass into the turbine. This flow of steam is continued for about ten to fifteen minutes, until the exhaust feels warm to the hand. The turbine may then be started up by opening the valve. A further by means of the hand wheel until the rotor begins to move. The machine can now be brought up to full speed by still further opening the valve A. The governor M is then borught into action and takes over the speed-control of the turbine.

The governor sleeve S on rising operates, by means of the levers T, the piston P of the controlling cylinder E, and the oil passes through the tube E into the regulating cylinder F above the piston G, while the oil beneath this piston flows away through the tube D. The controlling piston P is now brought back by means of the levers T into its intermediate position.

In the meantime the main oil pump D has gradually come into operation during the starting up of the turbine. The pressure of the oil is maintained at approximately 60-lb. per square inch, a pressure which when reached is sufficient automatically to shut down the auxiliary pump U. (The automatic control of the stand-by steam-driven oil pump is only provided with units of large capacity.) As soon as the machine has reached full speed, the three-way cock L must be opened. The non-return valve V in the tube A is pierced with a small hole in such a manner that the oil can pass through it only very slowly ; this fact prevents the main stop valve from being opened too quickly.

When the turbine is working idle, the overload valve C is totally closed, and the regulating valve B is open to the extent required for no-load conditions. The machine can now be paralleled with the bus-bars by means of the speed adjustment device. The speed can be adjusted either by means of the small electric motor W and its push button switch from the switchboard, or by means of the hand wheel X. In case of overload the valve C is partially opened, so that live steam is admitted to a stage near the centre of the turbine.

When the machine is being switched off from the bus-bars, the speed rises. The governor M coming into operation closes the valve B. to such an extent that only sufficient steam is admitted to meet the requirements of no-load running. Should, for one reason another, such as the jambing of the regulating valve B or of the piston G or of the governor M, the machine start to race when disconnected from the bus-bars, then the emergency governor "on the end of the turbine shaft comes into operation at a speed corresponding to the normal plus from 10 to 15 per cent. The controlling piston R then changes its position, so that the oil may pass from the tube F into the tube G. The valve A is then closed by the oil pressure above the pioston K, and the force exerted by the spring J. The oil beneath the piston K flows through the tube A and the non-return valve V back into the oil chamber. In the ordinary way the shutting down of the machine is effected by turning the cock L into the " shut " position.

If, during the regular working of the turbine, the oil pressure sinks below about 28.5-lb. per square inch, the signalling device Y. is operated, and the driver's attention is drawn to the low oil pressure by a signal bell. The main valve A begins to close, and is closed wholly if the oil pressure sinks to or below 22-lb. The machine, however, runs on, and the bearings would quickly become hot from want of lubrication. It is for this reason that a signal bell warning arrangement has been adopted.

The signalling device consists of a pressure gauge with a sliding contact, adjustable between the limits 7 to 28.5-lb. per square inch, a relay and a bell and dry battery. The pressure gauge is connected to the regulating cylinder at a point under the piston K. Normally, the oil pressure is between 55-lb. to 70-lb." Electrical contact is only effected in the gauge at a pressure of 28.5 lb., at which pressure the circuit of the relay closes, thereby releasing the relay armature and closing the local circuit of the bell. As soon as the oil pressure falls below about 7-lb. the contact in the pressure gauge will be broken, but the bell circuit remains closed until the relay armature is replaced by hand in its original position.

Each time the turbine is started up, the signalling apparatus operates, so that a check on the apparatus being in good working order is thus afforded. As soon as the pressure exceeds 28.5-lb. the relay armature can be re-set and the bell silenced.

The auxiliary pump U can be supplied to start automatically, as soon as the oil pressure sinks below about 50-lb., as the spring will then lift the piston and thus open the valve of the auxiliary turbine diriving this pump.

# Missionaries to Use Radio and Airplanes

Radio phones and airplanes as aids in carrying on missionary work in virtually inaccessible parts of China will be used by missionaries of the Methodist Episcopal Church in Tzechow, West China. Plans were announced by the Rev. James Maxon Yard, and relayed to the committee in America by the Rev. Paul Hutchinson, editor of the *Chinese Advocate.*

The delegates at the missionary meeting could see the mountains of Tibet. It is several weeks journey from Shanghai and there are no railroads in that region. The Tzechow territory lies in the heart of China's wealthiest province, Szechuan, with 60,000,000 inhabitants. Because of the lack of transportation facilities and inaccessibility of some sections, missionaries have been unable to reach many of these localities.

The missionaries planning work for the next ten years, voted for four sets of wireless telephones with which to link up the widely separated main stations, and four two-passenger airplanes with which to reach hitherto inaccessible sections.

# Fuller in China

Mr. Wilbur S. Sample, formerly manager of the Montreal, Canada, office of the George A. Fuller Co., Ltd., has recently left for Dairen, Manchuria (North China), to assume the duties of district manager of the George A. Fuller Co. of the Orient, Ltd., for that and other Chinese territory.

Mr. Sample will direct the construction of a general hospital for the South Manchurian Railway Company at Dairen, together with additional construction work which is to follow both in that section and in Shanghai, China.

Mr. William Oehrle is New York manager of the George A. Fuller Co. of the Orient, Ltd.

# Merryweathers' Purchase

The old established and well-known business of Shand Mason & Co., fire engine makers of Blackfriars, has been purchased by and is now incorporated with Merryweathers' of Greenwich who have been represented in Hongkong and China by Jardine, Matheson & Co., Ltd., for the last 15 years. This is one of the most noteworthy combinations in the recent annals of engineering as the two firms concerned are household names and stand for all that is best in the science of fire fighting.

大正七年七月十日第三種郵便物認可

# THE FAR EASTERN REVIEW

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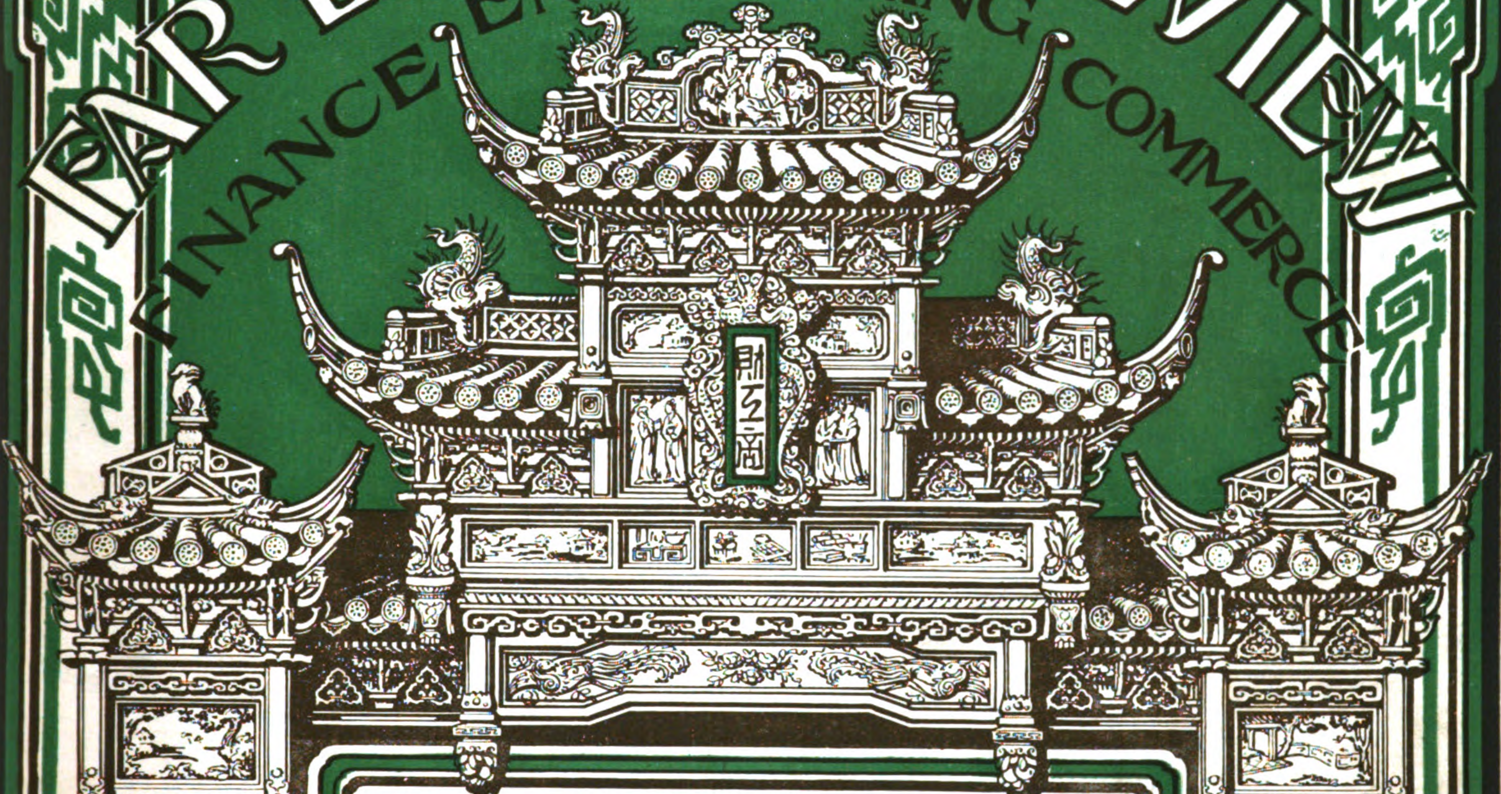

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# WALWORTH

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Fig. W2—Elbow

Fig. W1—Elbow

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Fig. W76—Flange

Fig. W13—Tee

Fig. W33—Coupling

Fig. W46—Union

Fig. W14—Tee

Fig. W21—Bend

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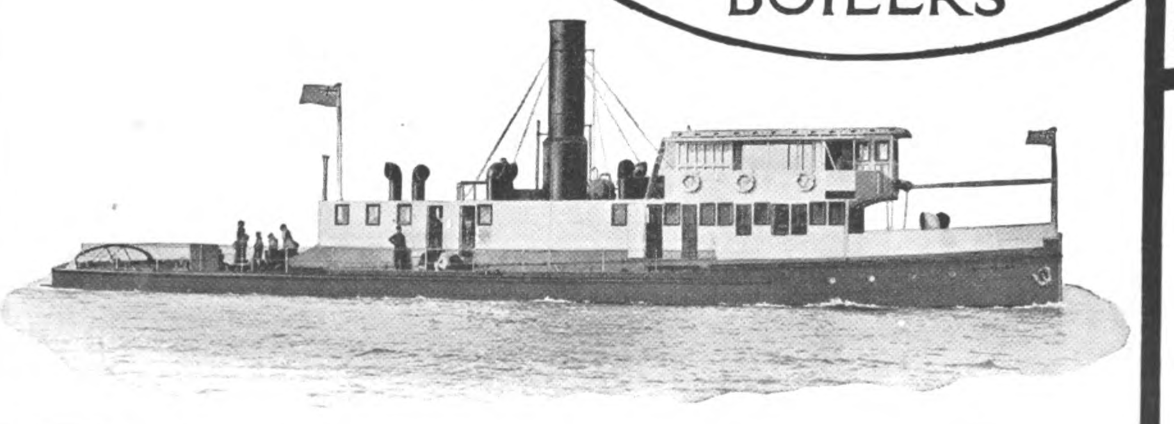

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX · SHANGHAI, MARCH, 1923 No. 3

# In Which We Return a Ton of Bricks

## (Marked with the "XX Chop")

WE recall vividly and with certain sadness our earliest experience with bricks. A large pile of nice red ones was stacked up in the back yard of our boyhood home and we used to play building houses or when tired of this, tried to throw them over the fence into the neighbor's yard. It was great fun—while it lasted. We never knew exactly how it happened, whether a brick rebounded from the fence or whether our next door playmate threw it back. When we came to in the hospital a week or so later, we sported a triangular hole in the cranium which darkened our young life for many months. We then learned a very useful lesson about bricks; never to throw them with an uncertain aim. They have a habit of coming back in the most unexpected manner and from unexpected quarters.

Now amongst the modern industries of Japan is the making of bricks. One of the largest and to date most successful of these enterprises is the Kobe Brick Works. The output is not sold on the market for legitimate construction work, but specially made and used for the exclusive entertainment of a petulant editor who carts them every morning to his sanctum on Naniwa-machi, where he spends the day amusing himself by throwing them indiscriminately at everything Japanese that comes within his vision. Nothing escapes him: the Imperial family, the army, the navy, the gods, the temples, the priests, family life, morals, commercial integrity, the diet, the politicians, the police, the censorship, the banks, the man-in-the-street, everything from high international policies to geishas, yoshiwaras and phallic worship come under his scrutiny and unerring aim. When he tires of crowning the Japanese, he tries his hand on his contemporaries, his own country, or any unfortunate who arouses his ire or comes within the range of his strong right arm. One of his pet aversions in Japan is the Kokusai News Agency; in China, THE FAR EASTERN REVIEW. Now we have no objection to our contemporaries shieing a brick at us once in a while: we rather enjoy dodging them, throwing them back, or acknowledging the hit if a good score is made. Being swatted continually by the same humorist, however, simply because our views do not agree, grows extremely monotonous.

Evidence brought out in a recent lawsuit against the *Shanghai Mercury*, disclosed that the largest shareholder of this British registered newspaper is a Japanese. This provides the editor of the *Japan Chronicle* with the opportunity to express his thoughts on "Japanese Papers in China" and incidentally, to indulge in his favorite pastime of throwing a specially baked brick at THE FAR EASTERN REVIEW.

According to the successor of Robert Young, the case against the *Shanghai Mercury* discloses a curious state of affairs, in analyzing which, he asserts that the object of the publication of English language newspapers in China under Japanese ownership or part ownership, must be to represent Sino-Japanese relations in a light particularly favorable to Japan and therefore unfavorable to China.

"Paid advocacy of Japan in Japan" according to the Kobe brick artist, "just passes muster. It is not regarded quite in the same light as paid advocacy in the law courts. Paid foreign journalism in Japan always masquerades as *bonâ-fide* personal opinion . . . it *can* be undertaken and social ostracism escaped."

In effect, the owner of the Kobe Brick Works says that it is ethically wrong for a foreign journalist to present Japan's side of the case in a foreign language newspaper published in Japan: he may escape social ostracism, or he may not. As an insight into the working of the foreign mind in Japan and the reason underlying the consistent anti-Japanese policy of the *Japan Chronicle*, this admission is illuminating. Naturally, a foreign journalist owning or editing a newspaper in Japan, must receive his support largely from Japanese interests if he hopes to prosper, thus bringing him within the category of a paid advocate if he fails to live up to the business rules underlying all newspaper ventures by presenting the Japanese side of the case, and, when they are right, of defending them.

The *Japan Chronicle* then goes on to say that this rule cannot be extended to China and recalls that "when the *North China Standard* started publication in Peking there was great difficulty in getting an English journalist in spite of the high pay offered, as the position was uncomfortable socially. They had at last to fall back on a man who was under sentence of imprisonment in Japan." Now we submit that this is a most uncalled for slur on a brother journalist, inasmuch as we are reliably informed that the late Robert Young, personally recommended the man for the position. The extension of the rule to the *Shanghai Mercury* whose largest shareholder is a Japanese, would imply that its British directors, shareholders and employees, should also be socially ostracised by the local British community. Considering that Great Britain and Japan have been allies for many years, it would seem that occasions would arise when British journalists would be legitimately called upon to defend Japan and many of her Asiatic policies, which, after all, were also British policies.

After a dissertation on the morals of publishing Japanese papers in the United States, the Brick-Thrower turns his attention to China, whose case he says, is peculiar. "There are a great many Japanese papers published in Chinese in order to try to convert the Chinese to the Japanese view of international relations, and there are Japanese papers published in Japanese for the benefit of Japanese residents in China."

It is perfectly correct for the British to establish newspapers in Japan, in China, in the United States, and in all other lands under the sun. The Paris and continental editions of some of the great London dailies printed in English, according to the *Japan Chronicle*, must be maintained solely for the purpose of influencing French and continental readers to accept the British viewpoint of international relations, and when British money is invested in an American publication, the only deduction possible, is that it is put there in order to influence the American public along lines favorable to British interests—fighting the shipsubsidy bill, for instance, or the free use of the Panama Canal to American vessels. If the Kobe Brick Thrower reads the American papers closely, he will find many allegations that large sums of British money are

being expended in the United States to influence public opinion to accept the British viewpoint on important matters.

The right of the British journalist to squat down in a foreign country and attempt to sway public opinion in favor of British policies is a fundamental Anglo-Saxon prerogative. According to the Kobe editor, for the Japanese, or any other non-English speaking people, to adopt the methods which Britain has found highly effective in influencing world opinion, is an intolerable presumption, one which must be sat upon, and, if necessary, social ostracism applied to any foreigner with the moral courage to say a good word for them, or challenge the lop-sided opinions of such petty exponents of Japanese thought as the *Japan Chronicle*. It was eminently proper, however, for the Japanese to spend hundreds of thousands of pounds in *The Times Japanese Supplements*; it was nothing to their discredit that similar supplements were published and paid for in important American newspapers, but it was untactful, to say the least, for the Japanese to send all these good yen out of the country for publicity purposes while the *Japan Chronicle* as the leading British newspaper of Japan, was denied a piece of the pie.

However, all this is nothing to the greater crime of publishing a paper in English in China for the purpose of influencing foreign communities and to prejudice the Chinese case in the eternal struggle between China and Japan. "This is on an entirely different footing," continues the *Japan Chronicle*.

"When these papers are published under foreign flags the case is worse still. It is naturally regarded as a "double-crossing," in a variety of ways, too. Take the case, for instance, of THE FAR EASTERN REVIEW, once a noisy advocate of Chinese *versus* Japanese interests, but since the Paris Conference which its editor attended, an equally noisy advocate of Japanese interests *versus* China—but a hundred per cent. American all the while."

This is real brick-throwing, and as we have now accumulated several of the missiles hurled at us by the choleric proprietor of the Kobe Brick Works, we crave the indulgence of our readers while we return them to their owner.

On various occasions during the past three years, the *Japan Chronicle* has intimated by inuendo that THE FAR EASTERN REVIEW has been sold to Japanese interests during the Paris Peace Conference, "or, just before it changed its policy," a fabrication that because of our exact knowledge of who originated and communicated it to the late Robert Young, was beneath our dignity to notice. Unbiassed readers of this magazine now admit that its main policy has been justified by events: that it was essential to the higher interests of the United States, of Japan and of China, that Japan's side of the case be presented, a task that no journal in the Far East cared to accept, a task which, the *Japan Chronicle*, the oldest foreign edited newspaper in Japan and the logical medium for presenting her case, dared not accept. Furthermore, as the issue of the war that was to have been fought between Japan and America, was China, it was also essential that the truth about the actual conditions in this country be also set forth.

The *Japan Chronicle* is discreet enough to admit that this magazine has remained one hundred per cent. American through it all. Exactly, but when we started to clarify the atmosphere, we faced the charge of being most unpatriotic and the *Japan Chronicle* worked hand in glove with the inside clique in China that did its utmost to "put us out of Business."

As to "double-crossing" the Chinese, the records of this office will prove that as far back as 1917, when America severed relations with Germany and pressure was being brought to bear upon China to follow our lead, cabled instructions were sent by the publisher of this magazine to its editor to extend every support to the parliamentary party. We saw then that the entrance of China into the war under the leadership of the militaristic crew at Peking meant the death of democracy in this country. We invited the attention of President Wilson to a situation which placed him in the paradoxical position of calling upon the manhood of America to make the world safe for democracy in Europe, while by driving China into the war, we were consolidating the power of the military autocrats in this country. We have reason to believe that it was this letter which influenced President Wilson to send his note of June 2, 1917 to the president of China informing him that the maintenance of internal peace in this country was of greater importance to the allied cause than China's participation in the war. We mention this, merely to emphasize that at no time since 1916 have we been in sympathy with the military freebooters who have ruled and plundered China from Peking.

At all times our sympathy has gone out to the parliamentary party. We felt then, and still feel, that no true American could view the struggle in China for good government without siding with the man, who with all his alleged faults, represented those principles which rest at the very foundation of democracy. We have never departed from this conception of Americanism, as our various articles in support of Sun Yat-sen will tend to prove. This will assist the *Japan Chronicle* and other critics to understand why at no time since 1916 have we been able to conscientiously support a regimé that has proven itself the poorest apology for a government the modern world has witnessed. If this be "double-crossing" China, we plead guilty, but we have not yet committed the crime of "double-crossing" ourselves by defending Peking militarists, or of being untrue to our national cause when the support of every citizen meant the salvation of its ideals. *We were not fifty per cent. pro-German during the war and ninety-five per cent. Bolshevist after the peace.* No contemporary has been able to designate us as "the German editor" or question our relations with Moscow.

The above will also help to invite attention to the fact that in supporting Sun Yat-sen we adhered to a conception of loyalty, that his foreign detractors could not understand, for we hold with the Chinese, that one of the greatest virtues in this world is loyalty without which no cause can triumph. One of the most painful incidents of recent Chinese history was the spectacle of a foreign publicity agent of Wu Pei-fu revelling in and glorifying the act of treason which cost Sun Yat-sen control of the Canton government, and nearly the life of himself and his wife. We may be guilty of "double-crossing" the Chinese by presenting Japan's side of the case, but if this leads to a better understanding and an amicable adjustment of their differences, the world and China will be better off. We have not violated that cardinal Chinese virtue of betraying or slandering the man, who took us into his counsels and gave us the right to speak with authority on certain phases of the Chinese problem, and in so far as the Chinese continued to repose confidence in us to assist them with straightening out their intricate railway problems, we never betrayed their interests or reaped one cent of reward other than the very small salary tendered us.

As to the charge of "double-crossing" the Peking mandarinate, we make the simple statement, that "it can't be did." They can be depended upon to do this for themselves. They have "double-crossed" the foreigner at every turn, then turned to the latter to help them out of their troubles and "double-crossed" them while they were doing it.

The Peking grafters "double-crossed" themselves and their American friends in the Siems-Carey railway contracts of 1916, precipitating an international political situation coldly calculated to pit the United States against the four allies on the "open door" issue at a time when they were fighting for their existence in Europe. We antagonized all our American and Chinese friends because we would not support this contract. In addition, they "double-crossed" themselves and the people of China in this deal by undoing all the good work that had been done by THE FAR EASTERN REVIEW in their behalf towards securing the lowest terms for the financing and construction of their railways, and precipitated the revision of all their previous contracts and loaded down the nation with an additional burden by reviving foreign participation in the profits of the lines.

We make the simple statement that the entire railway scheme of Sun Yat-sen or the international deal of 1914 could have been negotiated without delay and the loans raised and placed to the credit of the Chinese Government within a week had the same terms been accepted by those who had charge of the negotiations—

but, they would have been hounded out of China or paid the traditional Chinese penalty for such a betrayal of their higher national interests.

We may add for the enlightenment of the *Japan Chronicle* that right here is where we terminated our "noisy advocacy of Chinese interests." We condemned a conception of American policy which condoned this intrigue against the allied cause and treason to the higher interests of China, thereby incurring the enmity of a group of Chinese grafters who tried to "double-cross" the United States, and the support of Americans who stood to benefit through the transaction. Because we could no longer uphold a a conception of American policy which could take advantage of this surrender of China's interests, we departed from this country in December 1916 and rather than embarass the administration by criticism or attacks remained silent until the war was over and the peace signed. We were then at liberty to express our opinions publicly. In doing so, we got exactly what we expected; a shower of bricks marked with the "XX chop" from those whose interests were best served by maintaining secrecy over their betrayal of China.

The Chinese "double-crossed" themselves when they signed the Shantung and Manchurian railway agreements of September 1918, and then "double-crossed" their American friends by maintaining these transactions a profound secret while our delegation went to Paris to fight their case for them. There was a lot "double-crossing" done about that time. Many Americans hold that President Wilson was "double-crossed" when America entered the war and was not informed by her associates of the existence of the secret agreements over Shantung and the Pacific Islands, and which America also remained in complete ignorance of until the peace conference was well under way. Americans were "double-crossed" by secret European diplomacy and "double-crossed" by secret Chinese committments, yet we were expected by the latter to win their fight for them. When President Wilson found it impossible to override these secret understandings and was forced to accept the Shantung decision to save the league the Chinese at once started to "double-cross" him by dispatching a delegation of paid agitators to Washington to "kill the treaty in the Senate" and China then "double-crossed" her allies by refusing to sign the treaty with Germany, slipped into the league of nations by the back door, under the provisions of the Austrian treaty, while her agitators in Washington made the weilkin ring over Shantung. This gave the American opponents of the treaty the opportunity they were looking for to knife Wilson. It busted the Versailles treaty and for all practical purposes killed the league when the American senate refused ratification. China enjoys and has made much capital out of her seat in the league, but she did so by "double-crossing" the man who made the league possible and provided the major arguments which kept America out of this new combination for world peace. The irony of it all is that the very agitators who were most active as agents of China in killing the treaty which kept America out of the league, have attended every meeting of this body and capitalized their presence there in Chinese publicity articles. All this knifing in the back and "double-crossing"; for what? Simply because President Wilson and the other members of the Big Three trusted to the honor of Japan to comply with her pledged word to restore Shantung to China, while the Chinese and their American supporters contended that Japan's word was worthless unless it was plainly stipulated in the text of the treaty. The whole nasty Shantung mess, which took another international convention to clean up, arose from this distrust of Japan and the desire to humiliate her in the eyes of the world, preparatory to the launching of the campaign that was to have precipitated the "Showdown" which it was hoped would lead to hostilities between Japan and America.

There is not an honest editor in the United States who does not now admit that Woodrow Wilson has been vindicated by Japan's withdrawal from Shantung. The pendulum has swung the other way and with the passage of two short years the American people now fully realize how they were imposed upon by sentimentalists and agitators who knifed their own president in order to curry favor with China. The following editorial which has appeared in over two hundred American newspapers, tells its own story:—

> "The Shantung award was accompanied with the distinct understanding and explicit assurance that Japan would at the proper time retire from China and return Shantung to the Chinese.
>
> "When Mr. Wilson became a party to this agreement, vials of wrath were emptied upon his head. Phrases like 'the crime of Shantung' were brandied about by the unthinking and yawped repeatedly in the senate by Lodge and his partisans. Wilson had sold out China to Japan—that was the cry.
>
> "To all this the president made the simple answer that 'he had faith in Japan' and in Japan's promise that the Mikado's government would at the proper time restore Shantung to the sovereignity of China.
>
> "The faith of Woodrow Wilson's in the integrity of one of America's allies in the great war is now completely justified."

And again, it will interest the *Japan Chronicle* to know that when we arrived in Paris in December, 1918, and was informed of the program prepared by the American and Chinese delegations, we condemned it without hesitation, holding firmly to the opinion that success could be attained only by the American delegation living up to the thrice declared intention of the state department and to have the German interests in Shantung surrendered to the Allies in the peace treaty, leaving Japan as trustee, until such time as a separate international convention could be called to settle the whole problem of China. It is needless to say that we became *persona non grata* with both delegations for daring to challenge the wisdom of their program. Our one consolation is that we have since learned in Mr. Lansing's book and later in Mr. Ray Stannard Baker's presentation of President Wilson's story of the peace, that our opinion was subsequently acted upon, but only at the eleventh hour and with defeat staring China and the United States in the face. It was then too late. This is another reason why bricks of all sizes and shapes from those who had to defend their mistakes, became our portion, as soon as it was over, and we condemned their tactics. In the same manner as President Wilson was accused of selling out China to Japan, so the story was secretly circulated that THE FAR EASTERN REVIEW had been sold to Japan because we had the courage to denounce the tactics which made the decision possible and protest against the political treason which sent Americans scurrying to Washington in the pay of China to "kill the treaty" and stir up hatred against Japan.

As a result of this Shantung *fiasco*, America was to have been "double-crossed" and railroaded into a war with Japan over China, not by the Chinese themselves, so much, as through the activities of her foreign advocates and at least one adviser, who had the plans of campaign all drawn up to hold the fort at Peking pending American mobilization. Does the editor of the *Japan Chronicle* wonder that an honest American newspaperman declined to permit his country to be "double-crossed" in this manner without making some attempt to present the other side of the case? If there was any "double-crossing" of China by THE FAR EASTERN REVIEW in contributing to the collapse of this infamous conspiracy, the *Japan Chronicle* certainly did everything it could to "double-cross" us by associating itself from the beginning with those who were most active in throttling any attempt to have the other side of the case made known. It ranged itself solidly alongside the enemies of Japan and hurled mud at those who honestly endeavored to pave the way toward a better understanding.

When the inside history of the past five years is written, it will be known to posterity as the "double-crossing" period following the great war, in which a group of anti-Japanese fanatics and foreign agitators placed the interests of China above those of their own countries and demolished the work of the Paris peace conference and the Anglo-Japanese alliance. The great instrument created by President Wilson for the maintenance of world peace and a square deal to China was destroyed and the United States placed outside its scope by the agents of its beneficiaries. History will also record that Woodrow Wilson was betrayed and his great work undermined largely through the instrumentality and activities of his own compatriots whose sympathy and allegiance to their Chinese paymasters overshadowed loyalty to their president and

interests of their own country. History will furthermore record that as a result of President Wilson's simple faith in the honor of the Samauri, the propaganda was set in motion by the American and British advocates of China whose consequences could only have been another terrible war in the Pacific. Far above the welfare of the United States and her associates in the war, far above the interests of world peace and the league created to maintain it, was placed the interests of China, who alone of all the nations reflected the idea that the pledged word of Japan would be fulfilled in Shantung. Behind her stood a few Americans who dynamited the edifice their president so painstakingly erected and prodded their country along the road to hostilities. "Save China," was the slogan given out at Peking, yet to do this meant the overthrow of the only instrument that could have guaranteed her future integrity, the humiliation of the president of the United States and the precipitation of hostilities in the Pacific. It took another special international convention to terminate the campaign, a step which, if taken at the outset, would have avoided all this political treason and cemented world peace at the signing of the Versailles treaty.

In the same manner that Americans sold out Wilson and hastened to "kill the treaty in the Senate," so history will record that a similar fanatical group of Britons placed the interests of China above those of the empire and pulled down the Anglo-Japanese alliance, the one effective guarantee for Asiatic peace and protection of India against the constant menace to its security from the north. Fortunately, we were a hundred per cent. American in this, or we would labor under the "stigma" of being a paid advocate of Japan and as such to be ostracized by decent society. Of all the contemptible arguments ever employed by one newspaper editor to injure another, this is the worst. Even when faced with a war, which would have completed the demoralization of our civilization, the editor of the *Japan Chronicle* in his blind, rabid, unreasoning antagonism to Japan would have denounced as an undesirable, unfit to be associated with, any journalist who would have attempted to advocate her case in English. The *Japan Chronicle* learned nothing from the lessons of the great war, and could not know that the decent people of America and of his own country were fed up with lies and one-sided propaganda, and classified as enemies of humanity those who would again stifle the free expression and exchange of thought.

Li Hung-chang "double-crossed" Japan after the war of 1895 by entering into a secret alliance with Russia and handing over her territories to the latter in order that she might be revenged upon Japan. The Manchus then "double-crossed" the entire world by remaining a silent partner and ally of Russia during the war of 1904-05, escaping payment of the penalty and emerging from the conflict as the injured and innocent victim. According to Viscount Kato, Yuan Shih-kai "double-crossed" him in the matter of the twenty-one demands: Tuan Chih-jui "double-crossed" Japan over the Nishihara loans: the militarists "double-crossed" Americans after their government prevailed upon the other powers at Washington to give them a square deal; they "double-crossed" their own credit at home by issuing unauthorized internal loan bonds, and abroad by violating the principle of priority and breaking down their pledged securities.

The domestic history of China for the past decade is one long nauseating recital of "double-crossing," of treason, of jobbery and corruption in high places, and the saddest part of it all is that otherwise sensible foreigners who would not tolerate similar conditions in their own country, are forever taking sides in these Chinese domestic squabbles and upholding the wrong-doers.

Yuan Shih-hai "double-crossed" the Manchus, then "double-crossed" Sun Yat-sen in order to attain the presidency, and after he had "double-crossed" the parliament he attempted to "double-cross" the republic he had sworn to uphold. Since his death, Chinese political history is the story of sordid squabbles, of one group of grafters "double-crossing" the others. Coming down to the past year, we have witnessed a "war" between Chang of Manchuria and Wu of the Kin-Han, in which one of Chang's generals "double-crossed" his leader and handed the victory over to Wu: Chen Chiung-ming "double-crossed" his patron and chief, Sun Yat-sen, and forced him to fly from Canton to save his life, while the foreign sycophants of Wu Pei-fu loudly applauded and commended these most despicable of treasons. Wu's faction "double-crossed" its leader, Tsao Kun, forced president Hsu out of office, exiled his chief henchmen and elevated Li Yuang-hung to the vacant chair: now Tsao Kun's *entourage* is "double-crossing" President Li and paving the way for Tsao to take his place. And because a foreign newspaper published in China declines to join the clique, in which the Kobe Brick-Thrower is a prominent member, and applaud all this "double-crossing, its attitude is qualified as a "treacherous abuse of extra-territorial privilege." On the other hand, when other writers take the lead in discrediting Sun Yat-sen, glorify the contemptible treachery of Chen Chiung-ming and exert all their powerful influence to boost the cause of Wu Pei-fu, this constitutes no interference with the internal affairs of China; this is no abuse of extra-territorial privilege. This is simply the heaven-sent prerogative of a select clique which must not be extended to outsiders.

In conclusion, we would point out that those who live in conservatories should be extremely careful in the promiscuous throwing of bricks. All the arguments employed against Japanese papers in China apply with equal force to British-owned papers in Japan, and with special reference to the *Japan Chronicle*. When their government is charged with suppressing independent thought and opinion and of imposing its views on the press through censorship and police regulations, most any intelligent Japanese will point to the existence of the *Japan Chronicle* as proof to the contrary, explaining that it has been permitted to continue publication in order to prove to the world that Japan *does* tolerate the free expression of thought, even when that thought is consistently inimical to their higher interests. This could not happen in any other country that we know of.

The *Japan Chronicle*, we admit, has a legitimate grievance. It now faces an era of peace and co-operation between Japan and America and better relations between Japan and China. The present situation can be summed up briefly in the following extract from a speech delivered by Ambassador Warren before the Pan-Pacific Union at Honolulu on February 5. Referring to the "atmosphere of splendid friendship" on the Pacific, he said:

"But—it was not always thus. Things were very different in the area of the Pacific when I went to Japan. Those persons who think not, don't know.

"More than a year ago, distrust and suspicion made the relations of Japan and the United States almost dangerous—potentially dangerous. This distrust and suspicion have been largely removed. The task I went to Japan to do has been accomplished. If it hadn't been, I shouldn't be here now.

"Trade across the Pacific is increasing. In fact, the only foreign trade of the United States that is increasing is with Japan and the Orient, and the only foreign trade of Japan that is increasing is with China and the United States.

"I said the other day at Peking that Japan wanted to be a good neighbor to China. I said it because I believed it, but more important, far more important than the fact that I said it, was the fact it did not arouse resentment. Relations between Japan and China are better—gloriously better; and I think I know something about it."

It must be disappointing to the Far Eastern Amalgamated Union of Brick Throwers to watch the gradual coming together of China and Japan, depriving them of a favorite pastime, and in many cases, of lucrative employment. By presenting Japan's side of the case in China and frankly explaining their own mistakes, the Chinese are slowly gathering an idea of how they have been "doubled-crossed" by their own corrupt officials and the above-mentioned hard-working labor society who capitalized their ignorance. We have no fear when the proper time arrives that intelligent Chinese will concur in the opinion of the *Japan Chronicle* in that we have "double-crossed" them or "treacherously abused" our extra-territorial privileges. The day is coming, when an honest government will again direct the affairs of this country. When that day arrives we will have the satisfaction of knowing that we were one of the very first to see ahead and place ourselves on the

side of good government, long, long before any of the other so-called friends of China visualized the dangerous trend of affairs which have brought the country to its present unhappy position.

THE FAR EASTERN REVIEW has been consistent in its opposition to any foreign loan to the Peking government that would perpetuate the present situation, also one of the first to tell the truth about conditions at a time when others were slurring the consortium and advocating a huge loan to Wu Pei-fu. Again, we have the satisfaction of knowing that our opinions faithfully reflected the policy of the American and Japanese groups in the consortium, and from the recent speech of Mr. A. G. Stephen, chairman of the Hongkong and Shanghai Banking Corporation, we now understand that this view is fully shared by the highest British financial authority in China and reflects the attitude of the British group. Mr. Stephen said:

"As long as the present conditions persist and until the people of China show their determination to insist on effective measures being taken by the government for disbandment of troops, consolidation of unsecured debts and unification of the country, *every attempt to assist China from the outside must be regarded as futile.*"

That this opinion is fully shared by the representative of the American group is seen in the prolonged vacation to be taken by Mr. F. W. Stevens, who will probably not return to Peking until a proper government is established that the consortium can deal with.

Just a word about noise before we close. If THE FAR EASTERN REVIEW has been noisy in its advocacy of Japanese *versus* Chinese interests in the past three years, it is simply because it required considerable pounding on the drum to drown the sound of the quiet, steady, tapping and hammering of the Japanese anvil chorus led by the master knocker who rang the keynote from his forge in Kobe, and hurled bricks between blows at all who attempted to distract attention from his monotonous amusement.

Returning to the subject matter of this article, our advice to the *Japan Chronicle* is to get out of the brick business, dispose of the plant for what it will bring and invest the proceeds in a nursery. There are many beautiful flowers in Japan. Throw an occasional bouquet instead of a continual shower of bricks. Someday the editor of the *Japan Chronicle* may look out of his sanctum window and see stretching far down Moto-machi the formation of a line with bricks, carried by a multitude of apologetic Japanese, courteously determined to return the missiles to their owner. The successor of Robert Young, if he happens to have a cyclone cellar, may then remember our advice, and as he picks himself out of the ruins of the little old office building in Nariwa-machi, may perhaps think of starting that nursery. " Say it with flowers."

# Why Are the Philippines?

## Go Ask the British

THE JOURNAL OF THE AMERICAN CHAMBER OF COMMERCE of the Philippine Islands propounds the conumdrum, " Why are the Philippines " and then waxes wroth over the failure of their compatriots at home to understand the place of the archipelago in the Far Eastern scheme of things-how, as an American possession, they fit in: how their trade stacks up: how that trade can be developed, if at all: and if continued tenure of the islands is worth while from an economic standpoint. The journal invites attention to its invitation to Mr. Isaac F. Marcosson to visit the islands when he came to the East recently, assuming that this gentleman would be particularly interested in the above problems from the standpoint of their relation to American foreign policy, political and economic. Although the representative of the *Saturday Evening Post* accepted this invitation when he got to Shanghai he found that his time was too much occupied by an investigation of the weighty problems that confront China. The journal continues:

" On reading his articles and noting his amazing familiarity with Chinese names and places, we do not wonder at his great preoccupation in that country. He must have spent at least two hours a day memorizing names and keeping them straight, so as not to get them mixed up in his articles. . . Be that as it may, Mr. Marcosson did not come to Manila, and the American public now has a full and circumstantial account of the recent troubles in China, a complete and detailed running story of the Japanese political machine, and a masterly analysis of the economic status of both countries, together with a series of prognostications—none of which have as yet turned out to be true. Of the Philippines casual mention is made here and there, the total amount of space devoted to these unhappy and insignificant islands not aggregating more than six inches out of a total of several hundred or perhaps thousand."

" Now for our second indictment. Congressman L. C. Dyer, of St. Louis, Mo., is the father of the so-called China trading act. It seems that Mr. Dyer was a member of the congressional party that visited the Far East in 1920. On his return to the United States he at once took up the 'White Man's Burden' in China, became the champion of American trade in the Pacific and went about obtaining relief for the American trader who in competition with the traders of other nations was having a hard time of it to make both ends meet. His own American government was largely responsible for the American merchant's troubles because it imposed iniquitous and handicapping taxation upon him, according to Mr. Dyer. Hence this burden had to be lifted, and lifted it was through the China trading act, which was slipped through congress in exchange for the killing of the anti-lynching bill, also a product of Mr. Dyer's fertile brain."

"Soon after the passage of this bill, its author decided to come to the Orient to witness its workings. He happened to be in Shanghai at Christmas time. An invitation came to him from Manila to spend the holiday season there. He came, and in the course of his visit was requested to address the American chamber of commerce. Mr. Dyer made a neat speech on the China trading act, a speech that almost brought tears to the eyes of his listeners in commiseration of the hapless American trader in China. To the amazement of the numerous American business men present, however, he never even mentioned their own troubles, though he might have been aware of the fact that American business men in the islands have quite as much to contend with in the way of handicaps imposed by their own government as have the American traders in China. That there were similar problems and conditions to be righted under his very eyes, beneath the folds of the Stars and Stripes, never seemed to occur to Mr. Dyer. It was clear that he did not know the true answer to the question appearing at the head of this article."

" Why are the Philippines ? For years we've tried to tell the people of the United States that the islands are as large as the empire state of New York and some of the New England states combined; that their fertile lands are capable of producing all the tropical products needed by the United States; that their forests abound in the most beautiful hardwoods in the world; that there are in the islands millions of acres of the richest soil still untouched by the plow or untrod by a steer; that the people are progressive and their needs rapidly rising; that our trade with the islands is constantly increasing and now ranges between \$100,000,000 and \$200,000,000 a year; that the islands are ideally situated from a geographic standpoint to serve as a trade base and distribution centre for the entire Far East; that they constitute the keystone to the entire Far Eastern problem; that they are the most valuable trade asset of the United States on the Pacific, and that the American businessman here is in as much need of federal assistance and cooperation as his compatriot in Japan, China, Timbuctoo or Saskatchewan.

" These are some of the things we have been shouting from our house tops, but evidently our houses are not high enough or our voices are too weak, for as yet but a very insignificant portion of the American populace seems to be well enough informed to make an intelligent reply to the question: " Why Are the Philippines ? "

Why then with all these advantages have the American people refused to accept the chamber's definition as the answer to the big question ? We could write a book on the reasons why, but Americans in the Philippines, like their compatriots in China, are extremely sensitive to the truth. However, without raising debatable questions, we might say that the fundamental reason why Americans do no accept the Philippines at their face value is simply because that, at heart as nation, we are missionaries, philanthropists, educators and uplifters. When we took over the Philippines, instead of applying business-like methods to develope their resources, we laid down the fundamental law that we were there as trustees for the Filipinos to maintain their lands intact until such time as we educated them to our conception of popular government. We

raised all manner of obstructions to the influx of American business men and capitalists and sent over shiploads of school teachers. We then enacted laws which prohibited corporations from owning large areas of land and extended our exclusion act to be certain that no outside Asiatic labor would deprive the native of his patrimony. Our mission in the islands was purely altruistic and we have lived faithfully up to the principles originally laid down for our guidance. We now have the inevitable result in the second generation. We have accomplished a great educational task: we have unselfishly borne our share of the "White Man's Burden": we have uplifted the native and placed him socially, politically, intellectually and in all other respects, on a plane of equality with ourselves. It has been a wonderful example of unselfish missionary endeavor. We are proud of our work.

But missionary endeavor and trade do not always harmonize. We have attained the halo of righteousness but failed as business developers. The islands remain practically undeveloped, the rich soil untouched by the plow or untrod by the steer is still in its virgin state: the development of forest industries is handicapped by unnecessary restrictions, half the hemp grown rots in its stalks, the sugar industry, of which great things were expected, languishes for lack of labor, while the great island of Mindanao is a *terra incognito*, an empire of tropical wealth rotting under the rays of an equatorial sun.

What has our altruism actually cost us in dollars and cents? When we think of the great volume of tropical produce that pours into the United States from other quarters of the globe and on which we gladly pay a high tribute in export and import duties and other excessive charges by reason of their being monopolized by other nations, we can understand something of the enormous sums Americans have been called upon to pay for their altruism in the Philippines. We will cite one single instance and go no further.

The rubber boom struck the Far East in 1908. Hundreds of companies were organized in England, in its Asiatic colonies and in the ports of the Far East to develop rubber plantations in the Federated Malay States, in Sumatra and in Borneo. Millions of capital flowed into these enterprises and to-day, fifteen years later British Malaya controls the world rubber output. As a result of recent legislation restricting output and regulating prices, rubber is again booming and we find that American manufacturers must pay the British companies who control the raw rubber supply an annual tribute of something like $600,000,000. Before Americans can escape the payment of this contribution in six or seven years, it will wipe out the British war-debt to the United States. American manufacturers are weeping, wailing and gnashing their teeth over the prospect, but from the looks of things, they will have to toe the mark and "come across."

When everybody in the Far East was taking their savings out of banks and emptying their old socks of coins to invest in Malayan rubber shares, several efforts were made to attract attention to and invite subscriptions to shares in Philippine companies to develop rubber plantations in Mindanao. They failed. The people here laughed, and then begged, borrowed or stole more money to buy Malaya shares. Why was this? Simply because Americans had made it difficult for capital to own and operate large plantations in the islands and enacted laws which prevented the importation of labor to work them. Not a share of Philippine rubber stock could be sold in Shanghai. Americans who speculated wildly in British company shares would not even consider a proposition coming from a land under their own flag. There were no guarantees that the enterprise would succeed. We must now pay tribute to a nation of men who never permit altruism or idealism to interfere with their trading and commercial instincts and necessities.

The British also hold Malaya in trust for its real owners, governing the states for their respective sultans. They have learned by long experience that the Malay is not fond of hard labor, but they eract no barriers against the entrance of other Asiatics to develop its resources. In this one instance, our missionary propensities have maintained Mindanao, one of the largest islands of the world, closed to development on a large scale, holding it in trust, like an Indian reservation at home, for a people who can never colonize or develop its rich resources. Our experience with rubber alone will cost us several billions before we are through with the experiment, a loss that we can now never make up. Like in all other missionary work, Americans at home must foot the bill while others reap the material rewards. Americans have achieved in the Philippines the object for which they put forth their best efforts. Our colonizing experiment has been a wonderful success, a glowing testimonial to our philanthrophy and unselfishness. We have given of our best and raised an Oriental people to a high standard of civilization, but we have not brought them real prosperity, nor have we won their gratitude. Such prosperity as has come to the islands is not because of their tropical fertility or the industry of the natives. It is purely artificial, paid for out of the pockets of the American people, who have remitted the import tariff on their sugar and tobacco, opening for them a market and permitting the development of these industries to their present state of productivity. Not only have we given unselfishly of our culture and civilization and raised their standard of living of the natives, but we have gone deep down into our pockets and made them a present of the prosperity they now enjoy. Will we ever be permitted to reap financial returns on our investment? Never, under the present scheme of things, or until a way is found for capital to develop the islands and bring in the labor essential to make the investment profitable.

As we write this editorial, *Reuter's Service* under date of February 20, brings us the news that seven hundred and fifty American rubber manufacturers have been invited to a meeting on February 28 to discuss combative measures against the restrictive British rubber scheme, and at the same time says that a huge corporation with $50,000,000 capital is being promoted to develop new sources of supply and to bring pressure on the supporters of the restrictive scheme. We are also informed that the war department advocates rubber growing in the Philippines, but manufacturers are lukewarm in that connection, favoring the development of Latin-American sources should comprehensive action be taken.

Here we have the answer of "Why is the Philippines"? Fifteen years after the damage is done, and facing a yearly donation of $600,000,000 to a nation of practical colonizers, Americans are now trying to repair the damage. Do they turn to the Philippines, that wonderful dependency under the flag, with its untold acres of virgen soil untouched by the plow and untrodden by the steer; do they visualize the immense richness of that tropical empire in the great island of Mindanao that alone could supply all the rubber the United States could consume for the next century? When the chance is offered, they favor the development of Latin-America, nearer home, where they can jump on a steamer, junket down and look at their rubber trees growing and get back in time for the next game of golf. The possibility of the Latin-American governments holding them up in the future with export taxes, exorbitant freight or other charges moves them not. The land that is under their own flag across the Pacific is a long distance away, no longer a commercial asset but a political liability, a campaign nightmare in which home issues are complicated by "Little Brown Brothers" waving bolos and screaming for "Independence With or Without Strings!" And although the insular government has no money to devote to proper industrial propaganda, it can appropriate a million pesos to keep up the campaign for independence in the United States. The bark of the *politico* drowns the feeble of the merchant; voiced the cry of the American chamber of commerce is not heard beyond the mouth of the Pasig.

The Philippines have staggered under the burden all these years, and that they have reached their present stage of prosperity is due to the initiative, bull-dog persistance and the unconquerable pioneer spirit of the American element who have made the islands their home, and in spite of government laws and regulations. The Truth? Who wants to know the truth? Americans are satisfied with themselves in their rôle of altruists: we will have no other explanation. We have carried out our high mission in the islands and any American who would delve beneath the surface of things would be characterized as a backslider. However, it was not all

pure altruism which influenced our government to safeguard the lands of the Filipinos from exploitation and prevent their development by outside labor.

The truth about the Philippines is simply this: in order to hamper the growth of the insular sugar industry for the benefit of the domestic beet growers we enacted a law which prohibited any corporation from owning large tracts of land such as are essential to the profitable operation of a modern central sugar factory under one ownership. The domestic sugar interests have, since the occupation, practically dictated our national policy in the islands, opposing and then knifing Mr. Taft's free trade bill in congress and then forcing him to accept a limitation on the importation of duty free Philippine sugars (and tobacco) into the United States as the price of his nomination as candidate for the presidency. Taft and Roosevelt worked like Trojans to advance the interests of the islands, but the trusts which dominated the republican machine, killed their work, imposed their own conditions on the party, and fathered the land enactment which drove the final nail in the coffin which interred the industrial future of the islands, while the labor element sang the requiem over the poor little corpse to the strains of the exclusion act.

What prosperity the island now enjoys is due largely to the development of the sugar industry, the result of a compromise originated by the publisher of THE FAR EASTERN REVIEW in an after dinner talk with Mr. Palmer, the head of the beet sugar lobby in Washington, a compromise rejected at the time by President Roosevelt, Secretary Taft and General Edwards, but which they were subsequently forced to accept under the exigencies of campaign politics.

All talk about preserving the lands of the Philippines for the benefit of their inhabitants is pure moonshine. Take away that land restriction and permit the entrance of Chinese laborers and the sugar industry will grow by leaps and bounds, the rotting tropical empire of Mindanao will blossom like the rose: real prosperity will come to the far away isles of the Southern Seas. This is the one "nigger-in-the woodpile," the one fly in the molasses. To preserve the home market for the highly protected beet sugar farmers and factory owners, the bars have been erected that prohibits any other industry from gaining a foothold in the Philippines. For this protection to a pampered domestic industry holding the farmer vote club over our legislators by the most powerful lobby in the country, the nation is now called upon to pay itself out of its own pocket, the cost of a great foreign war, a mere bagatelle of five billions of dollars. Why, then, are the Philippines? Go ask the British. They have found the answer.

G. B. R.

# Courting the Fate of Greece

## A Vindication of Japan's Military Program

FOR the past three years we have lost no legitimate opportunity to explain Japan's vital policies in Asia which call for incessant vigilance in Manchuria and the urgent necessity of maintaining her army at a highly efficient state of preparedness to defend not only her own position but that of China against the ever present menace from the direction of Urga. Wilfull misrepresentation of her aims by hysterical propagandists, however, has inclined the world to believe that this preparedness cloaked sinister designs of conquest and to reject the idea that Russia could come back and be a menace within a generation. Japan's defensive military program is now vindicated by the highest American military authority, the soldier, who as chief of staff to General Pershing in France, and as assistant chief of staff of the American army after the war, enjoys a reputation as a strategist second to no army commander in the world. Major-General James G. Harbord recently resigned from the army to accept the presidency of the Radio Corporation of America, and freed from the restrictions of red tape has spoken his mind freely on the woeful state of the American army at the present time which lays us open to the same calamity which befell Greece: we are courting the same consequences. The Red army, he says, is the greatest in the world, and in obedience to the more or less direct pressure of the Soviet, Great Britain has been displaced in Constantinople and Japan forced to evacuate Vladivostok, cities at the opposite ends of Asia and nearly 8,000 miles apart.

"Consider this change of sovereignty," adds General Harbord "in connection with the fact that the Red government of Russia is maintaining to-day by far the largest army in the world. If with all her disorganization and her status as a virtual outcast among the nations, her influence is felt so strongly at such distances, the the world may well speculate as to possible combinations to which Russia may be a party, while Germany, in the bitterness of defeat and economic distress, is seeking a friend if not an ally."

Ponder over these words from the foremost American strategist and then say whether Japan is justified or not in taking every precaution to defend the political existence and independence of her empire. General Harbord's address was made, however, for the benefit of Americans whose indifference to strategic problems has permitted the army once more to lapse into a state of inefficiency, numerically weak and unable to faithfully discharge its function in the scheme of national defense.

Speaking as a private citizen at a luncheon of the National Republican Club in New York on January 20, Major-Gen. James G. Harbord made the startling statement that without definite plans for our defense in keeping with our position in the world to-day, "we are taking the same chance that Greece took and we are courting the same disastrous consequences."

The message of the old assistant chief of the American expeditionary forces is of such importance to the welfare of America that we reproduce it in full for the benefit of Americans in this part of the world, not only as an incentive for them to contribute their efforts towards the maintenance of a proper national defence army, but so they will see with a clearer vision how Japan has been cruelly traduced and villified for adhering to a defense program that their own country would do well to follow. General Harbord speaks with the wisdom of the ages, when he says that to hold a seat at the head of the conference table, a nation has to have an army and navy, and the larger the fighting force and the will and ability to use it, the greater influence will it exert in world affairs. When the full import of General Harbord's message is grasped, our readers will understand why we have so consistently upheld the Anglo-Japanese alliance as the surest guarantee of preserving peace in Asia and Great Britain's position in India. The Soviet pressure was behind the collapse of Britain's dreams in Constantinople; if the pressure is shifted to Central Asia, there will be no Japanese army to apply the brake from this end. The four-power pact will not take the place of the instrument that was destroyed at Washington. The menace from the direction of Urga is an ever present one to Japan, no matter what China or her friends may think about it, and her policies in that part of Asia simply announces that she is

determined to place herself in a position to endure as a nation, with or without the consent of the rest of the world.

Gen. Harbord declared that he wished to emphasize the vital importance of having such a plan " in a state of fire-alarm readiness for execution."

" There are those who," said Gen. Harbord, " for reasons of their own, will tell you that we need no such plan ; that this country was never in less danger of attack than at this present moment. Possibly so. I sincerely hope so, but I cannot forget that we have been told that same thing in every generation of this country's history, and that, in spite of such assurance, no generation has been without urgent need of such plans or has failed to suffer for lack of them.

### Points to Fate of Greece

" Within the past few months we have seen what may happen to a country in consequence of not having had definite plans commensurate with the position it has assumed in world affairs. We have seen its armies in defeat and disgrace ; its high officials condemned to death and executed ; its government overthrown by outraged people.

" Within the last four months two important cities of the world have changed hands in obedience to more or less direct pressure from the Soviet government of Russia, displacing Great Britain in the one case and Japan in the other. These cities are Constantinople and Vladivostok—cities at the opposite ends of the great continent of Asia and nearly 3,000 miles apart.

" Please consider this change of sovereignty in connection with the fact that the Red government of Russia is maintaining to-day by far the largest army in the world. If, with all her disorganization and her status as a virtual outcast among the nations, her influence is felt so strongly at such distances, the world may well speculate as to possible combinations to which Russia may be a party, while Germany, in the bitterness of defeat and economic distress, is seeking a friend if not an ally.

### Turkey's Quick Comeback

" In October, 1918, after complete defeat, Turkey signed an armistice. Her army which had lost 600,000 men by disease alone, was demobilized and scattered all over Western Asia. If there was a single nation in the war more completely humbled than the other defeated combatants, it was unquestionably the Ottoman empire. Demoralized and dismembered she seemed utterly prostrated. Within two years she has rallied from that condition by the organization of an army and is talking ultimatums on terms of equality with our late allies in the great war. This indicates the potentialities of a national army in being and a people willing to fight.

" In the limitation of armament conference in Washington in the autumn of 1921, China, with her standing for integrity among the yellow races, her 400,000,000 of people, and her tremendous expanse of territory, sat near the foot of the table below Holland, Italy and other second rate powers.

" Near the head of the table, with less than a twentieth of her territory and a mere fraction of China's population, Japan was sitting in the seats of the mighty !

" With less reputation for integrity and dependability among the other yellow or white races than China, why was Japan in the seat of honor and China in the tail of the procession ? The whole world knows that Japan is willing and able to fight. A nation has to have a navy and an army to sit at the head table in any world conference.

" Now, let us consider for a moment the defense measures to which the people of this country are asked to give their support. Just what do they amount to ?

### An Army of Non-Professionals

" Briefly, they involve the support of a professional force barely sufficient to provide for the peace time needs of our overseas garrisons and for the preservation of internal order, together with a non-professional, civilian force of approximately three hundred and seventy-five thousand officers and men, an aggregate of about half a million, less than one man to every two hundred of our population—and three-quarters of that force composed of non-professional soldiers.

" In the matter of cost, if we are of the calibre to count cost in a matter of such consequence, it amounts to the pitiful difference between enough and too little, a matter of a few millions each year ; a mere fraction of what we wasted during the world war through lack of such plans ; a tithe of what we throw away on unnecessary luxuries and contribute to the bootleggers ; an insignificant fraction of our national budget.

" But let me remind you that all of this is being done on a purely voluntary basis. The great majority of those who are laboring earnestly to make this scheme of defence mean something are doing so voluntarily and at the expense of time and effort that the average man devotes to golf, poker or bridge. What they are asking of the country in return is confidence and support—the kind and amount of confidence that the business man gives to his legal adviser, his architect, his engineer or his general manager ; the amount of support required to provide for bare necessities.

" Gentlemen, this matter of national defense is not a political issue, as some are inclined to make it. It is not a matter that the political profiteer or the synthetic statesman should be permitted to exploit in his own selfish interests. It is not a question of whether this party or that shall be enabled to go before the country with a record for economy falsely made by bartering our security.

" It is wholly a question of whether or not this country shall be placed in a position to endure with or without the consent of the rest of the world."

* * *

## Hongkong and Canton

ONE of the most significant parts of the speech of the chairman of the Hongkong & Shanghai Banking Corporation at the ordinary general meeting of its shareholders held in Hongkong on February 24, deals with the popular belief that British interests have steadily opposed the development of Canton as a deep-water port. As we have at various times referred to this Chinese view, we take this opportunity of presenting the other side, which effectively clarifies the matter and paves the way for a much better feeling between the Chinese and British, and a coming together on questions which have long irritated the Southern Chinese party.

Mr. A. C. Lang, in his very able presentation of Far Eastern trade and finances during the past year, placed the British position on record in the following words :—

" I would like to take this opportunity of speaking more particularly on a question which concerns both the policy of the consortium and the future interests of this colony. Allegations have been made in a responsible American quarter, and urged with an insistence which would seem to give them the character of a deliberate anti-British propaganda, that a treaty or agreement with the British exists whereby the Chinese may be debarred from creating railway facilities necessary for the development of a deep-water port for ocean-going vessels at or near Canton ; and that, although such development would be the natural accompaniment of any scheme for the completion of railway communication from Hankow to Canton, it is the fixed policy of the British to oppose it, as being detrimental to the trade of Hongkong. I am in a position to state categorically that no such treaty or agreement exists. Article 15 of the Canton-Kowloon Railway loan agreement contains an undertaking, usual in railway agreements where the line constitutes the security for the loan, that the Chinese government will not allow another line to be built competing with that railway to its detriment ; but this clearly refers to competing parallel lines, and could not possibly be held to preclude the Chinese government from constructing whatever terminal facilities they choose for the long-projected Hankow-Canton Railway. Whether river improvement and the construction of a deep-water harbor at Canton are practicable or not at an expenditure which would be justified by the advantages to be gained, is a question for experts to decide ; I am told that they are not. However, this may be, I am persuaded that no development of trade facilities at Canton can, in the long run, be detrimental to this colony, and our Chinese friends may be assured that British policy in this matter is bounded by no such narrow outlook as that attributed to it."

This is frank, clear and to the point and is so far as THE FAR EASTERN REVIEW has contributed towards creating any misunderstanding of British policy by presenting the Chinese viewpoint, we are now equally glad to correct it. The misconception about British ideas arises solely from the interpretation the Chinese place on Article 15 of the Canton-Kowloon Railway agreement, which, they assert, prohibits them from constructing a spur from the present railway line to the river opposite Whampoa. The Chinese have inclined to the belief since the survey for the line was completed, that it was deliberately carried far away from the river so that no spur could be built that might enable them to divert freight and traffic to deep water below Canton. There has always been a feeling amongst the Chinese, that any attempt on their part to develop the port of Canton would meet with opposition from British financial interests. This idea, we have reason to believe originated when Dr. Sun Yat-sen drew up his plans for the improvement of Canton and devoted as much attention to this scheme as he did to his favorite railways plans. We are also convinced that much of the initial British antagonism to Dr. Sun arose from the knowledge that he intended to push forward his scheme for the betterment of Canton, and develop a deep-water port at Whampoa.

The British position now set forth so clearly by the chairman of the Hongkong & Shanghai Banking Corporation will clear away all misconceptions and disabuse the mind of Dr. Sun Yat-sen of British antagonism to his pet scheme. Once British hostility to Dr. Sun is terminated, one of the greatest obstacles to the unification of China will be eliminated. The speech of Mr. Lang will be welcomed in more than one quarter.

# Not a Leg to Stand On

CHINA'S parliament has instructed its foreign minister to notify Japan of the abrogation of the Manchurian treaty of 1915 signed as a result of the twenty-one demands, in which the original lease to the Kwantung peninsula is extended to 99 years. The original lease (succeeded to by Japan in the Portsmouth peace treaty) signed in March, 1898, expires in March, 1923, and the Chinese now demand retrocession of the territory on the grounds that the extension was obtained under duress.

The agitation for the return of this territory was started by the Chinese several months ago, bouyed up by the hope that public opinion in the United States would bring pressure to bear on its government to intervene in their behalf. It was not known to the Chinese that Japan and America had reached a tacit understanding in regard to the former's position in Kwantung, a sort of an unofficial gentleman's agreement in which the United States accepted that any interference with Japan's acquired rights in Kwantung would result in hostilities. We once discussed this same question with a very high foreign-office official in London, and he said practically the same thing: "the Japanese are there, they will fight before they will get out: you can depend upon it that Great Britain will never send troops to that part of the world to assist in putting them out."

For the past four months, or since the agitation was started for the annulation of the Manchurian treaty, the highest Japanese authorities have expressed themselves in various ways and at various times as to what their answer would be in the event the Chinese government abrogated the treaty of 1915 and officially communicated the fact to their minister at Peking. In effect, they unanimously state "we will refuse to discuss the matter." Under such conditions, if China should persist in denouncing the treaty, the situation so created would call for a severance of diplomatic relations and preparations on either side to defend their position. In the event that China should be foolish enough at this time to precipitate such a crisis, the consequences would be upon her own head.

In our December number we presented a symposium of articles on the various phases of the Manchurian question in which we fully explained Japan's side of the case as communicated to us by several responsible Japanese officials. In these articles, the truth was brought out that certain inside facts surrounding the presentation of the twenty-one demands and the ultimatum have been maintained a profound secret by both sides. The world has been permitted to see only the outward manifestations of an intrigue, the true facts surrounding which may not be divulged for another generation. The highest Japanese official connected with the presentation of the demands (Viscount Kato) has made the statement that the ultimatum was specially invited by the Chinese authorities in order to save their face before the nation, and Dr. Sun Yat-sen, Tang Shao-yi and the late Wu Ting-fang have repeatedly asserted that the demands themselves were drawn up or suggested to Japan by Yuan Shih-kai as the price he was willing to pay for recognition of his right to mount the dragon throne. We have since been informed by one of the highest authorities in Peking that evidence exists to substantiate the statement that the intrigue went even deeper, that documents are available to prove that Yuan Shih-kai actually financed from the proceeds of the reorganization loan the political campaign of Count Okuma which elevated the latter to the premiership of Japan. These various half-told stories reveal the existence of some secret understanding between Tokyo and Peking which neither side are willing to divulge during the life time of the principal actors in the play. This partial lifting of the veil of secrecy however, helps us to understand something of the reasons which prompted Japan to depart from the usual diplomatic procedure and invite world censure of her activities at such a time of world stress. It will also explain the much criticised statement of Count Okuma to Bishop Bashford three months before the demands were presented, in which Okuma conveyed to Yuan through Bishop Bashford, the message that as long as he was premier of Japan there would be no cause for friction between the two countries, or words to that effect. The concoction of a subsequent pact between the two to support each other would explain why Okuma departed from the policy so forcible outlined to the American bishop.

The statement of Viscount Kato cannot be lightly ignored: the accusations brought against Yuan Shih-kai by Dr. Sun and his close adherants have never been denied: the recent revelation of Yuan's pact with Okuma, while highly improbable, all tells us that the real story of the twenty-one demands remains to be told. The iniquity surrounding these negotiations was not all on the side of Japan, who appears to be the victim of a "double-crossing" on the part of Yuan Shih-kai in which the world accepted the Chinese side of the case, for the simple reason that Okuma and Kato were compelled to observe a discreet silence. Japan may be constrained to reveal the truth before the incident is closed.

Any discussion over the legality of Japan's position in Kwantung must go behind the twenty-one demands and invite an examination into the reasons why she came to be there at all. Waiving aside superfluous arguments and documents and the recital of unnecessary history tending to becloud the question, the discussion must be carried back to the close of the Sino-Japanese war in 1895, in which the Kwantung territory was ceded to Japan in the Shimonoseki treaty of peace. Russia, supported by France and Germany

## Official Text of the Treaty of Alliance between China and Russia, May, 1896.

*Filed by the Chinese Delegation at the Washington Conference.*

**"Article 1.—The high contracting parties engage to support each other reciprocally by all their land and sea forces in case of any aggression directed by Japan against Russian territory in Eastern Asia, China and Korea.**

**"Article 2.—No treaty of peace with an adverse party can be concluded by either of them without the consent of the other.**

**"Article 3.—During military operations all Chinese ports shall be open to Russian vessels.**

**"Article 4.—The Chinese government consents to the construction of a railway across the province of Amur and Kirin in the direction of Vladivostock. The construction and exploitation of this railway shall be accorded to the Russo-Chinese Bank. The contract shall be concluded between the Chinese Minister at St. Petersburg and the Russo-Chinese Bank.**

**"Article 5.—In time of war Russia shall have free use of the railway for the transport and provisioning of her troops. In time of peace Russia shall have the same right for the transit of her troops and provisions.**

**"Article 6.—The present treaty shall come into force from the day on which the contract stipulated in Article 4 shall have been confirmed. It shall have force for fifteen years."**

" advised " Japan to forego the fruits of her victory on the mainland of Asia in the interests of Far Eastern peace, and faced with this coalition of the three strongest world military powers, Japan wisely surrendered her prize in exchange for a cash indemnity.

The modern history of the Far East dates from this episode. There is just one question that China has to answer in this controversy. Did Li Hung-chang enter into a secret alliance with Russia aimed at Japan ? Did she cede her territories to Russia in accordance with the terms of this alliance for the avowed purpose of enabling Russia to prepare for a war of revenge upon Japan ?

The Chinese government answered those questions at the Washington Conference when its delegates officially revealed for the first time the actual text of the treaty of alliance. The world is now accurately informed that this secret alliance was actually signed at St. Peterburg in May, 1896 and was to endure for fifteen years, or until May, 1911 : that the specific object of this pact was to support each other against Japan : that China was to permit the Russian fleet free use of her ports during such a war ; and cede the right to construct a strategic railway through Manchuria. Supplementing this treaty and in pursuance of its objects, China furthermore leased to her secret ally in March, 1898, the Kwantung peninsula and ceded the right to construct the South Manchuria branch of the Chinese Eastern Railway, connecting the fortress with the main strategic line at Harbin.

Russia then feverishly fortified the already formidable stronghold of Port Arthur, created the city of Dalny, and flung her battalions into the Manchurian territory in preparation for the war of revenge that was to drive Japan out of Korea. That war was fought. Russia was driven back into Northern Manchuria at a cost to Japan of over 200,000 men and national bankruptcy, and to keep pace with Russia's preparations for another war of revenge, Japan was still further compelled to increase her military establishment and burden her people with a staggering load of taxation to maintain her position.

Why then, is Japan in possession of Port Arthur and the Kwantung peninsula ? Ask the spirits of the 200,000 gallant Japanese whose graves dot the Manchurian landscape ? Ask the mothers and fathers, the widows and children of those who sacrificed their lives in the defense of a homeland that was to have been taken from them and the yoke of a foreign conqueror placed on their necks through the double-dealing of China ? Do we wonder at the thunderous voice of protest that goes up from one end of Nippon to the other when it is suggested that they surrender the prize which cost them so dear ?

Was China an ally of Russia during the war of 1904 ? The treaty of alliance was never denounced. China fulfilled her engagement under the pact when she opened her doors for Russia to walk in. She is equally responsible for the consequences. Owing to the secrecy surrounding the existence of the treaty, China escaped paying the price which Japan could have exacted at the Portsmouth Peace Conference. The truth, however, is now before the world. Has Japan the right to go behind the twenty-one demands and insist upon the legality of her position in Kwantung ? If the question is ever brought before the League of Nations, the Hague Tribunal or any other international court of justice, China will not have a leg to stand upon.

There is one road to the peaceful settlement of this question ; one solution that will bring China and Japan together in lasting friendship. China must recognize and admit her own part in precipitating the Russo-Japanese war of 1905. China must make full acknowledgement of her responsibility for bringing this calamity upon Japan. Then, and not before, can she hope for a friendly hearing from those she " double-crossed " and injured by reason of her secret understanding with Russia. Demands upon Japan to clear out of Kwantung can only make a bad matter worse. It is not a question of humiliation on the part of China, but the frank manly avowal that she has made a mistake, that she is willing to make such honorable amends as is in her power. Japan can not be bluffed by threats or coerced by the pressure of powers friendly to China. Japan has placed herself on record that she will fight before surrendering or restoring Kwantung and the other nations of real men know that she will keep her word. Roosevelt's maxim " speak softly and carry a big stick " should be taken to heart by China at this time, for without the strength and will to back up her position, she is courting certain disaster.

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# The Indictment of China's War-Lords

ONE year ago we predicted that within twelve months world opinion would swing around and turn against China in the same manner as it had turned against Japan, and as China lost in world esteem, Japan would regain its confidence. To-day, the Chinese government as distinct from the people stands almost without a friend, indicted on all sides for its failure to take advantage of the bill of rights extended to it at Washington. Following our own exposition of the facts, others have torn away the screen of publicity and focussed the lime light on the real situation in China. Last month, we gave prominence to the findings of Congressman L. S. Dyer, the personal representative of the president of the United States, and below we conclude the indictment of the military overlords by presenting extracts from the speech of the chairman of the Hongkong & Shanghai Banking Corporation and that of Minister Jacob Gould Schurman at the Washington Birthday dinner of the Anglo-American Association at Peking. Mr. A. O. Lang (Chairman of the H. & S. B. C.) emphasized the financial situation and the impossibility of the consortium affording relief in existing circumstances. He said :

> " The political history of China during the past year has again been one of deep disappointment ; and the general condition of the country, so far from realizing the fair expectations raised by its delegates at the Washington Conference, has become steadily worse. The standing army is larger than ever, and continues not only to be a crushing financial burden upon the country, but its ill-disciplined units have become a serious menace to both foreign and Chinese life and property everywhere outside the protection of treaty ports. Bands of brigands, consisting of deserting or unpaid soldiery, maraud through the provinces, burning, looting and kidnapping with impunity ; while the whole country continues to be rent by ever-shifting political dissensions and military intrigues. The Peking government, central only in name, is a puppet in the hands of contending *tuchuns*. The railways are over-run, their traffic disorganized and their equipment damaged by hordes of disorderly troops. The revenues which should go to maintain the railways and to pay the service of the foreign loans secured on them, are appropriated at their source by the military authorities. Over-shadowing this chaotic condition of affairs like a dark cloud, is the load of unsecured indebtedness, foreign and internal ; an indebtedness with which the Peking government, in its present circumstances, has shown itself entirely unable to deal unaided ; but which measured by the area, wealth and population of the country, would, if properly consolidated, entitle China to be placed almost at the head of the solvent nations of the world. So long as present conditions persist, however, and until the people of China show their determination to insist upon effective measures being taken by the government for the disbandment of troops, the consolidation of the unsecured debt, and the unification of the country, every attempt to assist her from outside must be regarded as futile. The consortium, which was formed to give much assistance, must continue to stand by, a patient and passive spectator of events. No financial assistance which would serve the real interests of China, while at the same time securing protection of bondholders, is possible in existing circumstances."

Minister Schurman's indictment was more in the nature of a diplomatic recital of the facts surrounding China's failure to meet the expectations of the Washington conference and put her house in order, and although it constituted a scathing rebuke to the military masters of the country, it breathed the true American friendship for the great masses of patient, dependable Chinese whose first concern in life is the eternal struggle for existence. Minister Schurman also believes that the day is coming when an honest government will once more come to China, but holds that this can be attained only through the instrumentality of the educated classes, the merchants, bankers and other elements which go to make up public opinion in this country. It is to these educated classes that China must turn to in order to solve her own problems, a task in which no other power can help them, except with sympathy and good-will, a task, as Mr. F. W. Stevens pointed out, will require much self-sacrifice and the possession of the qualities of which martyrs are made. The great Chinese people have not lost the friendship of the other nations : they are now in exactly the same position as Germany was

during the war when the world turned its vials of wrath upon the heads of the military leaders. The Chinese lack a leader around which they can gather for the purpose of overthrowing the rule of the *tuchuns*. That leader will arise, and as China once more returns to her proper place in the comity of well-government nations, those who now condemn and criticise her, will be the first to applaud and assist in the difficult task of reconstruction.

In expressing his opinion on the Peking government Minister Schurman simply invited attention to the existence of seven cabinets during the past year which in itself makes unnecessary any discussion as to its stability. "Since the Washington conference passed the resolution urging China to disband her troops, four civil wars have been fought in different parts of the country, each a struggle for political and military control by rival leaders. Banditry has steadily increased in China in recent years reaching during the last twelve months even alarming proportions." Under the above conditions, it has been impossible for any friend of China to extend a helping hand in stabilizing the government by financing any one group. As one of the consortium representatives remarked to us in Peking recently, "they (the Chinese) won't stand still long enough for us to negotiate with them." And we now see in the speech of the chairman of the Hongkong & Shanghai Banking Corporation and in the proximate departure of the representative of the American group from Peking an extended vacation, that the financial leaders have given up hope for the present of contributing through loans to any scheme of short of real unification and a permanent settlement of their differences amongst the Chinese themselves.

This colossal task, Minister Schurman reminded the Chinese, is exclusively their own concern. "Foreign nations can be of assistance only by manifestations of goodwill and sympathy and by rendering such specific service as China may ask of them. Concluding, he said that this has always been the attitude of the United States towards China. A warm friendship between the two governments and peoples has been built on that solid foundation of community of interest and altruistic service. The American people and the American government earnestly desire—I may truthfully say that millions of them devoutly pray—that this friendship may grow in depth, in intensity, in unalloyed sincerity and cordiality. There is nothing, I am confident, which the American nation ranks higher in China except indeed the jewel of its own soul. I mean justice, the inviolability of the lives and lawful rights of its citizens, and its own national dignity and self-respect," in other words, the honor of the flag and what it stands for, the honor that was outraged by the Chinese militarists at Kalgan when they fired on the American consul and murdered an American citizen while pursuing his lawful business under his protection. The indictment of the Peking government is now complete, and it is squarely up to the Chinese themselves to set their house in order and regain the sympathy and respect of the world which they have lost while engaged in discrediting Japan.

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## Sun Yat-sen

THE star of Sun Yat-sen is again in the ascendant. It is gratifying to all lovers of fair-play to witness the return to Canton of the popular leader who was so treacherously ousted only a few months since by his trusted lieutenant. In the meantime Dr. Sun has undoubtedly reflected over his attitude towards Hongkong, and the British also have had time to consider his side of the case as presented some months ago in the columns of THE FAR EASTERN REVIEW. In returning to Canton, Dr. Sun stopped over at Hongkong and while there the leading British authorities and himself had an opportunity to exchange ideas and come to an understanding. The open and frank exposition of British policy concerning the development of the port of Canton by the chairman of the Hongkong & Shanghai Banking Corporation, following so shortly after Dr. Sun's visit to that port, would indicate that one of the chief grievances of Dr. Sun against the British has been removed.

The visit of Dr. Sun to government house and his enthusiastic reception and speech before the students of the Hongkong University have further helped to clear away misunderstandings. Once British opposition to this Chinese leader is withdrawn, and their newspapers and writers concede him a square deal in publicity, the day will not be far distant when the rest of the world will be willing to accord him his rightful place in Chinese politics. With foreign opinion friendly to him, the masses of educated Chinese who take their cue largely from the foreign press, will turn to him as their leader, and follow him in the great task that lies before all patriotic Chinese.

Sun Yat-sen is human ; he has his limitations. He may fail to bring order out of chaos, he may be defeated in his plans for unification. Compromise and appeal to the higher instincts of the *tuchuns* may be of no avail in re-establishing a representative and stable government and the leader of the people, whether it be Dr. Sun Yat-sen or some other champion, may have to combat force with force. Sun Yat-sen stands for those principles which all Anglo-Saxons have sacrificed their lives in the past to uphold.

He is essentially a non-militarist ; fundamentally honest and patriotic. He has no personal ambitions and invariably in the past has sacrificed himself for the good of his country. His position as the head of the Canton government gives him an equal standing with the *tuchuns* and although it is to be sincerely hoped that compromise and concessions on all sides may bring unification, the warlords may reject any interference with their acquired rights and refuse to submit to a central authority. In which case, is Dr. Sun to be held up as the one disturbing influence in China if he meets force with force ? Whether it be Sun Yat-sen or some other champion of good government, the issue will have to be met and faced. Whoever it may be, if he fails and pays the price, he will go down in history as one of the world's martyrs.

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## The Jardine Engineering Corporation

ONE of the most important and far-reaching events in Far Eastern engineering was the recent incorporation of the Jardine Engineering Corporation, Limited, which succeeds to and takes over the engineering business of Jardine, Matheson & Company, Limited. The engineering department of this pioneer China company was one of the first in the field and many large industrial works and railways in China have been equipped through its agency. Through this department much of the purchasing for the British loan built railways has been successfully conducted, and British engineering interests materially advanced in China.

The complete severance of this department from the main business of the firm and its organization as a distinct corporation has many advantages that will make it a very formidable competitor for future Chinese business. At the reception held on February 23 to mark the opening of the new enterprise, Mr. John Johnstone, the local head of the parent concern, said the idea originated in the fertile brain of Mr. G. S. Aveyard shortly after he joined the firm as head of the engineering department, and although for some time the new company would still be closely identified with Jardine, Matheson & Company, Ltd., steps had been taken to enable it to stand alone when the time became propitious.

The new enterprise in effect, is the first step in a larger measure of co-operation with the Chinese, and at some future date in the not distant future, Chinese would be admitted as shareholders and as co-directors, equally interested in the development of Chinese undertakings for the benefit of the Chinese people.

"Some people," said Mr. Johnstone, "asked why Jardine, Matheson's as a firm had allowed one of their departments to be absorbed into such an undertaking. The explanation was simple. So long as they played at engineering it was possible for Jardine's, who were responsible for the management of the firm, to arrange matters so that engineering contracts and the financing

therefore, did not interfere with ordinary merchant business. It was quickly seen, however, that if they were to take their usual place occupied in most matters connected with China and Chinese business affairs, it would be necessary largely to develop the engineering department with a consequent loss of immediate personal control. His personal opinion for several years past had been that development with Chinese co-operation was to be aimed at. The formation of this corporation was the outcome of views which he was pleased to say were held by all the partners in his firm to-day."

"In conclusion Mr. Johnson said he would like to impress upon those of the staff present the desirability of acquiring a knowledge of Chinese. As employees of that corporation, they would be brought more closely in touch with the natives of the country than most people were and would have a better chance of pulling their weight in the boat. Employees would make themselves indispensable to the corporation if they knew the language."

As the premier British trading concern in China, Jardine, Matheson & Company, through its engineering department, has kept pace in the development of China's industries and contributed largely to bringing the engineering trade of Great Britain with China up to a place second only to the piece-goods business. The British manufacturer undoubtedly holds the lead in many of China's mechanical requirements despite the stiff competition of America and now of Germany and Japan. The future for the expansion of this trade is exceptionally bright. When conditions are once more settled, and British manufacturers are able to quote lower prices and offer longer credits, their percentage of the engineering trade with China is bound to increase. The new company is an exceptionally strong position to obtain its full share of this trade, we congratulate its promotors on its auspicious launching.

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# The Hot Springs of Japan

WITH the advent of the vacation season the mind of the sojourner in China and other parts of the Far East turns to where he will send his family for the summer, and to assist him in making a wise choice, the new guide book entitled "The Hot Springs of Japan" has been compiled by Mr. Frederic de Garis, director of publicity of the Japanese government railways. This book is more than the usual tourist guide and becomes a work of reference on the playgrounds of Eastern Asia, including as it does, not only the resorts of Japan, but also of Korea, Formosa and South Manchuria.

The book is written from a foreign viewpoint for foreign readers and aside from the scientific material concerning the analysis of the many medicinal and other springs is most informative and interesting. It lists diseases benefitted and prohibited by the different classes of springs and provides the vacation and health seeker with accurate data on the good resorts where hot spring and sea-bathing may be enjoyed, where cottages can be rented, the names and rates of all hotels and other information invaluable to those preparing their annual vacation budget. In addition, much valuable information is given about the customs of the people, the rules and rates prevailing at Japanese inns, what to bring to supplements the Japanese style of living and what to expect in the way of food, service, etc.

There is also a chapter on radio activity and radium with which many of the springs of Japan are impregnated, explaining their action on the human body and compares them with the principal springs in other countries. The chapter on hot springs near principal cities gives the names of foreign-style hotels and Japanese inns serving foreign food, and another chapter on Japanese inns gives prevailing rates, information about food, tea money, tips to servants, pillows, electric light, police regulations, gifts, customs and inns recommended, in all a most valuable guide to foreigners seeking information that will enable them to select their vacation resort with the least trouble.

Many of these really excellent springs are situated away from the regular routes of travel and are reached from small cities and villages, where the people still retain the simple, courteous charm of ancient Japan, and maintain the old customs of their joyous and kindly race more faithfully than their modernized fellow countrymen in the large cities. And with all this, the foreigner who seeks these springs for a complete change and invigoration of physical and mental powers after the strain of winter's activities, is only a few hours away from the larger cities or the social resorts at Miyanoshita, Nakone, Atami, Kamakura or Nikko.

No country in the world is so blessed with natural hot springs as Japan, and the book lists 951 hot and 155 cold springs, of which 250 have been found to possess radio-activity. Many of these springs are famous for their curative powers and under the careful supervision of specialists and proper publicity, they should in time rival some of the more world famous resorts of Europe, at least, they should attract the people in this part of the world because of their nearby location, facility of access and reasonable charges.

The book is highly illustrated, containing 504 pages, 196 illustrations, two colored lithographs and fifteen specially drawn maps. It slips into the pocket easily, and is sold at seven yen in the bookstores of the Far East.

# A Lucky Accident

MANY of the most important discoveries in science and engineering have been made almost by accident. There is now in general use a process known to the textile industry as "wool carbonisation" which is really a method of removing from wool all the vegetable matter, such as straw and burrs, which the sheep may collect in its fleece. A British firm of dyers had provided their workers with overalls of cotton for the summer and of wool for the winter. These overalls got freely splashed during working hours and it was noticed that the dye liquor, which contained acid, soon corroded the cotton overalls, while the wool ones were not affected. To make quite sure of the difference an overall was made with alternate squares of cotton and of wool; and after this garment had been splashed with acid it was found that the woollen squares remained while the cotton ones disappeared. As cotton is similiar in character to the straw, burrs and other vegetable fragments which get into sheep's wool, this firm quickly jumped to the idea that the same process could be used for destroying these foreign materials in wool.

* * *

# A New Railway Wagon Brake

THE traditional form of railway goods wagons had a brake lever on one side only, so that the shunter had frequently to cross over the line at considerable risk to get at the lever. Out of this arose a demand for some kind of appliance which would enable the brake to be applied from either side of the wagon; and several solutions of the problem, more or less satisfactory, were tried. The most satisfactory of all appears to be one which has been thoroughly tested on a British railway for the past two years. The brake can be operated by two short hand levers at diagonally opposite corners of the wagons. The mechanism is so designed that the brake is very rapidly and efficiently applied simply by pulling down the lever. Once the brake is set it is practically locked in position and cannot be released until the lever is definitely moved up again. By an ingenious device any wear in the brake blocks is taken up, so that repeated adjustment is not required. Although the pressure which the shunter exerts on the lever is only about sixty pounds, the brake block itself exercises a pressure of six thousand pounds—which is enough to give efficient braking and not too great to produce skidding. This new brake can be adapted to power braking with air pressure or vacuum systems.

# Chinese Engineering Development in Shanghai

## A Visit to Some Native Machine Shops and Machinery Manufacturers.

SO much has been written about the remarkable progress of Japanese engineering industries that little attention has been focussed on what is taking place along similar lines in China under the very noses of foreigners in such centres as Shanghai, Hongkong, Canton and other large treaty ports. Ten years ago we could count the number of Chinese machine shops in Shanghai on the fingers: to-day it is a most difficult task to list all the establishments that have sprung up in recent years, some of considerable size and merit, but the great majority, small shops tucked away in obscure alleyways where even the Chinese find it difficult to locate them. The rapid development of industrial plants in China and especially in Shanghai during and since the war has brought in its wake a swarm of native engineering works, foundries and machine shops, which, as a rule, commence by engaging in small repair work and soon expand into manufacturers of all classes of machinery, monopolizing the native market for cheap machine tools and special machinery. The correspondent of *The Times Trade Supplement* describing the large number of these small workshops in South China run by mechanics who have "picked up" their knowledge of engineering says:

"These men are not capable of judging the relative value of a good or bad machine-tool. They and their friends have put just enough money into the concern to equip it for repairing steam-launch engines, motor-boat engines, automobiles, etc. Their first thought is to obtain cheap equipment. It is quite obvious that with practically no overhead charges they can undertake repair work at a much lower figure than any European establishment.

These small concerns remind one very much of what was happening in the Midlands in Great Britain fifty or sixty years ago. The beginnings of Birmingham firms, which now possess world-wide reputations, were very inconspicuous. The founder of one of the largest of these machine-tool manufacturing establishments told the writer, some years ago, with justifiable pride, how, after working in a foundry for some time, he and his two mates commenced to do engineering work for themselves in a small tenement dwelling. History is repeating itself in China. There is this difference, however—that the Chinese mechanic can obtain modern equipment for his small works only if he can find the money to pay for it. He usually finds it difficult to raise the money, and that is why he favors the low-priced article."

The same thing is happening in Shanghai where at present there are over 200 machine shops of all kinds, many of them occupying a room or so hidden away in the interior of a Chinese block of buildings and operating a lathe or two and a few home-made machine tools taking in repair work from the many garages and native industrial establishments. Amongst the better class shops which rise to the dignity of engineering works, many are operated exclusively in manufacturing new machinery which, because of its low cost, finds a ready market in the industrial plants of the interior. In fact, many of these new native industrial plants in the interior are equipped throughout with machinery made in Shanghai, especially knitting and weaving works. The list does not stop here, as we find the machine shops in Shanghai turning out every conceivable kind of machinery and machine tools. A visit to these establishments reveals that many large and important machine tools are made in the works for their own use and in many instances orders are being filled for the equipment of new native machine shops in the interior. As an example of this, our correspondent visited the Sin Min Machine Works on Tangshan Road, where a 16-ft. by 20-ft. planer and 12-ft. by 25-ft. lathe of German model were being made to the order of a new native machine shop in Honan, the first in the province. Other shops, such as the Oriental Engineering Works, are making all the equipment for their new and enlarged works under construction. A feature which cannot fail to escape notice, is the employment of boys to operate machine tools, under the supervision of one expert foreman, and in another case a group of girls were being trained to operate machine tools on light work preparatory to their being engaged in a new establishment under a forewomen.

A visit to these various machine shops provides evidence that there are several companies which made good gap lathes, drill presses and planers for rough work, and as pointed out by Mr. Sam Dean of Peking not long ago, they are made so cheaply that they supply practically all the repair shops of the country. It is only in the larger railway shops, and the engineering establishments under foreign supervision that English or American tools are used exclusively.

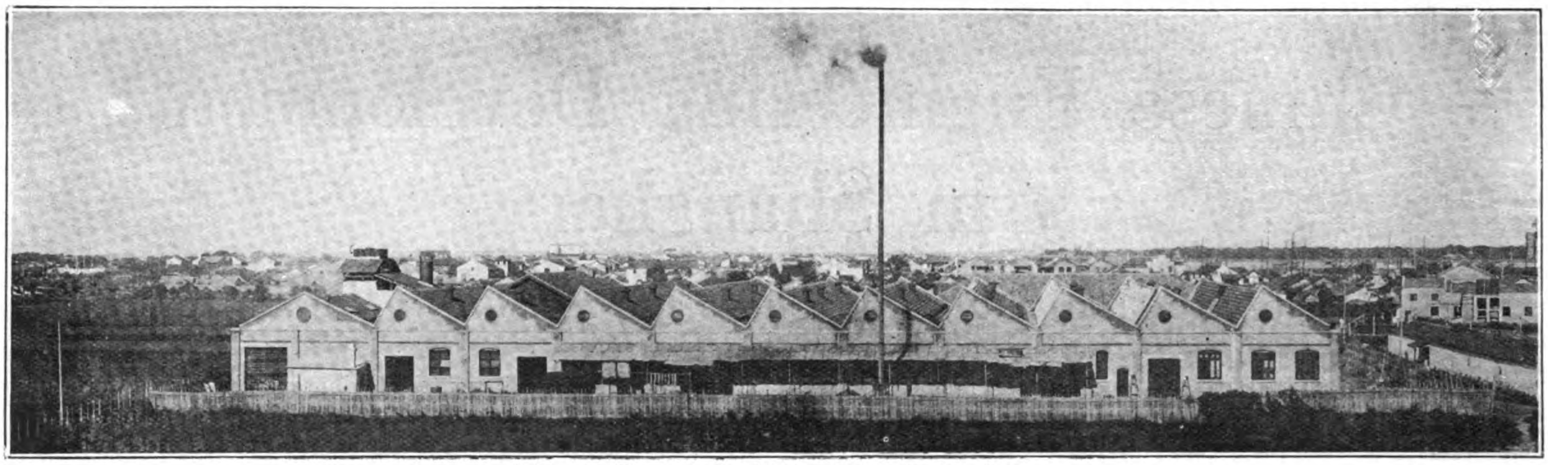
In commenting on this development Mr. Dean said:

"There is a large and increasing demand in China for machine tools of the repair shop type, but the Chinese have to be educated to the fact that one good foreign tool is worth several cheap Chinese-made machines. Perhaps the most popular American machine tool here is the lathe. This is rather too light for the work it is made to do, but accuracy doesn't matter on the jobs put through in most cases so it does fairly well.

"The expensive machines with gear boxes, electric drives and all that are quite outside the present demand and pocket book. Now and then a large mill will buy good machine tools, but there are comparatively few such mills. However, every city now has an increasing number of small machine shops and this is the trade which has volume and now uses Chinese and Japanese goods. These shops are run in many cases by graduates of Chinese technical schools and Chinese technical schools are mostly equipped with Chinese or Japanese, or at most English-made or German-made, tools. Naturally the students buy for their own shops what they have learned to use. Also the schools with their small incomes buy the cheapest machines.

"Personally, I feel that there are two lines which American machine tool manufacturers could follow in order to get the Chinese market. One is to put their tools in technical schools out here at prices that would enable them to be bought, rather than shoddy Japanese or Chinese machines. The other is to find out the companies that are supplying the Chinese repair shops with machines and in these shops at least work hard to put in American machines. I doubt very much whether we can compete with the Chinese-made machine for the makeshift repair shop, but we certainly ought to be able to furnish the machines that make China's machine tools."

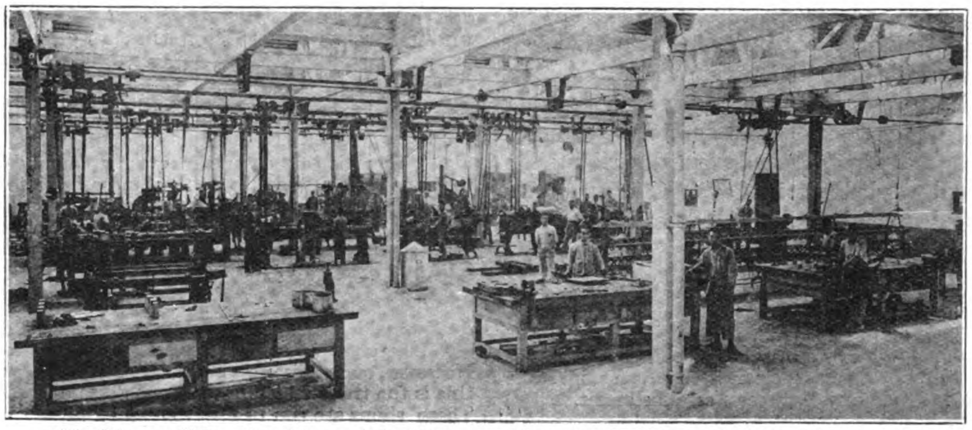
Any attempt to adequately describe the equipment and output of most of these shops is met with at the start by suspicion and it is not always easy to gain admittance. On the other hand, there are many who gladly welcome inspection and who take a pardonable pride in the equipment and work turned out. It was our intention to cover all these establishments so that the readers and advertisers of THE FAR EASTERN REVIEW would receive accurate information about the development of this new industry, but for the present will limit our remarks to a few of the more important that our correspondent was able to visit this last month. The larger foreign-owned and directed engineering works of Shanghai are well known, not only locally, but abroad. The Shanghai Dock & Engineering Company, Ltd., The New Engineering & Shipbuilding Works, Ltd., The Kiangnan Dockyard and the French establishment formerly operated by Nicolas Tsu are well known for the superior quality of their works, ranking with other first-class engineering works at home. There are, however, several smaller works in Shanghai under native supervision rapidly monopolizing a business which must materially affect not only the larger yards but the business of many foreign machinery importers.



Woosung Shops of the China Machine Works, Ltd.

## Eastern Engineering and Shipbuilding Company

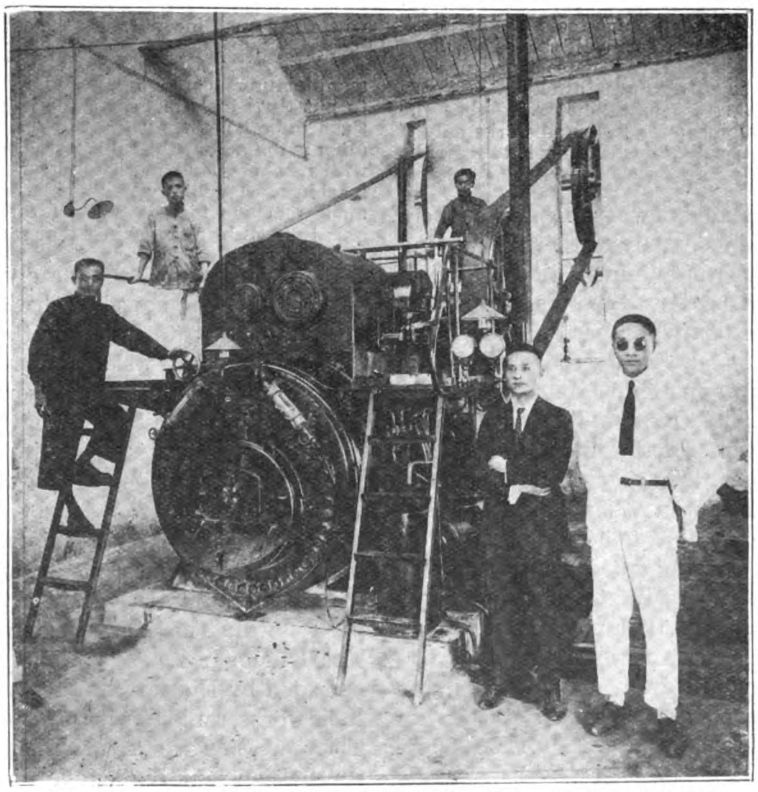
One of the most successful of these smaller establishments is the Eastern Engineering & Shipbuilding Works located at 66 Yangtszepoo Road. Operated as a purely Chinese concern established in 1909 under the name of the Hsing Fay Yung Company, the control passed into the hands of Japanese in 1919 and the works, formerly located on Arsenal Road, Nantao, were transferred to their present site in 1921. A Sino-Japanese concern, the managing director is a Japanese Mr. G. Ono, with a board of directors of three Japanese and two Chinese. It specializes in shipbuilding, in marine engines and boilers, railway and tramway cars and structural steel work.



Machine and Erecting Shop of the Woosung Shops of the China Machine Works, Ltd.

The works cover a large area running from the Yangtszepoo Road to the river on which they have considerable frontage. At the present time slipways are being laid down for the construction of two Yangtze River gunboats for the Japanese government. These are to be 200 feet in length, 30 feet wide, with a draft of 3-ft. 6-in., and a speed of 16 knots, with furnaces adapted for coal or oil fuel. In the past, these works have turned out steamers up to 1,000 tons, amongst which are the two upper Yangtze River light draft steamers, *Hung Fok* and *Hung Kiang* for the Ichang-Chungking service.

The shops are now busy with steel structural work for a new cotton mill, in fact, several such structures have been laid out and made at these works. They have also built twelve first and second-class coaches for the Shanghai - Hangchow - Ningpo Railway, nine passenger cars for the Tientsin-Pukow and four passenger and goods cars for the Nanchang-Kiukiang line in addition to tramway cars for the French and International lines in Shanghai and some tank cars for the Asiatic Petroleum Company.

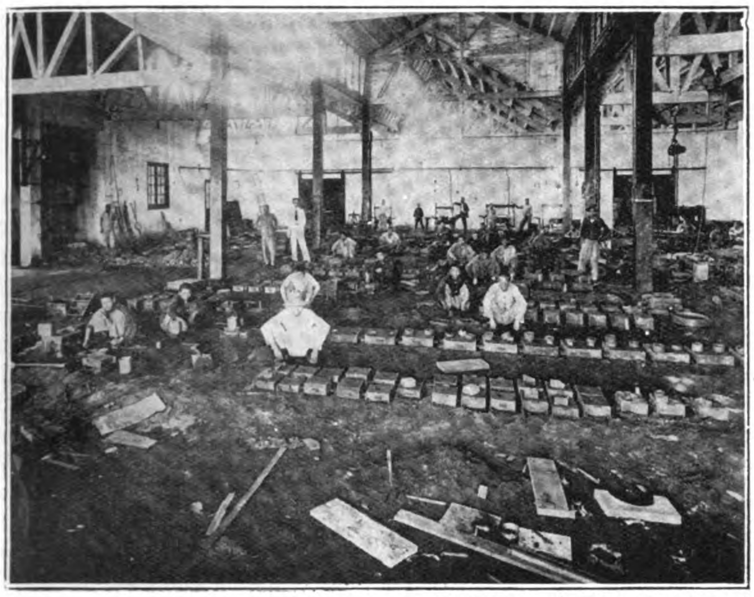


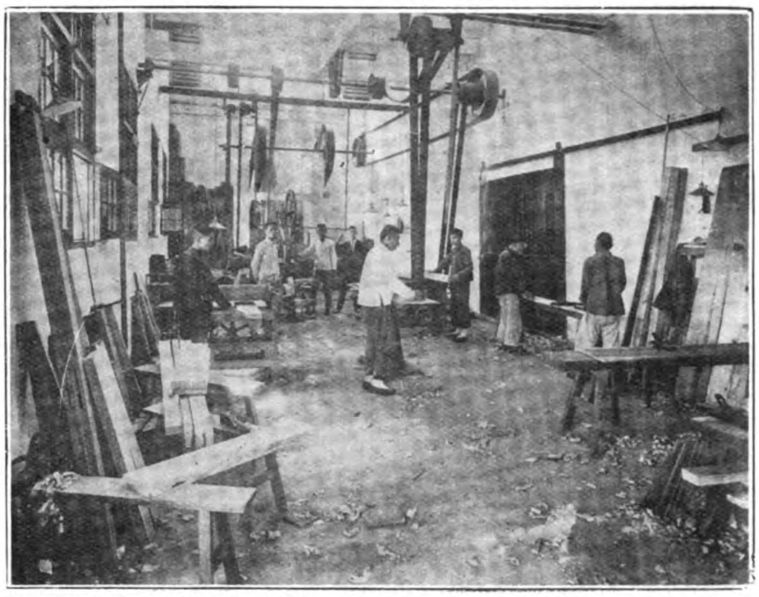
Engine Room of the Woosung Shops of the China Machine Works, Ltd.: Equipped with a 95 h.p. locomotive type boiler and engine of German make.

The foundry of the works is equipped with three cupolas, the largest of ten tons capacity, the blowers being of Japanese make. At present the chief output of the foundry is cast building columns. In the blacksmith shop is found a one ton steam hammer made locally. The pattern shop employs about forty workmen. The machine shop is equipped with 35 tools in all, comprising 17 lathes, 4 planers, 8 drilling machines, 1 milling machine, 2 screw machines and three punching and shearing machines. The largest planner, 14 feet long, 6 feet wide and 4-ft. high was made at the works. The other planers are made by Esterbrooke & Allcard, Sheffield, who also supplied some of the drilling machines. Others drilling machines are from Yamazuchi Katsuzo, a Japanese machine tool maker. The milling machine of American type is also made in Japan, and the two screw machines from Wells Bros., of Greenfield, Mass. The largest lathe is 20 feet long. American, British, Dutch, Japanese and Chinese makers names are seen on different lathes. A feature of these works is the ample space and lighting. The number of workmen employed at present is 150.

## The Oriental Engineering Works

Here is a typical native concern which at present is doubling its capital in order to erect a new establishment three times as large as the present



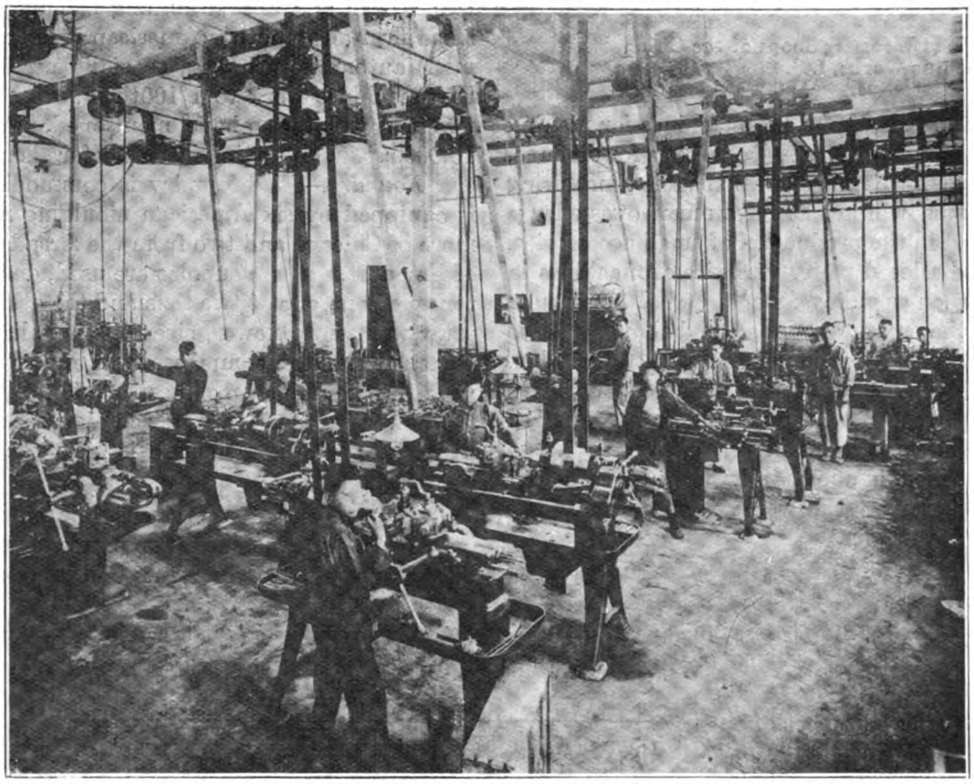


WOOSUNG SHOPS OF THE CHINA MACHINE WORKS, LTD.

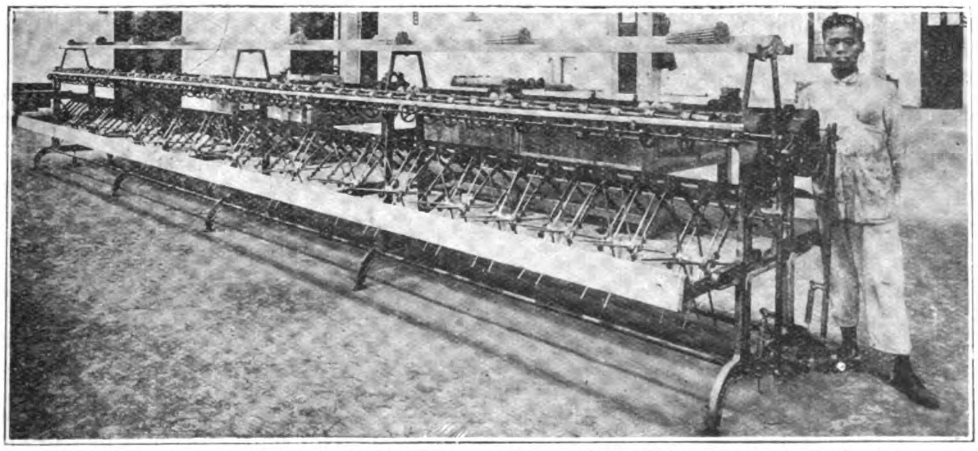
The Foundry — Carpenter's Shop

one on a plot of land already purchased lying outside the settlement limits in the western district. The offices are located on Pingliang Road. Connected with these are show rooms displaying weaving looms, flat clipping machines, bundling presses, threat twisting machines, double cylinder hydraulic pumps, plummer blocks, vertical steam engines, boiler feed pumps, mill hydrants, water and fire pump standards for street use for the local water company, gallows pulleys, shafting up to 4½ inch, self-lubricating bearings, steam traps, mill gearing, etc., a most comprehensive line of machinery and engineering accessories. The works are located on Dalny Road about five minutes' walk from the office and comprise a foundry and five machine shops.

In the foundry, castings up to 2½ tons, pulleys up to 12 feet and shafting in 24 feet lengths have been turned out. Three of the machine shops are on the ground and two on the first floor of the building. In No. 1 shop is found a 24-foot lathe made at the works with



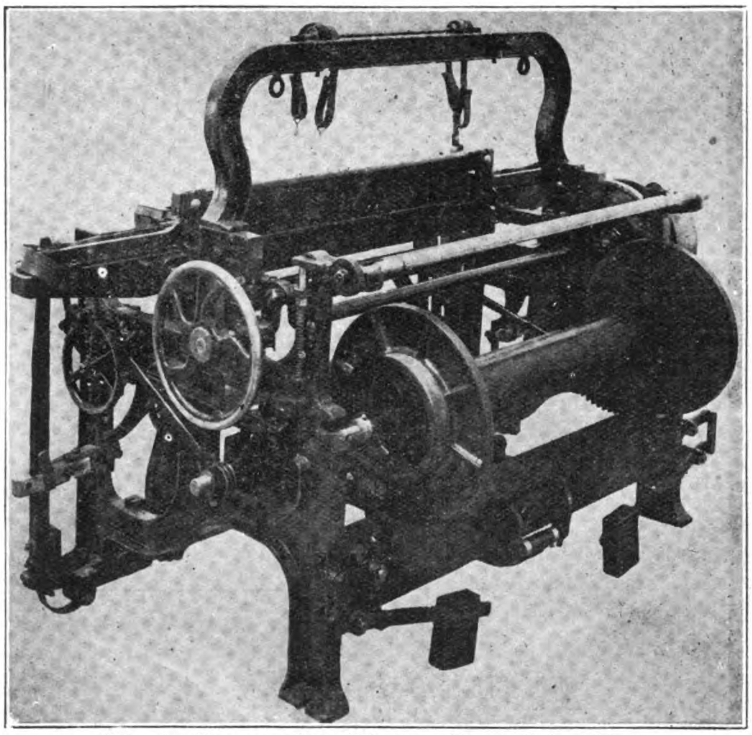
Tool and Spindle Manufacturing Shop of the Woosung Shops of the China Machine Works, Ltd.: Equipped with American and German Lathes.



Silk Winding Machine made at the Woosung Shops of the China Machine Works, Ltd.

thirteen smaller lathes mostly of British manufacture, some German and some American. There is also a milling machine, one shaper, and five drilling machines all British, with two planers, one British and the other, 36 feet long and 5 feet wide of German make. In No. 2 shop are found four German milling and one hobbing machine and ten American lathes of various sizes. No. 3 shop is fitted with three English planers and four drilling machines, six German grinders and two lathes. No. 4 shop with ten American lathes, with the exception of one British slotting machine all the tools in No. 5 shop were made on the works and consist of 24 lathes, nine milling and five drilling machines. In a small room off this shop there are installed two American semi-automatic machines, one a boring lathe with ball bearings and the other a semi-turret head lathe.

Adjoining the main works but with a separate entrance is a second works called the Model Women's Works, established in 1920, where some twenty women, graduates from the



Weaving Loom made at Woosung Shops of the China Machine Works, Ltd.

middle schools, are being trained in the use of machines for making small articles such as screw machine pins, studs, caps for oil cups, etc. When the new factory is ready for operation some time during the present year these women will act as forewomen over a large number of girls to be engaged in the production of small accessories.

A visit to these shops disclosed many varieties of machines in the course of manufacture, such as pulleys, machine tools, hydraulic baling presses to work with the pressure pumps noted above. These baling presses are made in two sizes, one for a pressure of 1,000-lbs. per square inch and the other for a pressure of 2½ tons per square inch. Cloth finishing machines and all the machine tools required for the new works are being made at the present time. These latter now being assembled, include about 40 lathes, 5 slotting and 2 milling machines. The power for the works is supplied by the Shanghai municipal electricity works.

## The China Machine Works, Ltd.

One of the most complete and interesting of the native engineering establishments in the Shanghai district is the Woosung shops of the China Machine Works, Limited, located on the Wen Chaopang. The Shanghai offices of the company are located at 112 Szechuen Road. Mr. C. C. Nieh, the well-known Shanghai industrial magnate, is managing director of the enterprise, Mr. C. S. Hau, the manager, and Mr. W. T. Wong, the engineer-in-chief. The latter courteously took our representative through the works and pointed out what they were doing.

The works are located at Woosung thirty minutes by train from Shanghai and two minutes' walk from the station. A siding is to be brought to the works later on. A roofed bay running the width of the factory has been erected for the handling of motor truck loads. The shops with saw tooth roofs are well lighted, having ample space between the machines and scrupulously clean. In fact, it may be called a model factory in many respects. The works were opened in June, 1921, and have been running day and night ever since, shutting down every other Sunday for cleaning. The number of employees is now about 300.

*Machine Shop.*—In the drawing room, which opens into the large machine shop, ten men are employed. About half the space in the machine shops is free of tools and is used for erecting and assembling, but eventually this space will be filled with tools and the assembling done elsewhere. In the machine shop are found five German Schulte turret lathes (in the tool and spindle shop two more are installed). Each machine has two cutters, 6 to 4 and one 20 m.m. to 40 m.m. There are 30 ordinary lathes in this shop from 5 to 20-ft. in length mostly German with a few American monarch lathes. Drilling machines and radial drills are also German and American make with two gand drillers. In the same shop are two American gear cutting machines, seven American and two German milling machines and one vertical milling machine from Brown & Sharpe Manufacturing Company. Power for the shops is distributed by shafting supplied by a semi-locomotive type 75 h.p. engine made by Henrich Lang of Mannheim. During the visit of our representative, the following machinery was in course of manufacture in this shop: pumps, silk machines, weaving looms, stoves, spindles, cast iron pipe, and bean oil presses. The pump was a positive pressure pump designed to deliver 300 gallons per minute at 160-ft. head through a three inch delivery working at 300 r.p.m.

*Tool and Spindle Shop.*—In this shop all the tools with few exceptions were manufactured at the works. There are, in addition, two Brown and Sharpe milling machines and one grinder by the same firm also another American grinder and six roto type (German) automatic grinders, specially used for turning out spindles. The machines work to 1/100th m.m. Here are installed also the two turret lathes above mentioned. All spindles are tested to 10,000 r.p.m. on testing frames before being sold.

*Foundry.*—The foundry is commodious and well lighted and is equipped by six American moulding machines, four from Pridmore of Chicago and two from the Arcade Manufacturing Company of Freeport. Three cupolas are used, one with a capacity of seven tons per hour, one of two tons and the other one half ton. A Root's rotary pressure blower, size 4, is installed for the cupolas and an Ingersoll-Rand air compressor working to 80-lbs. per sq. inch for use with the moulding machines. A 56 h.p. crude oil engine provides the power for the blower, air compressor and an 8 k.w. dynamo for lighting. The pig iron used is from the Han-Yeh-Ping Company at Hankow.

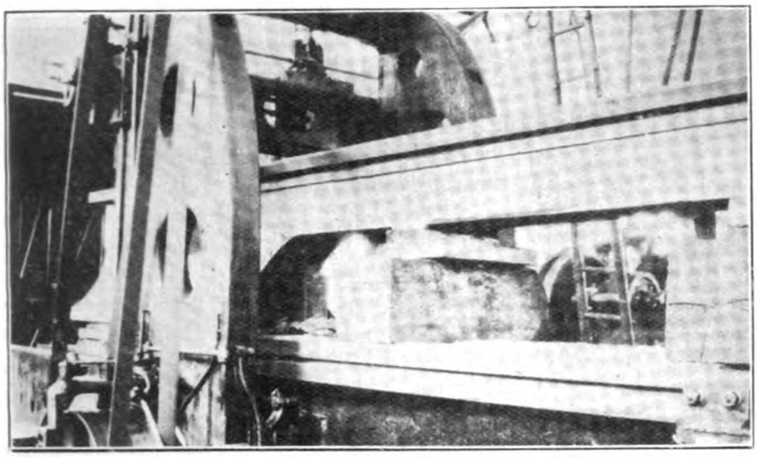
*Forge*: In the forge is a case hardening stove, a German punching and shearing machine, two power hammers, one German and one American by the Little Giant Company of Mankato, also a blower for the forges. The heating stoves manufactured at the works are for use with hard coal or coke and fitted with a lever regulator to give four heats. Cast iron pipes are made up to 14-in. diameter.

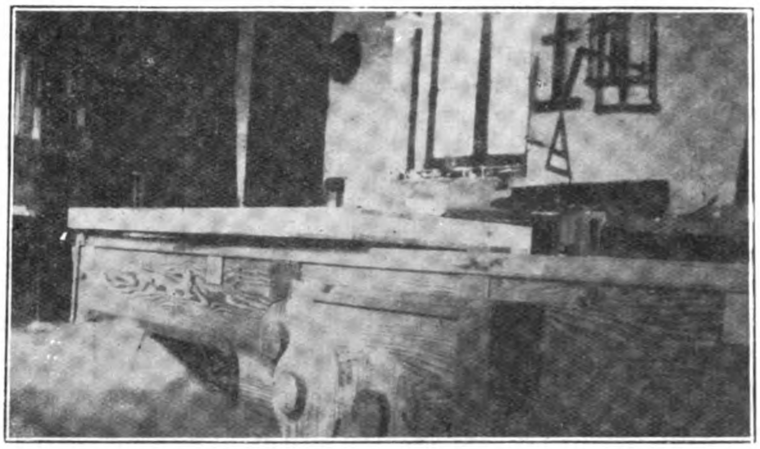
Structural Steel Frame Work for a large Chinese Cotton Mill in which all Columns and Girders were made by the Eastern Engineering and Shipping Company

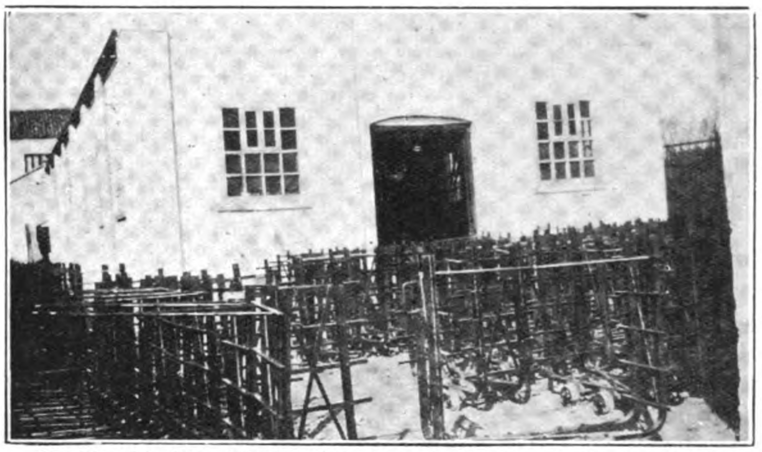
The belt-driven bean oil presses being made at the time of the visit were destined for Haichow, Kiangsu province, having a capacity of 1,000 piculs per hour.

The factory building is 180-ft. by 300-ft. with all shops under the same roof divided by partitions. The machine shop is 100-ft. by 150-ft.; tool and spindle room, 40-ft. by 125-ft.; foundry, 75-ft. by 120-ft.; forge, 40-ft. by 75-ft.; drawing office, 25-ft. by 60-ft. The balance of the space is taken up with a wood working and pattern shop with a packing room and tool rooms. A house to accommodate 200 workmen is also attached to the works.

These works, owned and operated exclusively by Chinese and catering largely to industrial establishments in which the larger shareholders are interested are an indication of the trend of native engineering progress in China. Here we have an enterprise backed with plenty of capital, large shops, commodious and well equipped with modern machinery, supplying much of the mechanical requirements of Chinese textile mills, together with pumps, oil presses, and other special machines, an enterprise with an established market which in time will undoubtedly expand into a full fledged machinery manufacturing plant.





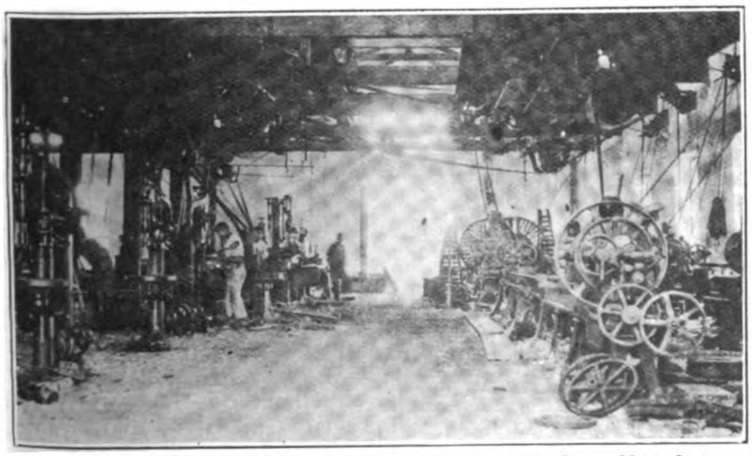


Sin Min Machine Works, Tangshan Road, Shanghai. Top, View of Works: Left, a 16-in. by 20-in. German planer and 12-in. by 25-in. machine lathe being made for a new machine shop in Honan Province: Right, Pattern shop, working on pattern for a 10-in. by 18-in. planer for new Honan shop: Bottom, Trucks for the Shin Ja Brick Works.

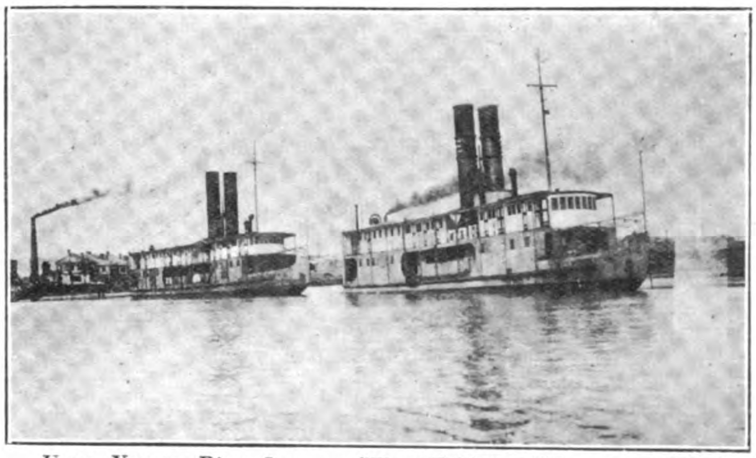
## The Yah Dah Iron Works

Somewhat smaller and less pretentious than the former establishments are the Yah Dah Iron Works, established in 1904 by Mr. Zung Tse-chew their proprietor. Although a general manufacturing engineering business is carried on the works specializes in the manufacture of machine tools of all kinds. Although a small factory employing 50 workmen, the tools are kept in constant use turning out tools for other native machine works. All of the tools used in the works were made therein, while those imported are of English and German origen.

There are 16 lathes in use. There is one 36-ft. and another 16-ft. lathe, two milling machines, one planer 10-ft. long by 43-in. wide, and a thread roller planing machine for manufacturing flour mill rollers up to 36-in. long and 10-in. diameter all made at the works for its own use. The total number of machines now installed is 27. A foundry is attached to the machine shop where castings up to four tons are produced. Kerosene engines from 10 to 100 horse-power are manufactured in addition to cotton spinning and printing machinery. Several of the drilling machines, lathes and



Eastern Engineering and Shipbuilding Company Works at Shanghai. Partial View of Machine Shop

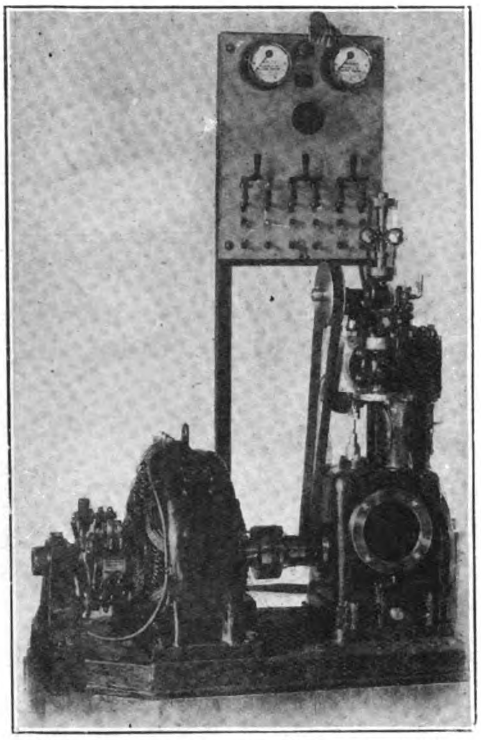


Upper Yangtze River Steamers "Hung Fok" and "Hung Kiang" built at the above Works for the Ichang-Chungking Service

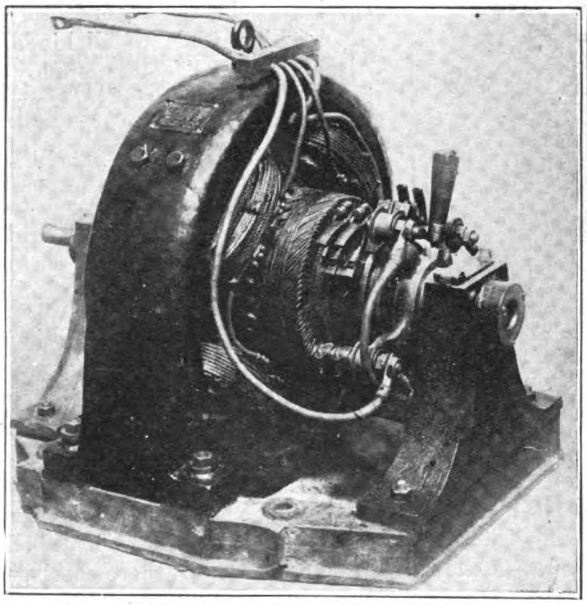
special machinery made at these works are illustrated. Special attention is invited to the lathe which has met with high favor amongst other Chinese machine shops.

## The Sin Min Machine Works

Here we have another new works located on Tangshan Road and with the exception of the machine tools made at the works, it is entirely equipped with German machinery. Being new, the buildings, machine shop, foundry and pattern shops are roomy and well lighted. Mr. C. W. Hu, the manager of the works, is also manager of the Hien Ta Cotton Mill, the Shin Ta Brick Works, which provide the shops with considerable repair work and orders for new equipment. For the brick factory, the Sin Min Works are busy on an order for 400 trucks, turntables, points and a 6-ft. 5-in. diameter belt driven fan. In addition, the works are turning out the equipment for the Kaifeng Machine Works in Honan, the first to be established in that province. This comprises a 18 h.p. horizontal steam engine single cylinder 8-in. diameter and 13-in. stroke for a working pressure of 160-lb. also a German type planer 16-ft.



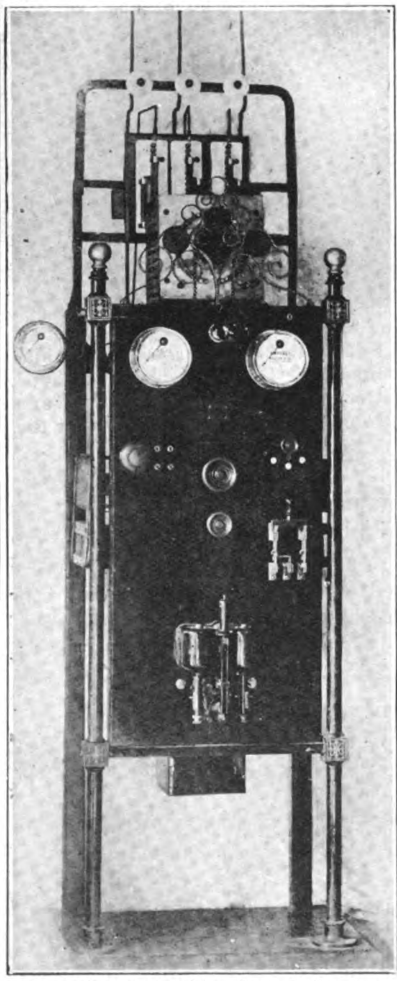
4 K.W. Generating Set, 750 r.p.m. manufactured by the Wahson Electrical Works for Steamships



Dynamo for Ship Lighting Set. 4 K.W., 110 volts, made by the Wahson Electric Works

long by 40-in. wide, a lathe 12-ft. long and 28-in. swing. In the pattern shop there was a pattern for a planer 10-ft. long and 18-in. wide. The lathes in the machine shop vary in size from 6-ft. to 12-ft. long. There are also drilling machines up to $1\frac{1}{2}$-in. holes. Six of the lathes are German also the larger drilling machines.

The foundry and pattern shop are in keeping with the other equipment and equally busy. This factory was opened in the early part of 1922 with Mr. B. S. Wong as works manager and Mr. Y. S. Yu as engineer. About 60 workmen are now employed. The illustrations give a fair idea of the work being turned out.

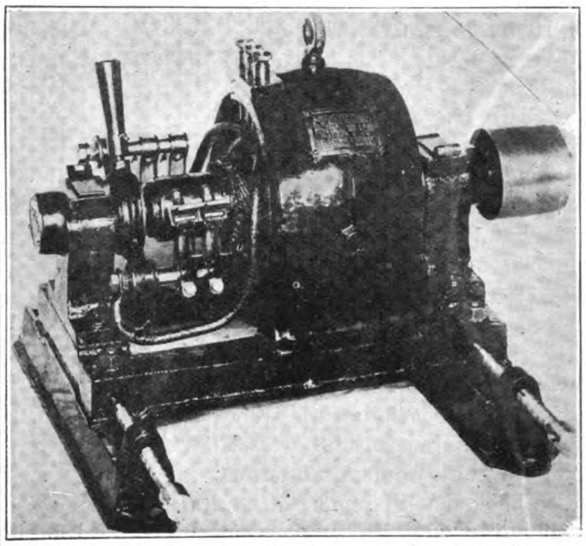


Extra Generator Panel made by the Wahson Electrical Works for the Nanking Electric Light Co.

## Kung Sing Iron Works

Located on Yangtzsepoo Road or to be more exact No. 18 Thorburn Road, we find the Kung Sing Iron Works financed and operated by Japanese. These works were opened in 1918 at the height of the engineering boom in China, with a capital of Y.200,000 of which Y.120,000 is paid up. Although our representative was not permitted to enter the machine shop, the manager gave him the following data concerning the works:—

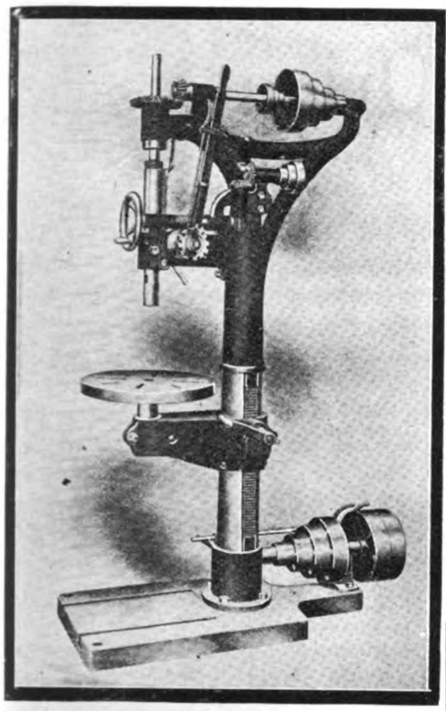
The specialties of these works are the manufacture of tobacco cutting and cotton spinning machinery and mill gearing. Being a Japanese company most of the machines in use are of Japanese make. Fifty lathes are in use a few being American and British, the remainder, Japanese. The largest lathe has a 24-ft. bed. There is also a facing lathe with a 24-in. face plate, both of English make. There are 2 Japanese and 2 English planers, 3 Japanese and 1 American milling machine, 4 Japanese and 1 English shaping machines, 6 Japanese and 2 English drilling machines. The size of the machine shop is 250-ft. long by 50-ft. wide. In the foundry is a one ton cupola with a Root's blower. The pig iron comes from the Han-Yeh-Ping Works at Hankow. Power is taken from the Shanghai municipal electricity department and five motors with a total of 80 h.p. are used.

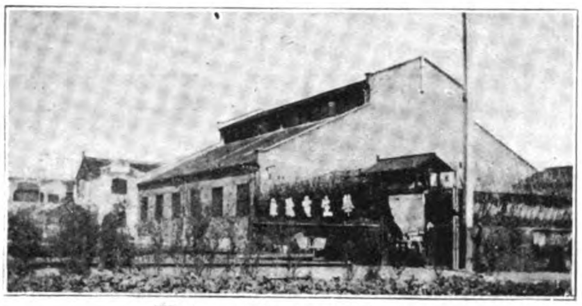


Plating Dynamo, 6 volts, 6 amperes made by the Wahson Electrical Works

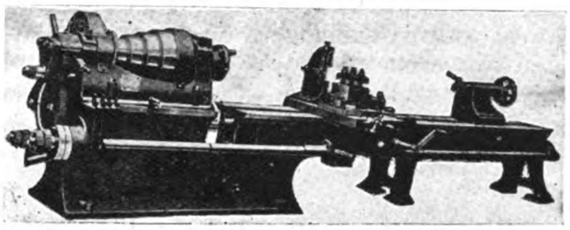
## The Wahson Electrical Works

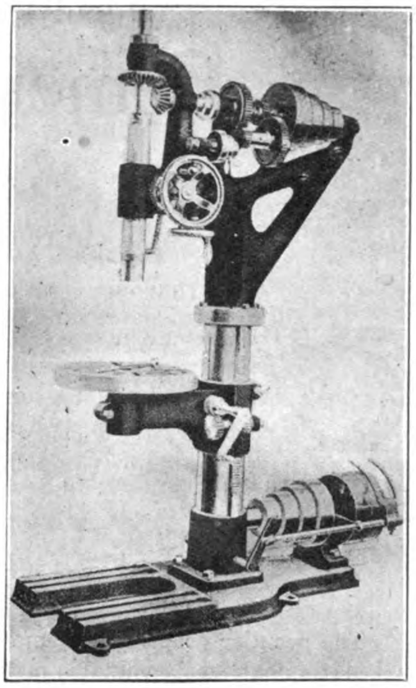
One of the most interesting of the new native engineering enterprises is the Wahson Electrical Works located on East Yalu Road, Shanghai, which commenced operations in 1916, the first electrical manufacturing concern established in China, financed, managed and controlled exclusively by Chinese. The capital invested is $100,000, Mr. Young, the engineer who designed and erected the plant and is responsible for the drawings of new machinery has never been out of China. Our representative, who visited the plant, is an electrical engineer and he speaks most highly of the quality of the work turned out which include direct current dynamos and motors up to 25 k.w., and direct coupled steam generating sets of 4 k.w. for steamships. One steamship company has been supplied with fifteen of these sets. Oil cooled transformers up to a capacity of 200 k.v.a. made and supplied to various lighting companies. Several of these are now being made to the order of

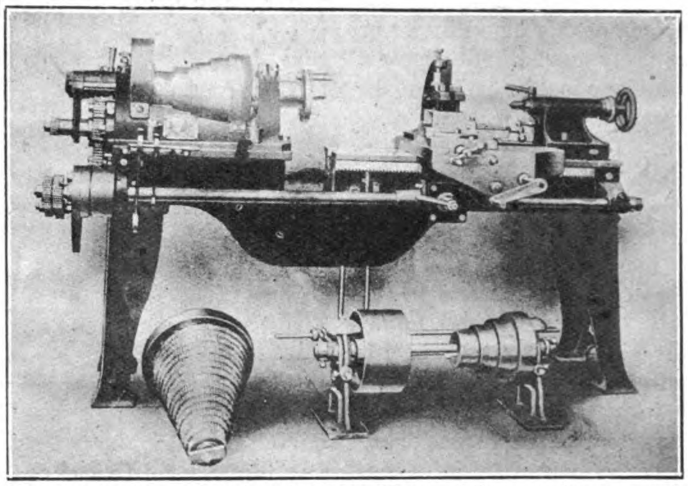




Wahson Electrical Works







The Yah Dah Iron Works, Shanghai. Top and Bottom: Lathes made at the Works: Centre, View of Works: Sides, Types of Drilling Machines made at the Works

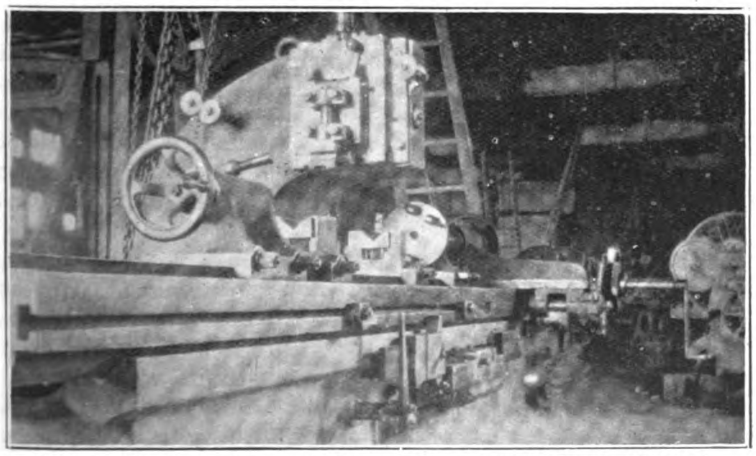
the Changchow Electric Light and Power Company for a primary voltage of 2,200 and secondary of 230 to 400 volts with star connections and with a guarantee of 20 per cent. overload.

High- and low-tension switchboards are made which includes all parts for the front and back of the boards and from measuring instruments to te.minals, the only manufactured articles purchased being the angle-iron. One board now being made measures 14-ft. in length and 5-ft. high for a direct current plant also some extra high-tension panels 10-ft. high and 6-ft. wide, the projection from wall being 13-ft. These panels are for the Nanking Electric Light Company. Ammeters and voltmeters for direct and alternating currents are also made and sell for about Taels 17 each. Rectifiers for all ordinary voltages are produced, a very useful type for Shanghai being one rectifying 200 volts a.c. to d.c. at 75 volts and a ten ampere current. About twenty of these have been sold locally at about Taels 45 each largely for electric automobiles.

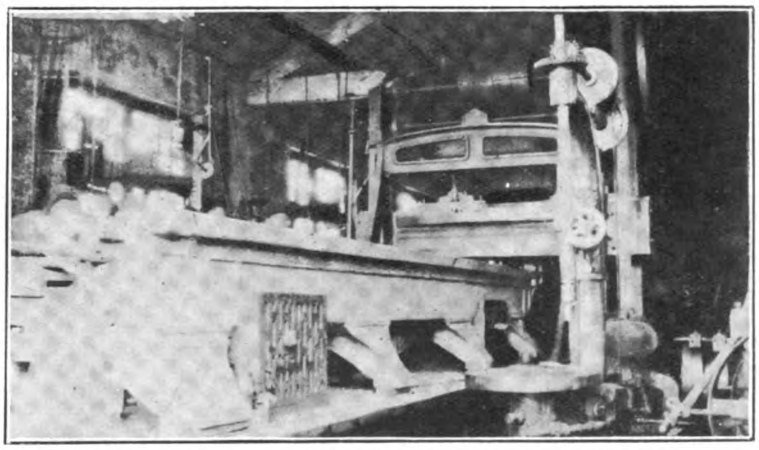
In addition, a neat type of radiator is made in three sizes, 1½, 2 and 2½ kilowatts, the prices ranging from Taels 12 to 30. Current limiters for giving warning when a pre-determined current is exceeded are also made for use on lamp circuits of from one to twenty watt lamps. The price of these is about Taels 4. On the ar.ival of new mach'nery from America it is the intention of the works to manufacture kettles, irons and fans.

Amongst the machine tools in the works are seen machines from the American Milling Machine Company and the Carrol Johnson Machine Tool Company, but many of the machines were made by local shops located within a few hundred yards of the works and some by the company itself. As noted extra machine tools have been ordered and when in position fans, cooking and heating utensils will be added to the list of manufactured articles now turned out at these works. Many foreign firms are among the steady customers of the company, and there is every reason to believe that if the present policy is continued its future success is secured.

(*Continued in April issue.*)



13-ft. by 6-ft. Lathe for special flour mill work made by the Yah Dah Iron Works for own use



36-ft. by 5-ft. planer made by the Yah Dah Iron Works for own use

# Cement Industry in the Orient

*By M. H. Chou, M.S., University of Wisconsin*

## I. Introduction

### (1) Discovery of Cement-Making

THE cement industry is one of the youngest chemical industries in the world. Before its discovery, the calcined lime, clay and sand were used as building materials. When John Sweaton was commissioned in 1756 to replace the earlier Eddystone Lighthouse, he discovered that clayey limestone after being calcined could resist the action of water much better than the pure limestone. This is the real beginning of discovery of cement-making.

### (2) Manufacture of Cement

The peculiar property of cement becoming hardened in water makes it an extremely valuable material for construction purposes. Naturally, scientific brains and mechanical genius are called upon to make the best cement at the lowest cost. At the very beginning of cement making vertical kilns are used. The proper proportions of limestone and clay are ground to fine paste and made into bricks which are placed in the vertical kilns for burning, and, after burning, are taken out and ground to powder. This method is called discontinuous. The advantage of this method is saving of fuel, but the disadvantage lies in the slowness of the process and in the high cost of labor for making briquettes. Such a method might be feasible in countries where labor is cheap. Nowadays, this process has been almost entirely replaced by the continuous process which consists of feeding in the slurry to a rotary kiln, and carrying the burned clinker in a continuous conveyor to the compound mill for grinding. This process wastes more coal in calcining, but saves more labor, as the machinery is practically automatic.

### (3) Two Processes for Making Cement

There are two main processes for the manufacture of cement—dry process and wet process. Which process is preferable all depends upon the raw materials used. In the United States where there are very rich zones of natural cement rock, especially in the state of Pennsylvania, dry process is extensively used. If the raw materials were clay and limestone, wet process is usually preferred.

## II. The Status of the Cement Industry Making in the Orient

When Japan was first opened to foreign trade by Commodore Perry in 1853, she at once awakened to the realization that the key to national strength and prosperity lies in scientific conservation and utilization of national resources. Therefore, she sent many students to the States and Europe to learn the science and art of commerce and industry. Ever since, Japan in Asia, in the development of various industries like shipbuilding, steel, mines, etc. The same thing is true in the cement industry. The author is grateful to Mr. Van Zandt of the Asano Cement Company for the information on cement mills in Japan.

Native Staff of Siam Cement Works

### (1) Cement Mills in Japan

| Name | Location | Capitalization | Monthly Capacity Barrels |
|---|---|---|---|
| Asano Cement Co. ... ... | Tokyo, Moji, Kawahaki, Hokkaido, Formosa | Y 33,000,000 | 510,000 |
| Onada ,, ,, ... ... | Onada, Kona, Manchuria | 7,500,000 | 150,000 |
| Kokuka ,, ,, ... ... | Karita | 5,000,000 | 75,000 |
| Miye ,, ,, ... ... | Yamada | 4,000,000 | 15,000 |
| Iwaki ,, ,, ... ... | Yatenkura | 3,000,000 | 30,000 |
| Aichi ,, ,, ... ... | Nagoya | 3,000,000 | 30,000 |
| Oita ,, ,, ... ... | Oita | 3,000,000 | 25,000 |
| Nippon ,, ,, ... ... | Yatsushiro | 2,600,000 | 50,000 |
| Tosa ,, ,, ... ... | Kochi | 2,000,000 | 30,000 |
| Nagoya ,, ,, ... ... | Nagoya | 2,000,000 | 20,000 |
| Toa ,, ,, ... ... | Amagasaki | 1,500,000 | 18,000 |
| Kitzu-gawa ,, ,, ... ... | Asaka | 1,400,000 | 25,000 |
| Chuo ,, ,, ... ... | Kurosaki | 1,000,000 | 20,000 |
| Asahi ,, ,, ... ... | Wakayama | 1,000,000 | 15,000 |
| Teikoku ,, ,, ... ... | Kumamoto | 1,000,000 | (building) |
| Saga ,, ,, ... ... | Saga | 800,000 | 20,000 |
| Asaka Yogyo ... ... | Asaka | 4,000,000 | 30,000 |
| Sakura ,, ,, ... ... | Aita | 800,000 | 20,000 |
| Hinode ,, ,, ... ... | Aomui | | |
| Suzuki ,, ,, ... ... | Tokyo | | 15,000 |
| Neppen Chisso Cement Co. ... | Mizumata, Kagomimachi | | 25,000 |
| Denki Kagaku Kogyo Cement Co. | Omuta | | 15,000 |
| Mikana ,, ,, ... ... | Taharamochi | 500,000 | 5,500 |
| Yashikawa ,, ,, ... ... | Okayama | 200,000 | 2,000 |

There are altogether 24 cement plants in Japan most of which are turning out 500 barrels a day. There are three mills producing 1,000 barrels daily. The Onoda Cement Company, the oldest in Japan, has three modern plants located at Onoda, Japan, in Korea and in Manchuria. It has the total capacity of 5,000 barrels a day. The new Hokaku Cement Co. is the second largest, producing 2,000 barrels a day. The Iwaki, Aichi, Oila, Tosa, Kidzugawa, Asaka, Yogyo plants are producing 1,000 barrels of cement per day.

The production of cement in Japan at present is five million to six million barrels a year, of which ten per cent. is exported and 90 per cent. consumed at home. The government railways are the largest consumer of cement in Japan. The production capacity of cement in Japan was doubled during the war and the normal increase of consumption of cement is ten per cent. annually.

The domestic price of cement in 1907 was 4.5 yen but increased to 12 yen in 1921. The export price of cement in 1912 was 5 yen and increased to 7 or 8 yen in 1921.

The Japanese export trade of cement to other oriental countries is as follows :

| Year | | North China Bbls. | Yen | Kwangtung Bbls. | Yen | British India Bbls. | Yen |
|---|---|---|---|---|---|---|---|
| 1917... | ... | 35,950 | 5.12 | 62,700 | 5.47 | 83,400 | 5.16 |
| 1918... | ... | 36,000 | 6.33 | 185,500 | 6,60 | 110,000 | 7.09 |
| 1919... | ... | 65,600 | 6.33 | 414,000 | 6.55 | 92,700 | 6.52 |
| 1920... | ... | 79,750 | 8.96 | 161,600 | 7.52 | 134,800 | 8.75 |
| 1921... | ... | 75,000 | 6.64 | 179,000 | 7.39 | 122,100 | 7.44 |

| Year | | Straits Settlements Bbls. | Yen | Dutch East Indies Bbls. | Yen | Philippine Islands Bbls. | Yen |
|---|---|---|---|---|---|---|---|
| 1917... | ... | 44,700 | 5.26 | 263,000 | 4.85 | 23,850 | 5.24 |
| 1918... | ... | 106,200 | 6.50 | 385,000 | 6.59 | 82,700 | 6.34 |
| 1919... | ... | 47,000 | 6.51 | 243,500 | 6.63 | 131,000 | 6.19 |
| 1920... | ... | 63,700 | 8.97 | 426,800 | 9.38 | 388,000 | 8.38 |
| 1921... | ... | 14,280 | 7.22 | 312,000 | 7.01 | 159,500 | 6.68 |

(2) Cement Plants in India

The following is a list of cement plants operating in India :—

| Name | Location | Capacity |
|---|---|---|
| Dwarka Cement Co. | .. Dwarka | 50,000 |
| Katni ,, ,, | .. Katni | 16,000 |
| Bundi ,, ,, | .. Lakheri | 13,000 |
| Indian ,, ,, | .. Por Bander | 10,000 |
| Madras ,, ,, | .. Madras | 5,000 |

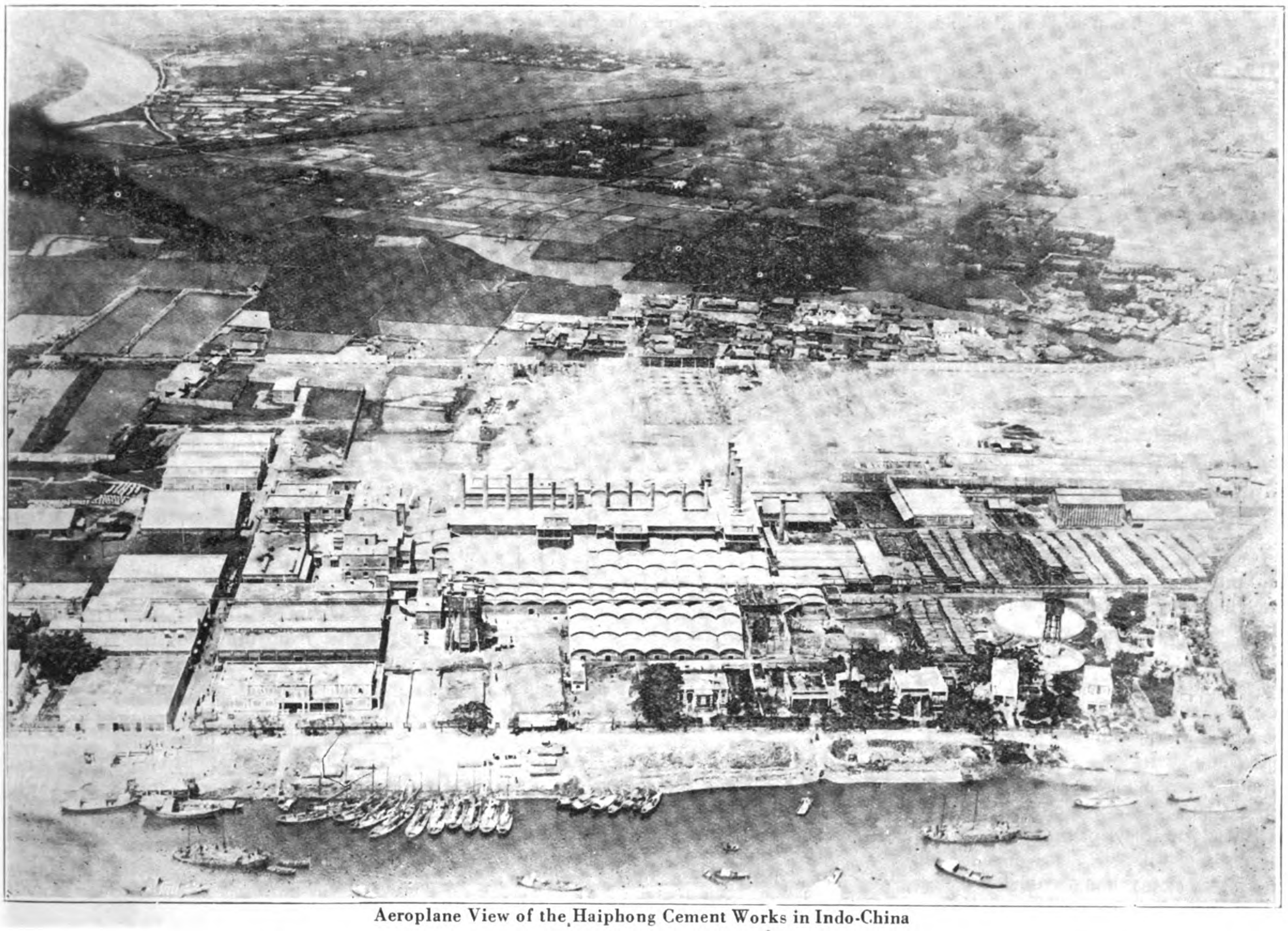
The largest producers in India is the Dwarka Cement Company. It has two rotary kilns. All the machinery is of American-make. The next in size are the old plants, Katni Bundi and Indian. The total output is not sufficient to supply the local demand. A considerable quantity is imported from the United States and Germany. The consumption of cement in India is one million barrels a year. To meet this demand, four new cement plants are being built.

| Name | Location | Capacity |
|---|---|---|
| Gwaloir Cement Co. | .. Gwaloir | 25,000 |
| Central Prornicle Co. | .. Inbblepore | 50,000 |
| Photas Cement Co. | .. Ribar State | —— |
| Inbblepore Cement Co. | .. Inbblepore | —— |

(3) Cement Plants in the Philippine Islands

The Rizal plant in the Philippine islands of 500 bbls. capacity was built by the Krupp Works of Germany and operated for two years. Lime rock and "tufa" were used as raw materials. The operation was stopped due to the difficulty in transportation which rendered the cost of manufacture excessive.

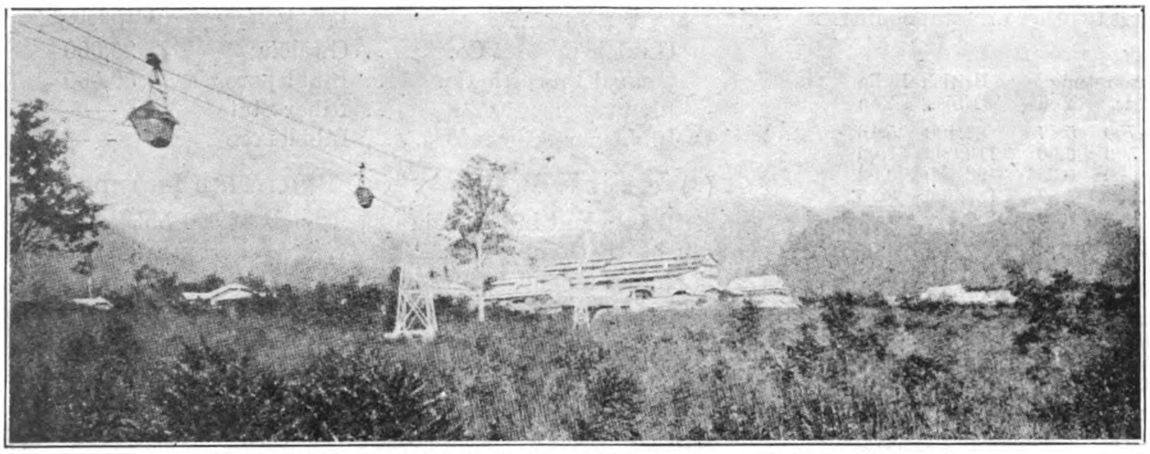
Another new plant of 800 to 1,000 barrels daily capacity has been started in Cebu. The machinery is entirely of American make and erected by the National Security Cement Company of the United States. It is largely owned by the government. The greatest drawback against the cement industry in the Philippine islands is scarcity of fuel. Crude oil from Borneo may be used for firing the kiln of the cement plant at Cebu.



Aeroplane View of the Haiphong Cement Works in Indo-China

4. Other Far Eastern Cement Plants

| Name | Location | Monthly capacity |
|---|---|---|
| Batu Caves Cement Co. .. | Butu Caves, F.M.S. | 15,000 |
| Padang Cement Co. (owned by Dutch) .. .. .. | Padang, Sumatra | 20,000 |
| Siam Cement Co. .. .. | Bangkok, Siam | 13,000 |
| Onoda Cement Co. (owned by Japanese) .. .. .. | Dalny, Dairen (Japanese Leased Territory) | |



Plant of the Netherlands Indies Cement Company, near Padang, Sumatra

## III. Detailed Survey of Cement Industry in China

(*a*) Cause of Slow Development of Cement Industry

Cement is not so extensively used in oriental countries, because the people have not been so advanced in scientific education as those in the Western countries. There are many factors responsible for the slow development of cement industry in China; the principal ones are as follows:

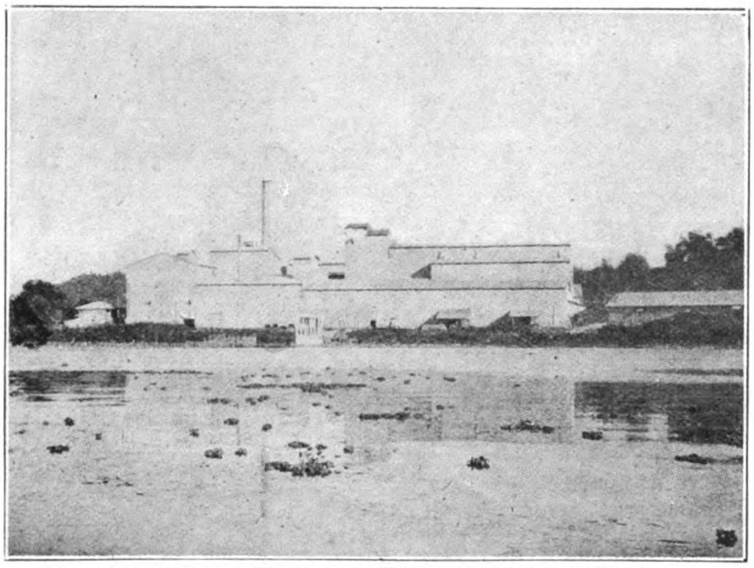
(1) Superstition, ignorance and conservativeness of the people.

(2) *Laissez-faire* policy of the government, both national and municipal.

(3) Slow development of industries and commerce.

(4) Lack of enterprising spirit and proper knowledge to finance big capitalized schemes.

The cement industry needs big capital and the stock company for financing is inevitable. But the latter system is an innovation to the Chinese people who hesitate to invest their surplus money in such companies whose mismanagement by unscrupulous persons causes failure as was seen in the 150 stock exchanges last year which, with few exceptions, were nothing but wild cat gambling places. The closing of over 100 stock exchanges during 1922 dealt almost a death blow to the enterprising spirit of small investors. Consequently, this bad example has retarded the development of legitimate industries like cement, porcelain, machinery, glass, paper, etc. This briefly summarizes the industrial situation of China to-day.



Rizal Cement Plant in the Philippines, Closed Down

(*b*) Cement Used in China

The cement consumed in China is partly supplied by Japan, Italy, Germany and partly by the cement plants in China and adjacent territories.

Cement Plants in China Proper

At the present time there are four cement plants operating in China.

(1) Chee Hsin Cement Co. (Ltd.), Tongshan, Province of Chihli.

(2) Tayeh Cement Works, Province of Hupeh.

(3) Shantung Cement Works near Tsingtao, Province of Shantung.

(4) Canton Cement Works, Canton, Province of Kwangtung.

Cement Plants in Adjacent Territories

(5) Kowloon Cement Works, Hongkong, Leased Territory.

(6) Green Islands Cement Works at Macao.

(7) Ho Hong Cement Co., Singapore, Straits Settlements.

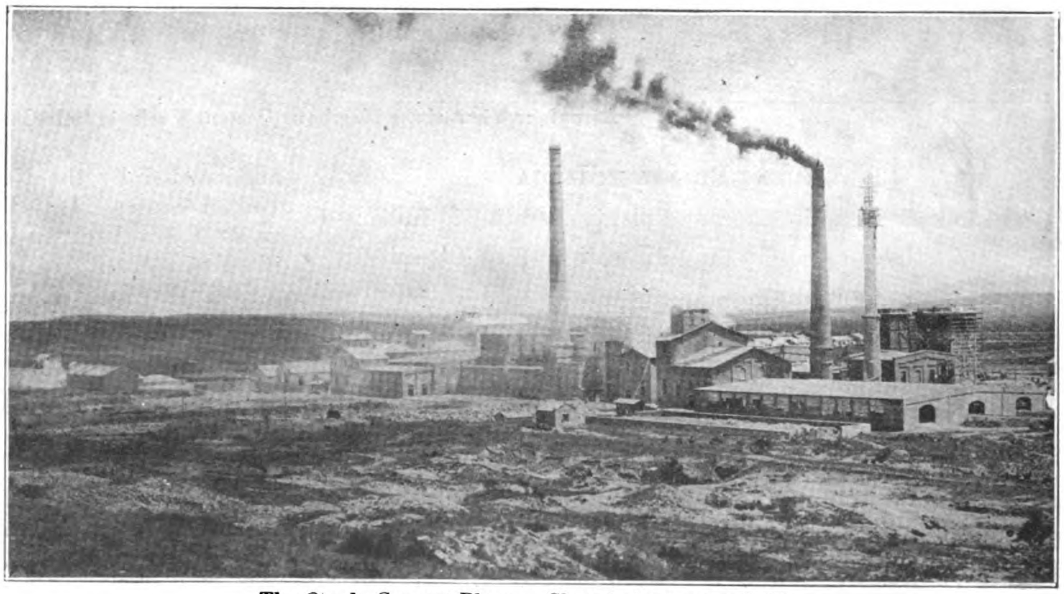
(8) Haiphong Cement Works, Tongking, Indo-China.

### Chee Hsin Cement Works

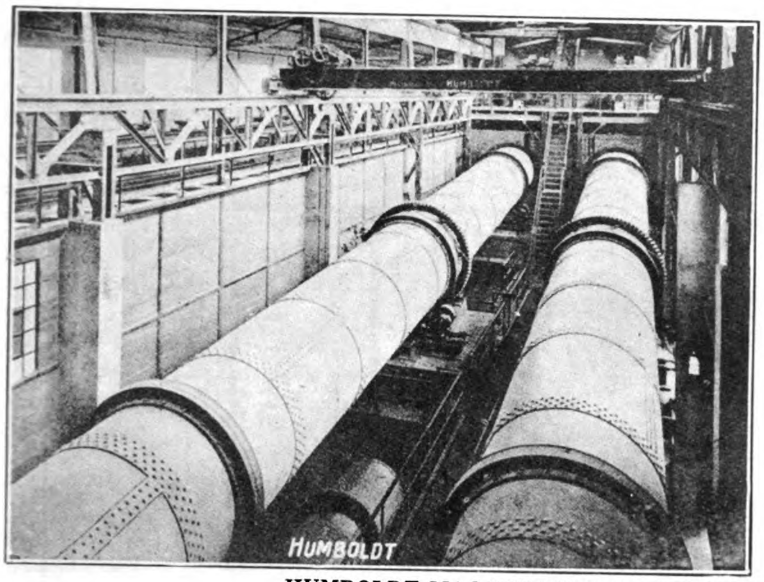
The plant is located at Tongshan, province of Chihli, on the Peking-Mukden Railway, 74 miles northeast of Tientsin and 91 miles by rail from the port of Chinwangtao. The works were formerly owned by the Kailan Mining Administration whose nearest coal colliery is about one mile from the cement plant. Later, the plant was sold to the Chee Hsin Cement Company.

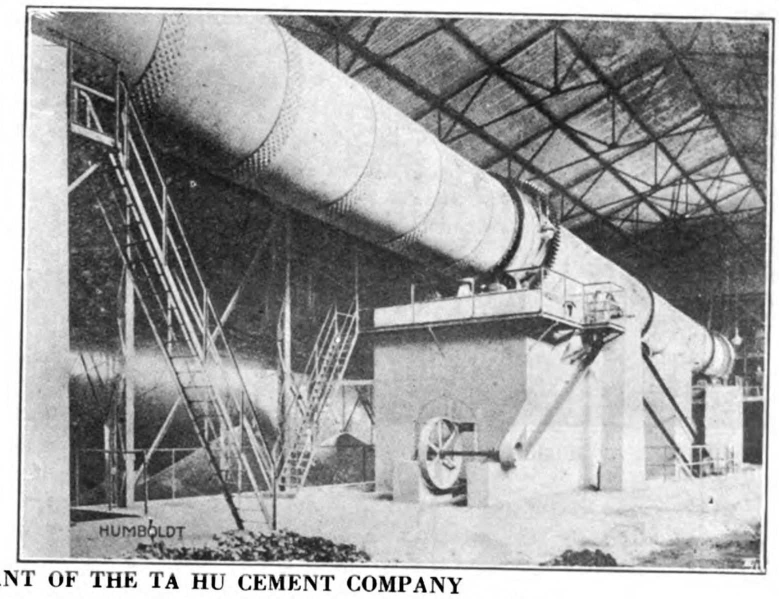
The raw materials used—limestone and clay—are located under the plant. The coal is from mines of the Kailan Mining Administration. A small amount of gypsum from South-central China is added to the finished product to prolong the setting time of cement.

The mill building is of brick and consists of two plants, which have two units each. The older plant with machinery driven by



The Onada Cement Plant at Choushuitzu, near Dairen

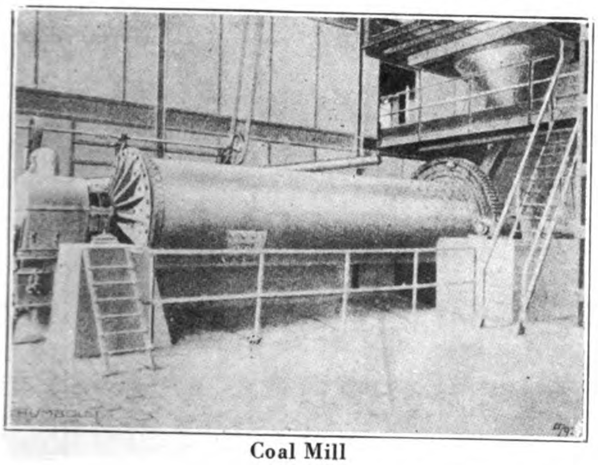


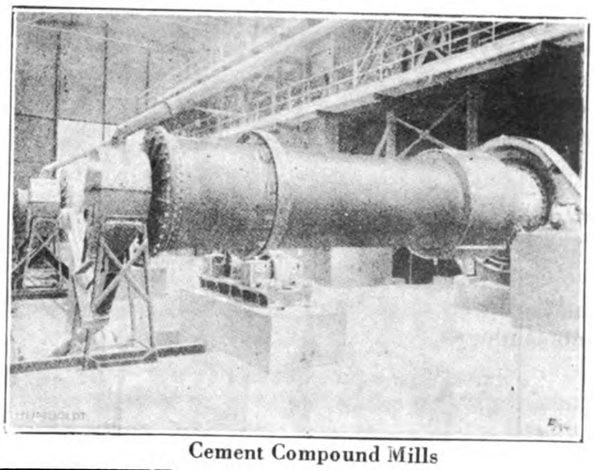

HUMBOLDT MACHINERY IN THE NEW PLANT OF THE TA HU CEMENT COMPANY

Kiln House with Traveling Cranes

Electric Rotary Kiln



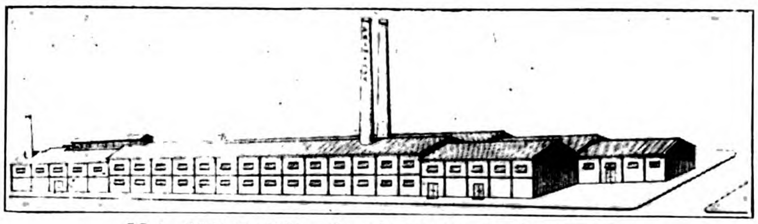
Coal Mill



Cement Compound Mills

steam consists of two 100-ft. rotary kilns, making cement by the dry process. The new plant has electrical-driven machinery, making cement by the wet process. First the limestone is roughly crushed to the size of two inches and then mixed with slurry and grounds in short ball mills, using steel balls. The mixture passes to tube mills for final grinding and then into slurry tanks where samples for analysis are taken, then the slurry is fed into rotary kilns of 100-ft. long. The clinker comes out in air-cooled steel kilns.

The Chee Hsin Co. also owns a small brick plant near the cement works and a tile and pottery plant which turns out sewer pipes, cuspidors, toilet articles, electric porcelain and other heavy stoneware.



Main Mill Building for the Ta Hu Cement Works

## Tayeh Cement Works

The Tayeh Cement Works, erected in 1910, is situated at Shi Hui Yao village in the Hupeh province. The machinery was supplied by the firm of Arnhold, Karberg & Co. It was operated for four years at a loss of 850,000 taels, when it was bought by the Chee Hsin Cement Co., Ltd., and operated under the new name of the Hwa Chi Hupeh Cement Works Co. and capitalized at 1,000,000 taels.

Suitable limestone and clay are abundant in the vicinity of the plant. The coal used is brought a distance of 1,255 miles from the mines of Kailan Mining Administration.

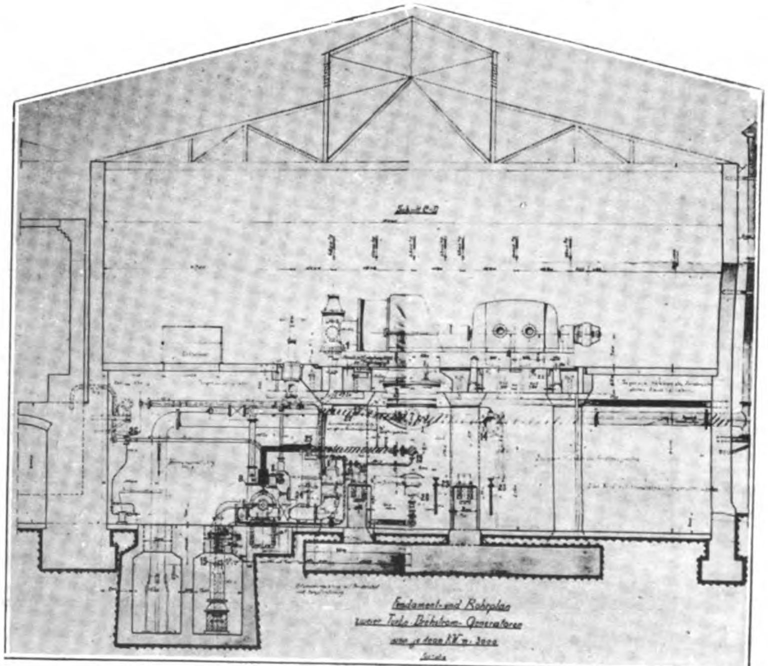


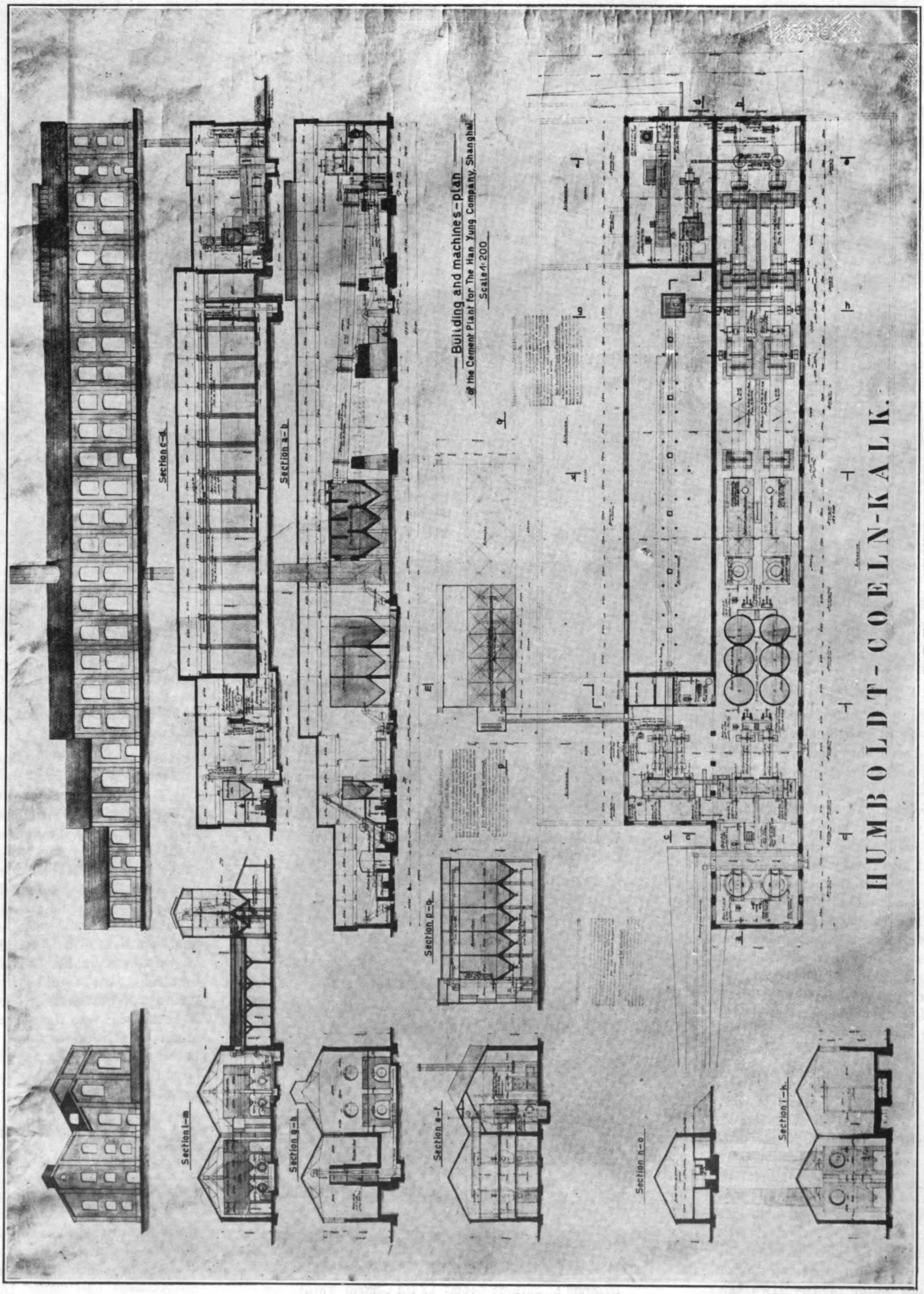
Diagram of Turbine Room: Ta Hu Cement Works

## Shantung Cement Works

The Shantung Cement Co. is a Japanese owned and operated plant located at Tsankan, near Tsingtao, in the province of Shantung. It was established by a Japanese concern named the Santo Kagyo Kaisha at a capital of $1,000,000 yen. The equipment consists of a vertical kiln of Japanese make. The raw materials are found in the vicinity of the plant, while coal is obtained from the Tsuchuan Mine. The total output is 300 barrels per day. It may be enlarged in the future to 700 barrels.

## Canton Cement Works

This plant is situated on the south bank of the river across from and directly opposite the Canton-Kowloon railway station, on the eastern edge of the city of Canton. It was built in 1907 by the imperial Chinese government but after the es-




GENERAL PLAN OF THE TA HU CEMENT PLANT

tablishment of the republic, the Kwantung provincial authorities took it over under the direction of a Chinese engineer educated at the University of Michigan.

The mill buildings are of brick. The machinery consists of eight vertical kilns with four stacks with a total capacity of 550 barrels of 375-lbs. net. Limestone is shipped from Fahyuen, 16 miles up the river and costs 93 Mex. cents per long ton. The clay is obtained from the island of Daitong, four miles down the river, and costs from $0.80 to $1.00 Mex. per long ton. Some gypsum is brought from the south and central parts of China. Some hemitate may be added to color the cement. Coal is supplied by the Kailan Mining Administration mines in North China and from Japanese mines on the island of Formosa. The Kailan lump costs $17.50 per ton and is used for burning cement in the kilns. Kailan and Formosa stock coals costing $12.000 per ton are used for heating boilers.

After preliminary crushing, the materials are mixed and ground in ball mills, using steel balls and the final grinding is accomplished in the tube mill, using beach pebbles brought from some where near Hongkong. As reported recently, the Kwangtung Cement Works are now being operated by a private concern, the Wai Kwan Co., for the Canton government at a guaranteed income of $364,500 a year. The plant is capable of turning out 500 barrels of cement daily ; but owing to shortage of raw materials and other causes, is now producing but 200 barrels a day on an average, since the first of January this year. The cement from this local factory is being sold at about $3.60 a barrel.

## Green Island Cement Works

Two cement plants are operated by the Green Island Cement Co., Ltd., a British corporation registered under the Hongkong ordinances with its head office at Hongkong and managed by Shewan, Tomes & Co. One of these plants is at Kohun, a supurb of Kowloon just across the bay from Hongkong. The second is on Green Island at Macao about 40 miles by water from Hongkong. This was established in 1886.

The Green Island plant at Macao has five vertical kilns with other necessary grinding equipment of English make. The clinker is ground to 180 mesh in the tube mill, using local pebbles. The daily capacity is about 350 barrels of 375-lbs. each. Limestone is shipped from Yutak on the North River in Kwangtung (about 200 miles distance by water) and costs $3.50 Mex. per ton. Clay is dug from the mud flats about half-a-mile from the plant.

The plant at Kowloon is situated on the water front at Hoken. It has two units, one of old type, consisting of the vertical kilns and one new unit of four rotary kilns each 80-ft. long. The engines and crushers are of English make. The materials for cement are automatically weighed and mixed. The clinker is ground to 180 mesh with about 14 per cent. oversize. The limestone is shipped from Yiutak, Kwangtung, 230 miles away. Clay is brought from the affiliated plant at Macao. The daily capacity of the plant is 2,000 barrels. The report of the Green Island Cement Co., Ltd. to the shareholders from the year ending December 31, 1919 declares a gross profit of 524,717 Haikwan taels.

## Ho Hong Cement Company

The Ho Hong Cement Works is located close to Singapore, Straits Settlements. The wet process is adopted for the method of manufacture. The raw materials are coral and clay. Coral is obtained from reefs located about six miles from the plant and is collected into barges by Chinese coolies with the aid of bars and axes.

The machinery is of American make. Roll crushers are used for preliminary grinding of the coral and griffin mills, for the fine grinding. Clay is obtained at the plant site, by means of dragline cableway excavation. The coral and clay are mixed in the wash mills, fed in the tube mills for final grinding and stand in concrete tanks of approximately 1,000 tons capacity. After passing the chemical test for proper composition, the slurry is fed into two 7½ by 125-ft. kilns which can produce 400-500 barrels of clinker per day. The clinker is discharged into rotary coolers placed beneath the kilns, and thence to the clinker storage house by means of a pan conveyor. The clinker is first ground in the griffin mills and finally in the tube mills. The fresh product is packed into barrels of 375-lbs. net.

## Haiphong Cement Works

The Haiphong Cement Works or the Societe des Cements Portland Artificials De L'Indo-China were started on December 25, 1899. The raw materials necessary for cement manufacture are found quite abundantly in the vicinity of the plant. Consequently, the important deposits containing the best limestone are those of " Ile des Deux Songs " in the province of Quang-Yen. The clay used is drawn from the bed of the Cua-Cam River.

The process of manufacture is a dry one. It is done by mixing clay with limestone and grinding to very finely divided powder and compressing the mixture into bricks which burned in fifteen vertical kilns. The clinker is ground again to powder and the finished cement is packed in bags or barrels. The power necessary for the plant was furnished from the two turbine alternators of 1,200 h.p. each constructed by the "Societe Alsaceinne de Constructions Mecaniques " at Belfort.

The grinding machinery originally consisted of nine groups of preliminary crushers and tube mills. Later two compound crushers and three " Centaure " crushers driven by electric motor have been added. The supervision of the whole plant is in the hands of several chemists. The cement is used extensively by the board of public works in Indo-China for the construction of the railways of Tonkin, Cochin-China and Yunnan. It is not only locally consumed, but exported in considerable quantities to China, Philippine islands, Siam, Netherlands Indes, Singapore, etc. The output is 150,000 tons a year. This will be soon doubled by a new factory now in the course of construction.

### Capacity of Cement Plants.

The estimated daily capacity, in barrels of 375-lbs. of the cement plants which have been so far mentioned is as follows :

| | Barrels |
|---|---|
| Tongshan Cement Works | 3,000 |
| Tayeh ,, ,, | 1,200 |
| Shantung Cement ,, | 300 |
| Kwantung ,, ,, | 500 |
| Macao } Green Island Cement Works | 350 |
| Hongkong } Green Island Cement Works | 2,000 |
| Ho Hong Cement Co. | 500 |
| Haiphong Cement Works | 2,000 |
| Total | 9,850 |

This give a total annual productive capacity of 3,595,250 barrels.

The brands for different kinds of cement consumed in China are as follows :

| | |
|---|---|
| (1) Chee Hsin Cement Works | Horse Brand |
| (2) Tayeh Cement Works | Pagoda ,, |
| (3) Haiphong ,, ,, | Black Dragon Brand |
| (4) Japanese ,, ,, | Tiger Head Brand |
| (5) Green Island Cement Works | Black Donkey Brand |
| | Green Island ,, |

*(To be continued in April issue).*

# THE PURIFICATION OF WATER SUPPLIES WITH SPECIAL REFERENCE TO SHANGHAI

*Paper Read Before the Engineering Society of China*

By C. D. Pearson

WATER purification may be broadly defined as the art of removing foreign and polluting substances from solution and suspension in water: the water engineer's share in this is to render impure water potable and hygiencally safe for drinking purposes and suitable for industrial uses.

Natural waters may be classified under two headings: Surface waters and underground waters. Although water is obtained in Shanghai and neighborhood from shallow wells and from borings, the quantity so obtained is so small, and the quality varies so greatly, that it is not proposed to touch, in this paper, upon the purification of waters obtained from such sources except to point out that, from information so far obtained, methods of purification must vary for each boring and, as regards well water, sterilising appears to be essential.

In Shanghai and vicinity, we have a flowing surface water in the Huangpu and its tributary creeks and, at a distance of about 35 miles, impounded surface waters in the form of shallow lakes.

The Huangpu affords a supply which is practically unlimited in quantity but which, as regards quality, is probably the worst water, from a water engineer's point of view, it is possible to conceive.

Huangpu water is always turbid and the matter in suspension varies, as will be seen from Fig. 1, from hour to hour largely owing

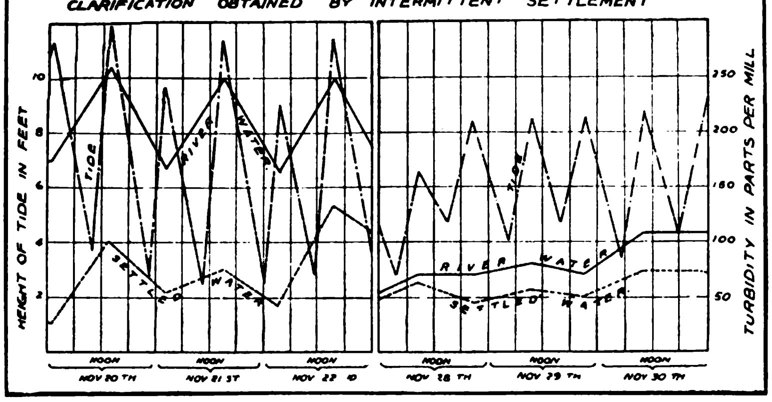



FIG I
EFFECT OF TIDE ON TURBIDITY OF RIVER
CLARIFICATION OBTAINED BY INTERMITTENT SETTLEMENT

to the effect of tides; the variation is, not only in the quantity but also in the nature of the sediment. The water in the river is polluted by the wastes from the densely populated settlements and by the wash or run-off from the highly cultivated land through which the river passes. In addition to this, the water is subject to rapid and considerable changes in temperature, and this temperature change has as much effect of filtration problems as turbidity.

A less polluted but more turbid water is obtainable from the Yangtze, and a less polluted and less turbid water from the Tai Hu and Si Tai Lakes, but the distance of these sources from Shanghai rendersthem unsuitable for economical as well as political reasons.

Impurities in water can be divided into two classes: "Dissolved" and "Suspended." As regards the former, the Huangpu affords a water which is fortunately free from abnormal quantities of dissolved ingredients such as chalk, magnesia and common salt and, consequently, the removal of any dissolved mineral matter is not necessary.

Table 1.

Characteristics of Huangpu Water.

1917—1922.

| | Solids in Suspension parts per 100,000 | Hardness in degrees (Clark) Total | Temp. | Perm. | Salinity (Chlorine) parts per 100,000 |
|---|---|---|---|---|---|
| Average .. | 15.2 | 9.6 | 5.2 | 4.4 | 2.5 |
| Maximum .. | *34.0 | 12.0 | 7.0 | 5.4 | †28.0 |
| Minimum .. | 10.4 | 7.0 | 3.0 | 2.7 | .9 |

Notwithstanding our propinquity to the sea, salinity has not been the cause of anxiety during the last twenty years.

Authorities have laid down the desirable maximum as 25 parts chlorine per 100,000 although many towns use a water considerably more saline than this and, as will be seen from Table 1, we have on one day only slightly exceeded the desirable limit. The small amount of hardness is beneficial as regards potability and is insufficient to render softening necessary for boilers or other industrial purposes: Shanghai water is considered excellent for brewing purposes.

Suspended impurities, the reduction or removal of which call for purification works, include the heavier sediment, consisting largely of fine sand and clay, colloidal suspensions (which are intermediate between solutions and suspensions of finely divided particles), microscopic plant and animal life (algae and diatoms) and bacteria.

The necessity of removing sediment for domestic and industrial purposes is evident and five parts per million may be taken as the limit of suspended matter for acceptable drinking water.

The removal of algae and diatoms is necessary owing to the development of bad tastes and odours often accompanying the growth and decay of these organisms.

As regards bacteria, by far the greater number play a beneficent role, but a few species are capable of producing disease. The bacillus typhosus, germs connected with dysentery, the cholera vibrio and other types emanate from the bodies of those stricken with disease and maintain their vitality in water for days, and even weeks.

The alimentary canal, in health and disease, contains an abundance of the bacillus coli, so that the presence of this bacillus in water is an indication of contamination. B. coli itself is not considered dangerous, but is an indication that more virulent species may be present. It has been proved that the purification processes which eliminate B. coli remove also the pathogenic bacteria. The latter are (*a*) less tenacious of life, (*b*) cannot pass a filter which intercepts B. coli, (*c*) less persistent in stored water and (*d*) less capable of resisting disinfectants and bactericides.

There is no definite standard of purity as regards B. Coli, but in America absence in 10 ccs. after a suitable period of culture on nutrient material is considered satisfactory; in England, absence in 100 ccs. is aimed at. It will interest members to know that with the purification methods employed water is pumped to consumers in the international settlement with B. coli absent in 100 ccs. in about 75 per cent. of the daily samples.

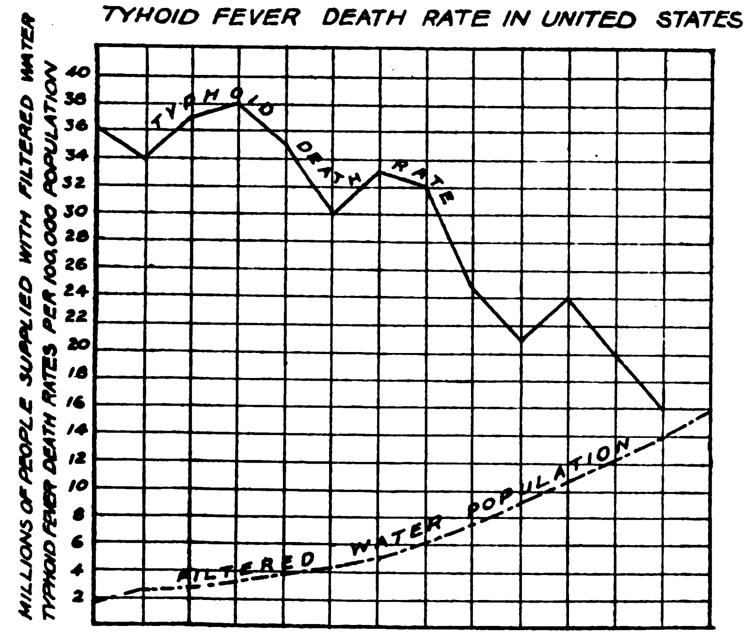
It is beyond the scope of this paper to discuss epidemics of water borne disease, but from Fig. 2 the effect of water filtration will be noted. It is on record that a reduction of 90 per cent. in the death rate due to typhoid fever has been obtained by introducing filtered, in place of unfiltered, water.

## Purification Methods

Purification methods may be divided into four classes : " Storage," " Settlement," " Filtration " and " Sterilisation." These processes when artificially controlled and properly carried out are able to purify water of very poor quality.

Chemical re-agents used mechanically are employed to facilitate these processes.

FIG. 2.
EFFECT OF WATER PURIFICATION ON TYHOID FEVER DEATH RATE IN UNITED STATES




1900 TO 1915.

Rivers and lakes possess striking powers of self-purification. Under storage, Thames water has been found by Sir Alexander Houston to reach a safe condition in four or five weeks after being purposely infected with the bacteria of epidemic diseases, unfortunately, natural depressions do not occur near Shanghai, and the cost of constructing storage reservoirs would be prohibitive.

When Dr. Fowlei visited Shanghai, he was struck with the fact that the Yangtze and its tributaries were not more contaminated than is the case considering that the whole country is manured with nightsoil, and he is of opinion "that the power of purification of these rivers is to be found in the large amount of fine silt carried by them, each particle of silt acting as a nidus for the necessary bacteria." Dr. Fowler has concluded that this natural action might be assisted artificially in a manner analogous to the activated sludge process of sewage purification, and he is now engaged on experiments with a view to ascertaining the best description of silt to be employed to produce the best results and the proper means of applying the process for the purification of water: no definite conclusions have apparently been yet arrived at as to the merits ot the scheme for the purification of water on a large scale.

## Settlement, or Sedimentation

The removal of suspended material and organic matter is most easily accomplished by settlement. Plain settlement—or sedimentation without a coagulant—is the cheapest method of removing those particles which settle out in a moderately short time and which would rapidly clog a filter.

Settlement in Shanghai is necessarily effected in artificial basins constructed in masonry and of comparatively small capacity.

Settling basins may be either " Intermittent " or " Continuous:" in the first system the basin is filled, the water allowed to stand for a period sufficiently long to allow the smallest (usually called the " limiting ") particle it is desired to remove to fall below the draw-off level and the settled water is then drawn off and led or pumped to the filters.

The intermittent system has been hitherto employed in Shanghai, largely owing to the tides permitting settling basins to be filled wholly, or in part, by gravity without the necessity of deep excavations.

In continuous settlement basins the water is allowed to flow continuously through the basin or basins, baffling being employed to give the necessary settlement period and to control movement. Experiments are at present being carried out at the Waterworks to ascertain the desirable dimensions of and velocities in continuous settling basins for water of various turbidities and at different temperatures.

Although it is possible to clarify and purify even a turbid and polluted water by plain settlement and storage alone, the capacity of the basins required would necessarily be enormous and the primary duty of settling basins is, usually, therefore, to render the water suitable for filtration : the degree of clarification required being dependent upon the amount and nature of the suspended material, the type of filter employed and the temperature of the water.

TABLE 2.

COMPARISON OF DIFFERENT ARRANGEMENTS OF SETTLING BASINS.

| *Description of Basin.* | *Values of* a-t *One-half removed.* | *$\frac{3}{4}$ths removed.* | *$\frac{7}{8}$ths removed.* |
|---|---|---|---|
| Theoretical maximum (cannot be reached) .. .. .. .. | 0.50 | 0.75 | 0.875 |
| Intermittent basins reckoned on time of service only .. .. .. | 0.63 | 1.26 | 1.89 |
| Intermittent basin in service half time .. .. .. .. .. | 1.26 | 2.50 | 3.80 |
| Continuous basin well-baffled .. | 0.76 | 1.66 | 2.75 |
| One long basin well-controlled .. | 0.90 | 2.34 | 4.50 |

From Table 2 it will be noted that a well-baffled continuous basin (*vide* Fig. 3) is the most economical arrangement, an intermittent basin necessarily never being in service continuously.

On account of the greater viscosity of water at low temperatures, a particle of silt will settle twice as fast at a temperature of 74° F. as at 32° F.

Fig. 1 shows the clarification effected in plain intermittent settling tanks with a water temperture at 50° F. : the figure also illustrates the effect that high tides have upon turbidity.

In Shanghai natural intermittent settling tanks with an average period of twenty hours' quiescence will provide a water which can normally be dealt with by slow sand filtration.

To filter water at a more rapid rate than slow sand beds are capable of doing, it is necessary to remove the smaller particles in suspension that cannot economically be removed by natural settlement.

If these fine particles can be collected into groups which present a smaller surface per unit of volume they will settle more rapidly and their removal by sedimentation will become practicable : this collection into groups can be accomplished by coagulants.

The common coagulants are soluble salts of allumina, iron and other metals which react with the alkaline salts in the water to form an insoluble gelatinous substance which breaks up into " flocks " the size of a pin head. These flocks settle slowly but attract to themselves particles of silt, other flocks and bacteria until masses of considerable size have been formed which settle quickly.

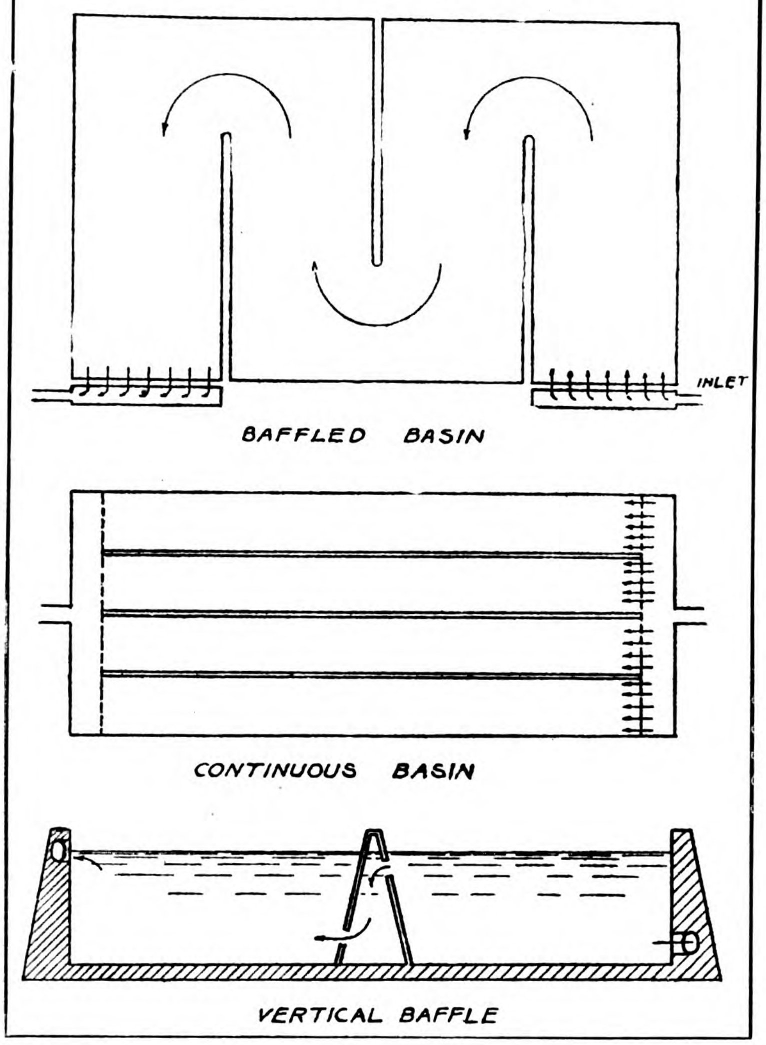
The coagulant most usually employed is sulphate of alumina which may be fed into the water in solution or in powdered form : both have been tried in Shanghai, and the latter method has been found most economical.

To ascertain the dose required various formulæ are given, but it has been found advisable to make a daily trial by adding varying

quantities of a standard solution of alum to samples of the raw water : the results so obtained with experience enable the correct dose to be ascertained.

FIG. 3.

TYPES OF SETTLING BASINS.




As will be seen from Fig. 4 considerable reduction in bacteria may be effected by natural settlement : when a coagulant is employed the reduction is greatly increased. When waters of high turbidity are clarified, removal of bacteria is probably adequate except where the water is highly polluted.

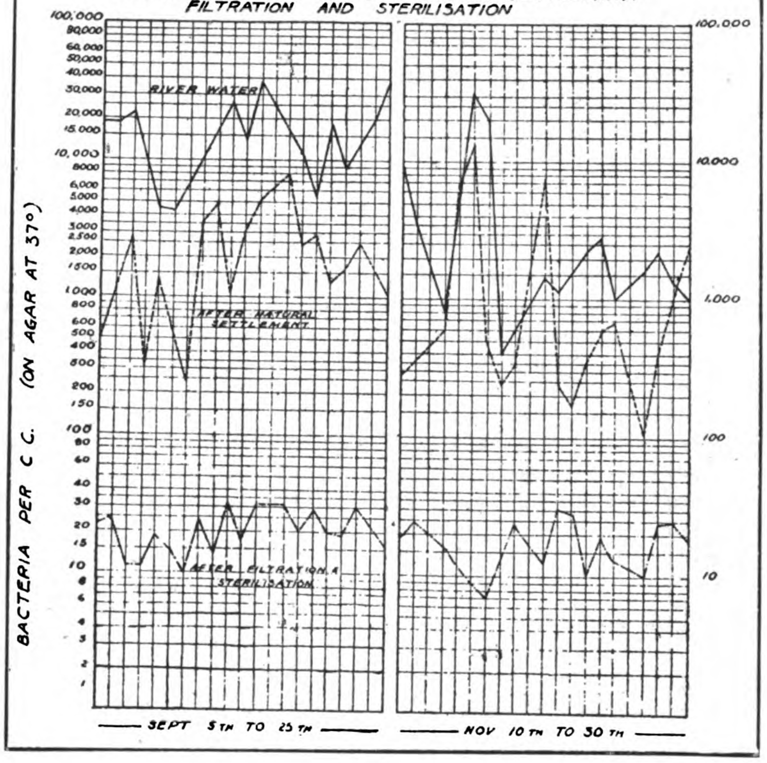
The length of time required to bring about the proper degree of clarification is influenced by the character of the suspended colloids, by the quantity of coagulant applied, by the temperature of the water and by the agitation to which the mixture has been subjected. Complete flocculation usually takes place with Huangpu water in from four to six hours.

There is a popular prejudice against putting " chemicals " in water largely due to ignorance of the fact that natural water usually contains matters as truly chemical as those used in treating water, and also that the amounts used are so minute that a consumer would need to drink hundreds of gallons to obtain a medicinal dose. The prejudice is probably not so great in Shanghai owing to the Chinese having used alum as a coagulant probably for centuries.

It will have been noticed that the expressions " Turbidity " and " Matter in Suspension " are used. Turbidity is a measurement of the opacity of a water and the standard generally adopted is that of comparison with a mixture of fine silica and water in such proportions that a platinum wire one m.m in diameter disappears from view a submergence of 100 m.m. This turbidity is called 100,

FIG. 4

BACTERIAL REDUCTION OBTAINED BY SETTLEMENT FILTRATION AND STERILISATION




and other turbidities are assigned numbers, a few of which are given in Table 3.

TABLE 3.

GRADUATION OF TURBIDITY ROD.

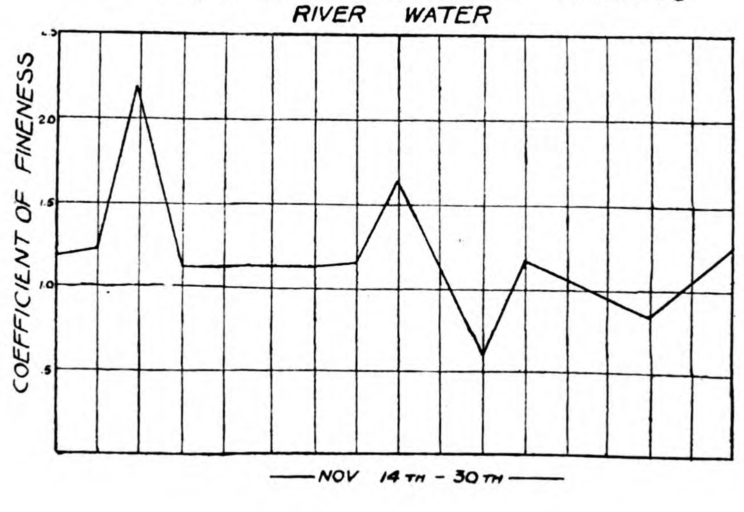
| *Turbidity.* | *Depth of Wire m.m.* | *Turbidity.* | *Depth of Wire m.m.* | *Turbidity.* | *Depth of Wire m.m.* |
|---|---|---|---|---|---|
| 10 | 794 | 40 | 228 | 200 | 57 |
| 20 | 426 | 50 | 187 | 500 | 31 |
| 30 | 296 | 100 | 100 | 1000 | 21 |

Equal weights of suspended matter do not necessarily produce the same turbidity, *e.g.*, sand produces less turbidity than the same weight of clay : the ratio between the silica turbidity determined optically and suspended matter determined gravimetrically is important as an index of the character of the suspended matter.

The quotient obtained by dividing suspended matter (expressed in parts per million) by turbidity is called the " coefficient of fineness " : as will be seen from Fig. 8, this coefficient has even a greater variation than the turbidity.

FIG. 8.

VARIATION IN COEFFICIENT OF FINENESS RIVER WATER



## Filtration

Although, under certain conditions, settlement following coagulation is capable of producing satisfactory clarification it is neither economical nor safe to rely on such a method: whether plain settlement or coagulation is employed however, a water can be produced which can be satisfactorily clarified and, in most cases, satisfactorily purified by filtration.

Sand and gravel are the media almost universally employed for filtering water. The factors which affect the efficiency of filters are:

the thickness of the bed
the size and uniformity of the sand grains
the nature and temperature of the water
the amount and nature of the coagulant used
the rate of flow.

The primary function of a filter is to strain out suspended particles: those particles larger in size than the interstices between the sand grains are, of course, readily strained out, but it is also found that, after a filter has been in service for some time, the submicroscopic particles and bacteria are also removed.

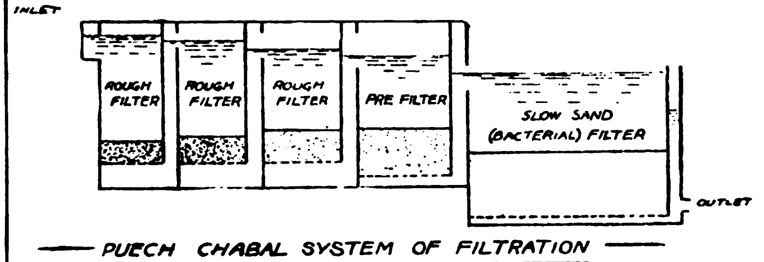
A close examination of a well ripened filter reveals the sand grains covered with a gelatinous film which is most abundant near the surface but permeates to some depth. The material forming this film is composed of organic matter in gelatinous form partly or wholly filling the interstices between the sand grains.

Water passes readily through this gelatinous material but the very fine suspended particles are kept back either because they are too large to pass through the openings or because they stick to the surfaces of the gelatinous matter already in the bed.

Before a turbid water is passed through a filter, it is necessary to partially clarify it by settlement with or without a coagulant or by pre-filtration through roughing filters. Roughing filters have been used in addition to settlement in Shanghai for a considerable period but have now been abandoned.

A combination of roughing and slow sand filters shown in Fig. 5 has been employed to a considerable extent on the Continent. In this system, the water is passed through a series of pre-filters each one of greater area than the previous one and containing a finer gravel. This system has been used in Shanghai and also in connection with turbid waters in India and Egypt.

FIG. 5



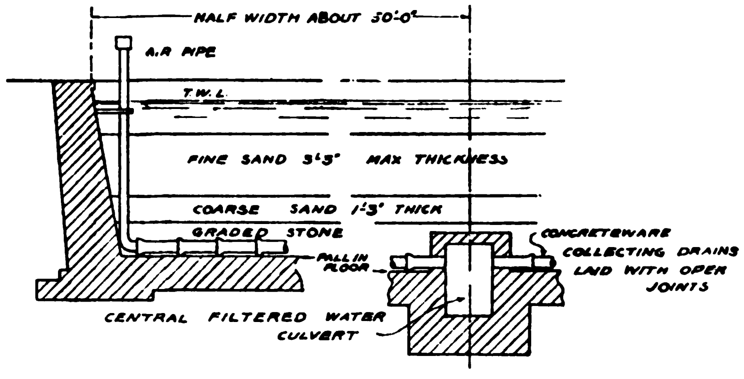

PUECH CHABAL SYSTEM OF FILTRATION

The original type of filter was the slow sand or English filter.

These filters are usually rectangular in plan and contain a filtering medium consisting of a thick layer of fine sand supported on layers of gravel and stone. Filtration is downward, the filtered water being collected by under-drains laid on the bottom of the filter basin, these drains discharging into a central culvert which discharges into the clear water well.

Fig. 6 shows the arrangement of the filtering material and drains in the beds used at the Shanghai Waterworks, these beds have successfully clarified and purified the greater portion of the water supplied to the international settlement for the last forty years. A satisfactory filtrate is usually obtained from these beds with rates of filtration varying from 2.0 to 1.5 gallons per square foot per hour. The sand employed is ordinary Ningpo sand, an analysis of which is given in Table 4.

FIG. 6




PART CROSS SECTION OF SLOW SAND BED

TABLE 4.

MECHANICAL ANALYSIS OF SAND FOR SLOW SAND BED.

*Percentages passing through sieve.*

| *Meshes per lineal inch.* | *Sample I. Fine sand taken from bed.* | *Sample II. Same sand as in Sample I but with portion retained on 10 and passing 40 sieves rejected.* | *Sample III.* |
|---|---|---|---|
| 10 | 82.55 | 100.0 | 100.0 |
| 20 | 57.65 | 59.7 | 81.6 |
| 30 | 29.45 | 17.55 | 6.4 |
| 40 | 15.65 | 0 | 0 |
| Effective size | 0.43 | 0.61 | 0.69 |
| 60% finer than | 1.2 | 1.02 | 0.82 |
| Uniformity coeff | 2.78 | 0.67 | 1.33 |

To clean a slow sand bed the usual practice is to lower the level of the water below the surface of the sand and remove the top layer—usually about 1½-in.—after this "scraping" the bed is charged with filtered water and the filtrate is then run to waste as found necessary until a new film is formed.

As will be realized, the expense of maintaining a slow sand bed is mainly in cleaning and washing the sand removed. The period between "scrapings" varies according to the amount and nature of the suspended matter in the water, but it is usually found necessary to scrape every 14 days. When the layer of fine sand is reduced to a thickness of about 1-ft. 6-in., clean fine sand is added to the full thickness of 3-ft. 3-in.

With cheap land and labor, slow sand beds are still economical, and this method of filtration has many advantages, however, the cost of land and labor and increased pollution have now rendered it advisable to adopt, in Shanghai, rapid filtration.

An intermediate stage between slow and rapid filtration has been employed in Shanghai for the last two years with satisfactory results: water after being clarified by means of a coagulant in intermittent settling tanks is passed through slow sand filters at about three times the normal rate and the resultant filtrate has been most satisfactory both as regards clarification and purification.

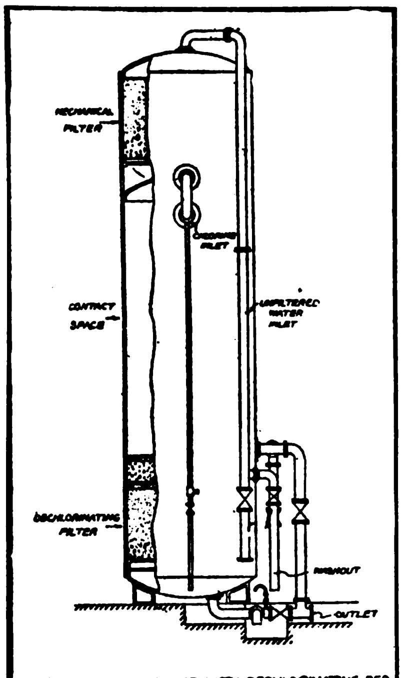
With a clear water exposed to bright sunlight, it is reasonable to expect heavy algal growths, but so far no trouble has be caused by algae either in clogging the beds or in imparting taste or color to the water.

The rate of flow in rapid filters is usually about 120 gallons per square foot per hour, *i.e.*, 50 times as fast as slow sand beds, and in consequence, relatively small areas are required with consequent reduction in initial cost but, as coagulation prior to rapid filtration is essential, working costs are necessarily higher.

The usual filtering medium in rapid filters is sand supported on a gravel layer; the filtered water being collected through a system of strainers. The water having been treated with a coagulant carries a certain amount of flock, this is caught in the top

layer of sand and the remaining water passes through the fine pores leaving behind the finest suspended matter not previously enmeshed by the coagulant.

Should the raw watei not contain sufficient flock, it is necessary to film the bed by adding a coagulant, usually an aluminium sulphate solution, to the water on top of the filter.



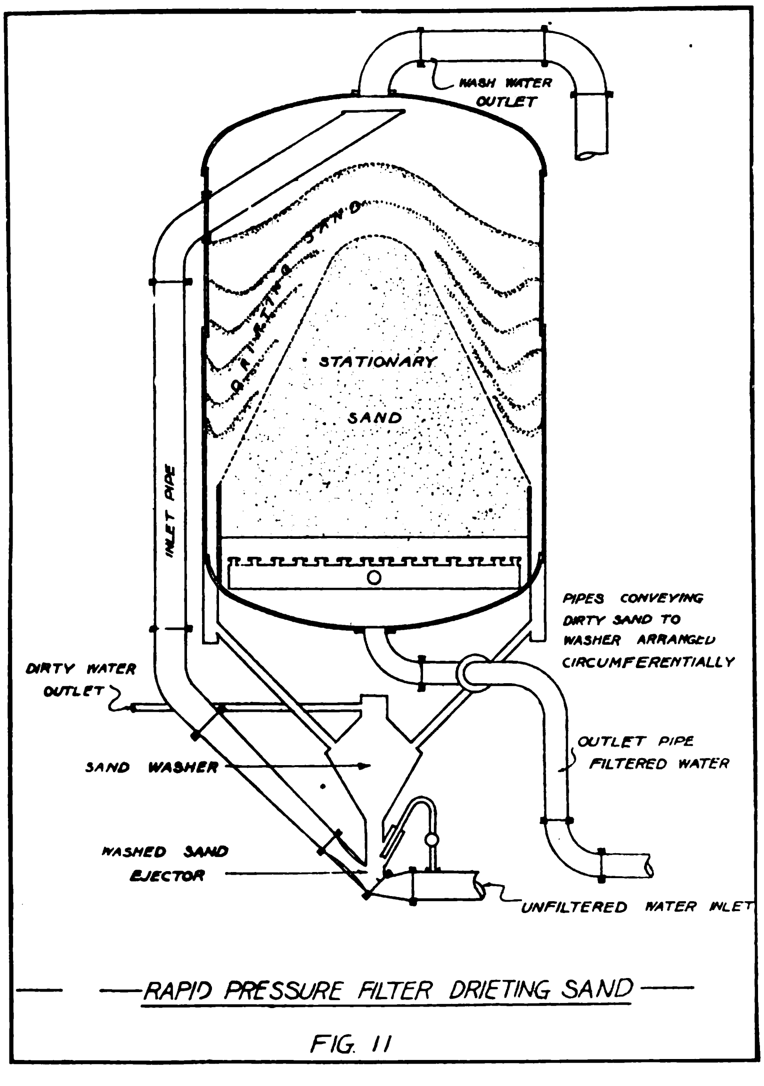

RAPID PRESSURE FILTER WITH DECHLORINATING BED

FIG 10.

As rapid filters deal with 50 times as much water as slow sand beds, per unit of area, they require more frequent cleaning, this is effected in most cases by reversing the flow of water through the filter: the upward flow carries off most of the silt and coagulant jelly and the dirty water is drawn off through overflow channels.

In several of the smaller types of rapid filters revolving arms, or rakes, are employed to loosen the sand, in others hydraulic jets are used and in large types compressed air: in the latter case, the air is applied for several minutes prior to the admission of the wash water.

The larger rapid filters are usually cleaned by the application of wash water under pressure at a rate of about 12 gallons per square foot per minute, the proportion of wash water to effluent being normally two per cent.




RAPID PRESSURE FILTER DRIETING SAND

FIG. 11

Rapid filters may be divided into two classes, pressure filteis and gravity filters. The former are closed cylinders fixed vertically or horizontally containing sand through which the water is forced under pressure. Figs. 10 and 11 show two pressure filters, the former is of interest as it is a continuous filter which is cleaning itself as it works. Pressure filters are best adapted for delaing with comparatively small quantities of water, and where large outputs are required the gravity type is usually preferred.

Gravity filters are usually arranged in units of about 400 sq. ft. aiea dealing, at prevailing rates for this type, with about one million gallons per day. The filters may be constructed of steel, concrete or timber, circular or rectangular in plan: the usual arrangement is as shown in Fig. 9 in which a double battery of filters are divided by a pipe gallery.

Present practice in rapid filtration usually provides for a depth of sand ranging from 20-in. to 36-in. although lesser depths may be used successfully if the sand is sufficiently fine.

The size of sand grains at present being used locally is given in Table 5, but it appears desirable to use a fine sand with slightly smaller grains.

TABLE 5.

DETAILS OF FILTERING MATERIAL IN RAPID FILTERS.

| *Thickness of layer in inches.* | *Material.* | *Size of mesh passing material.* | *Size of mesh retaining material.* |
|---|---|---|---|
| 21 | fine sand | 16 per lin. inch | 30 per lin. inch |
| 3 | coarse sand | 10 ,, ,, | 16 ,, ,, |
| 2 | gravel | 3/16" sq. | 10 ,, ,, |
| 3 | ,, | 3/8" sq. | 3/16" sq. |
| 4 | ,, | 5/8" sq. | 3/8" sq. |
| 4 | ,, | 1" sq. | 5/8" sq. |
| 5 | ,, | 2½" sq. | 1" sq. |

A comparison between Tables 3 and 4 shows that ordinary Ningpo sand, while well adapted for slow sand filters, requires 60 per cent. sifting out before it can be used in a rapid filter.

The depth of the gravel layers is dependent upon the method of washing employed, but those given in Table 4 have been found satisfactory locally with a pressure water wash.

The strainer system of a rapid filter serves the double purpose, in most types, of collecting the filtered water and of distributing the water required for the cleansing of the filter during washing.

Fig. 7 shows a few of the many types of filter bottoms.

The rate of flow through rapid sand filters is usually automatically controlled: there are numerous devices in use, one of the most successful depending upon the difference in pressue of the full and contracted portions of a Venturi tube being used to operate, directly or indirectly, a valve controlling the outflow from the filter.

To ascertain when a filter should be cleaned, it is necessary to have a loss of head gauge which records the diffeience in level of the watei above the sand and that to which it will rise in an open pipe connected to the effluent pipe: these gauges are operated by floats placed in tubes connected to the parts of the filter mentioned.

Experimental work in Shanghai has proved the efficacy of rapid gravity filters in affording good clarification and, under most conditions, good bacteriological reductions.

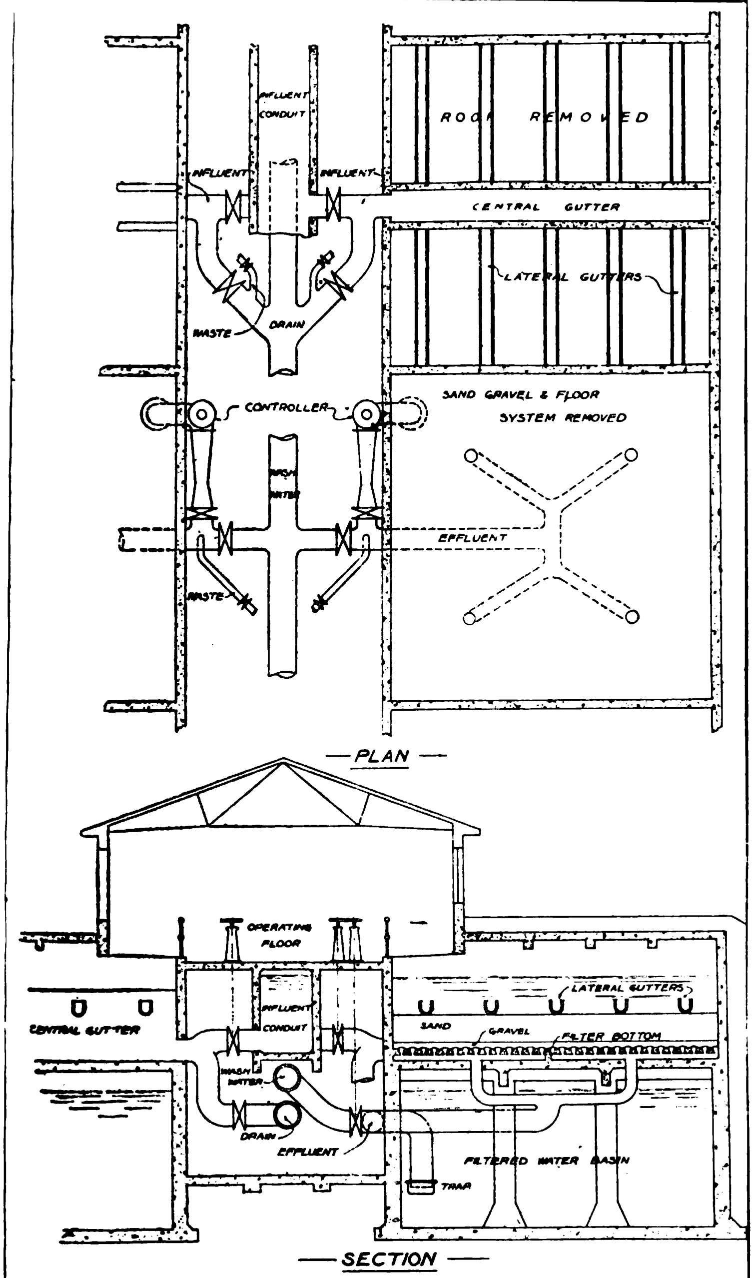
## Sterilisation

The removal from a water of disease producing organisms, as well as those which are harmless, is accomplished, mechanically, by the processes already described.

The pathogenic organisms which, by chance, pass through a filter may, or may not, be injurious from a sanitary point of view

since their ability to infect depends in a great measure upon their number and virulency.

As an additional safeguard to the purification methods previously described, sterilisation has been employed for the last 25 years, but the greatest strides in its use have been made during and on account of the late war when polluted supplies were, so often, all that could be obtained.




TYPICAL ARRANGEMENT OF RAPID GRAVITY FILTER PLANT.

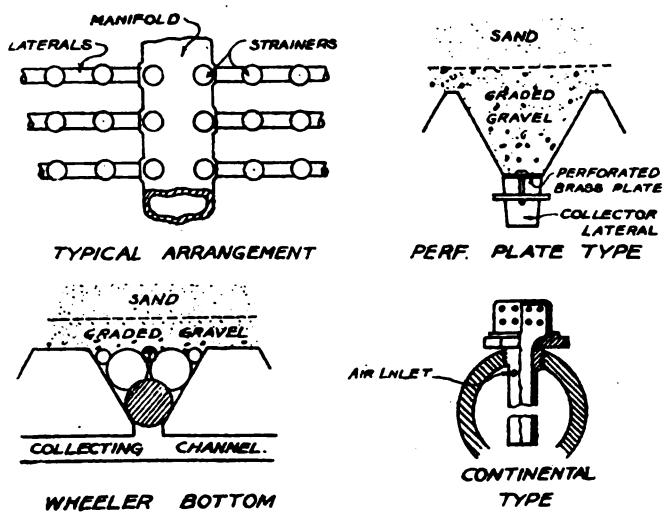
FIG. 8

Disinfection, or even sterilisation, may be obtained by boiling, but on account of the cost it is an impracticable method where any considerable quantity of water has to be treated.

Sterilisation may also be effected by ozone. The usual method is to blow ozonised air into the bottom of scrubbers—usually towers 12 to 15-ft. high—containing coarse gravel, the water to be sterilised passing downward through the scrubber. The largest plant constructed is capable of dealing with 13 million gallons per day but it has, apparently not been a success, owing to the difficulty in obtaining a sufficiently intimate mixture between the air and water.

The destructive effect of sunlight upon many of the lower forms of plant life is well known and it has been proved that bacterial growth can be prevented by exposure to the violet rays of the spectrum, but that the invisible rays beyond the violet rays having the shortest wave lengths are the most effective bactericidal agents: many of the pathogenic forms can be destroyed by an exposure of 10 to 40 seconds.

FIG. 7.




RAPID FILTER STRAINER SYSTEMS.

The difficulty in ensuring that all bacteria in the water are exposed to the light rays has prevented sterilisation by ultra violet rays becoming a practicable means of sterilising any but small quantities of water.

The agent commonly employed for disinfecting water supplies is chlorine, either in its gaseous form or as calcium hypochlorite or bleaching powder.

The latter contains from 30 to 37 per cent. available chlorine and a diluted solution is fed into the water to be disinfected. The liability to deteriorate and its corrosive properties have been the chief objection to bleaching powder, and it is being rapidly displaced by liquid chlorine.

There are several devices for applying chlorine gas obtained from liquid chlorine: the difficulties arising from the pressure variations of the gas at different temperatures, its corrosive effect on metals in the presence of moisture and its slight solubility have been successfully overcome.

Bleaching powder has been displaced by liquid chlorine in Shanghai, and the apparatus used to feed it into the water to be disinfected has been most successful.

The dose found desirable has been very small vaiying from 0.1 to 0.3 parts per million. With such small doses dechlorination is not necessary, but this can be accomplished by passing the water through a charcoal filter or treating it with sodium thiosulphate.

A mechanical filter with dechlorinating bed now in use at Chinkiang is shown in Fig. 10, and is apparently yielding an excellent filtrate both as regards clarification and purification, the raw water being pumped direct from the Yangtze without previous settlement.

The reduction in bacteiia obtained at the Yangtszepoo works by means of settlement, filtration and sterlisation is shown in Fig. 4, the mean reduction during the period given—which is a fair average—being 99.8 per cent.

Mr. Allen Hazen, the consulting engineer of New York, has formulated what he calls the "six lines of defence" against water-borne disease. They are: (1) Ownership of catchment area; (2) sanitary supervision of watershed; (3) treatment of sewage arising on the watershed; (4) storage of water; (5) filtration, including sedimentation and coagulation; (6) disinfection.

The first three lines are necessarily difficult to occupy with a watershed of 600,000 square miles, the fourth is, unfortunately, impracticable for Shanghai at present, but it is hoped that this paper will show that the last two lines are being satisfactorily held.

# Some Recent Electrical Developments in Japan

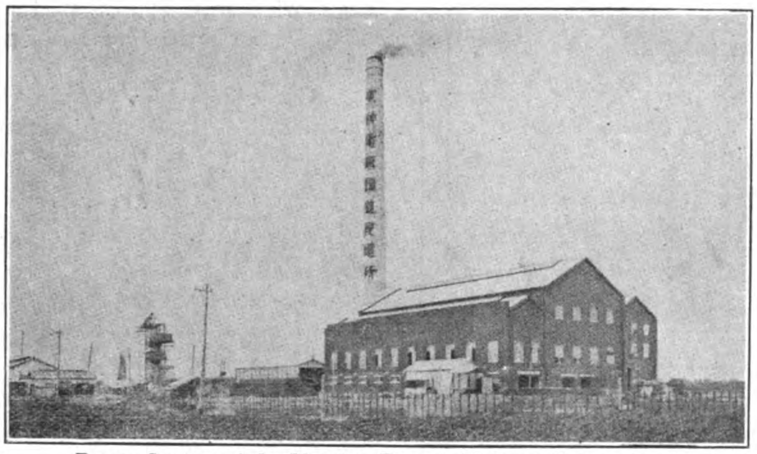
## Water Power Resources of Central Japan.

WATER power enterprises in Central Japan, in the prefectures of Aichi, Mie, Gifu, Toyama, Ishikawa and Fukui, have been gradually increasing in numbers in recent years. On the rivers flowing into the Japan Sea, and those to the south, something like 780,000 h.p., is generated by power plants having a capacity of more than 100 h.p. The Kiso River yields the greatest amount of power; the Jintsu, Kurobe and Sho Rivers, yield more than 100,000 h.p. each. On the River Kiso there are seven power sites where more than 10,000 h.p. is now generated. The Jintsu and Kurobe Rivers have six sites of similar power; the Sho River has four, and the Joganji and Kuzuryu rivers have two sites each. The amount of water power now generated at these sites is about one-quarter of the total generated from water power in Japan to-day.

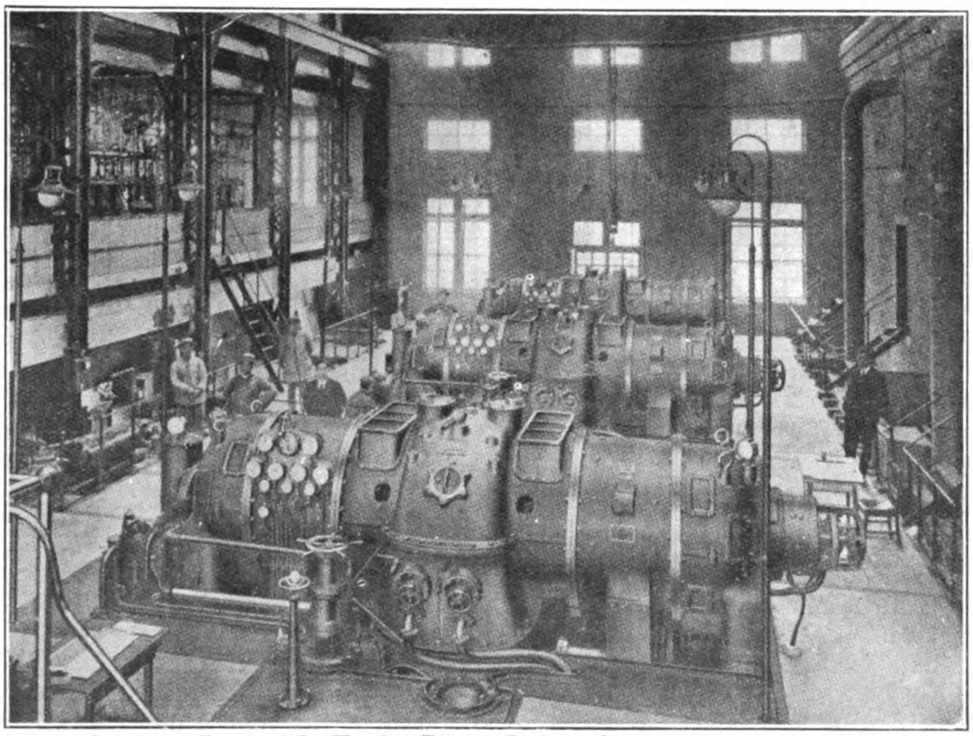
The average power generation capacity per square *ri* (*ri*= 2½ miles) in Central Japan is 620 h.p.; for all Japan it is only 220 h.p. The number of power plants licensed to be built in Central Japan is now 225, to generate a total of 1,340,000 h.p. Only 260,000 on this total capacity is in operation. There are many companies which have not yet started construction, and many which will never start construction. This is due to the fact that unconsidered competition for favored power sites has crowded the investment field, and funds are not obtainable to develop even some very favorable regions.

The supply of water in Central Japan is ample. Classifying power sites according to their generation capacity, 22 per cent. will yield from 1,000 to 10,000 h.p., while 74 per cent. will generate more than 10,000 h.p. each. The recent official survey of water power in Japan has shown 230 sites, capable of generating 1,012,172 h.p. in Central Japan. Each of these sites produces more than 1,000 h.p. About 78 of these sites are already licensed to produce 565,829 h.p. The following table shows the location of the sites which have not yet been licensed to any concern:—

| River. | No. of Sites. | Capacity. | River. | No. of Sites. | Capacity. |
|---|---|---|---|---|---|
| Toyo | 4 | 4,166 H.P. | Katagai | 1 | 3,148 |
| Yasaku | 5 | 7,782 | Jintsu | 25 | 73,125 |
| Kiso | 40 | 90,429 | Sho | 18 | 95,580 |
| Kushida | 5 | 3,599 | Asano | 1 | 879 |
| Kumode | 5 | 4,231 | Sai | 3 | 3,684 |
| Miya | 8 | 7,920 | Tedori | 8 | 25,358 |
| Sakai | 1 | 651 | Tei | 1 | 563 |
| Ko | 1 | 961 | Daishoji | 1 | 325 |
| Kurobe | 3 | 73,573 | Kuzuryu | 11 | 43,264 |
| Joganji | 1 | 3,101 | | | |
| | | | | 152 | 446,343 H.P. |



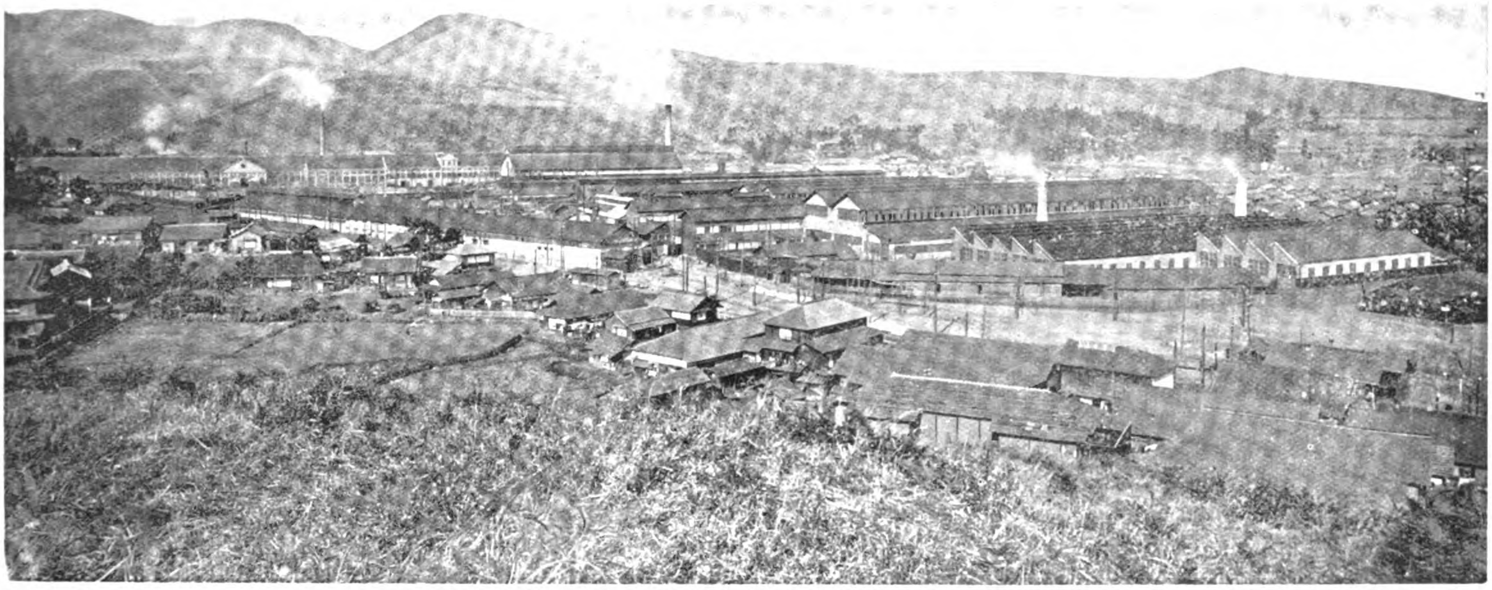
Power Station of the Hanshin Electric Railway Company at Amagasaki, Japan



Generating Room of the Hanshin Electric Railway Company, Amagasaki, Japan: Equipped with three 4,200 k.w. Stal. Turbo-Generators

Competition for the supply of materials to equip these new plants is naturally keen, and although foreign manufacturers are obtaining many of the larger orders, a fair proportion is being placed with the larger Japanese electrical machinery manufacturers notably the Shinaura, Mitsubishi, Hidachi and others. In another article is given an idea of the progress made by the Mitsubishi interests in the manufacture of high-grade turbo-alternating machines, and in a recent article we described the plant and operations of the Shibaura Engineering Works. The Hidachi Engineering Works operated by the Kuhara interests which suffered somewhat from the slump of two years ago, however, is making strenuous efforts to hold its own and has obtained many important orders for new equipment.

In the matter of water turbines, the Swiss firm of Escher, Wyss & Company has had remarkable success in Japan and seem to set the standard in competition. The Hadachi Engineering Works claim to have made and installed water turbines whose actual operating results show as great an efficiency as any of the foreign manufactured products. Some



General View of Hidachi Engineering Works, at Sukegawa, Ibaraki Prefecture, Japan
One of the Largest Manufacturers of Water Turbines and Generators in Japan

of these Hidachi turbines were illustrated in our April, 1922, number.

## Hidachi Equips Many New Plants

Since then, the Hidachi Works have supplied to the Hirose Denryoku Company for its Moniwa plant a vertical shaft turbines and generators and two 4,444 k.v.a. turbines and generators for the Takenosawa plant of the Kinugawa Hydro-Electric Company. These generators are equipped with Kingsbury bearing pneumatic brakes and have a maximum of 7,400 kilowatts capacity with a head of 275-ft. and single spiral of 500 r.p.m. This plant is located at Fujiwara-mura, in Tochigi prefecture. One of the turbines was tested on January 7 of this year and the other is now ready for its official tests. These turbines have vertical shafts of 65-ft., a rare size in Japan. The switchboard and other accessories have also been supplied by the Hidachi Works.

At their power plant located at Komamaki-mura, Gunma prefecture, the Tokyo Electric Company has also installed four Hidachi water turbines of 6,750 h.p. each operating under a head of 374 feet, single spiral with pneumatic brakes. The generators, however, are from the Westinghouse Company and have a capacity of 4,800 k.v.a., 50 cycle, 6,600 volts with Kingsbury bearings. These turbines have all passed successfully the heavy tests and been accepted. Another 1,500 h.p. and 1,370 h.v.a. generator turbine has installed in its Torinami plant of the Shidzuoka Electric Company, located at Shibatomi-mura in Shidzuoka prefecture. The results have been satisfactory that plans have been made to increase the equipment of this and the Okazaki plant, by the addition of one more turbine in each.

The Nankai Hydro-Electric Company has also installed a 435 h.p. generator driven by a Hidachi 510 h.p. water turbine, head 26 feet at its Matsubara plant at Ishigaki-mura in Wakayama prefecture, and another 710 h.p. Hidachi turbine is being installed at the main mill of the Uchiumi Spinning Company at Uchimi-machi in Wakayama prefecture. The capcity of this generator is 450 k.v.a., 1,199 volts. The head is 750 feet. In addition to the larger turbines installed at the Takenosawa plant of the Hirose Electric Company, the Hidachi Works has installed in the Moniwa plant of the same company a 650 k.v.a., generator operated by a Hidachi 850 h.p. water turbine. The head is 57 feet, single open spiral wheel.

## The Daido Denryoku K. K.

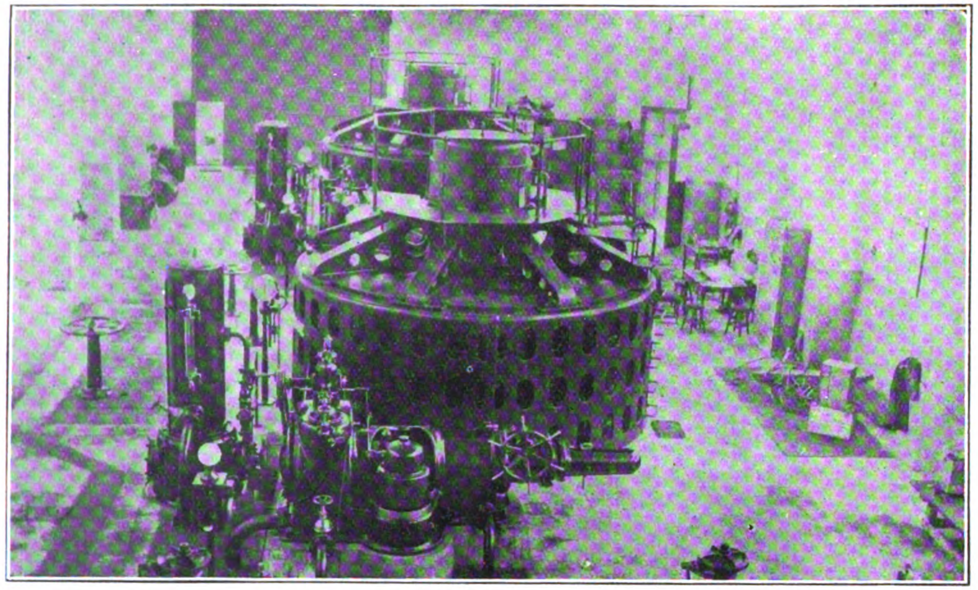
The Daido Electric Power Co., Ltd., paid a dividend of 6.2 per cent. on its total paid-up capital of Y.44,000,000. The authorized capital is Y.100,000,000, with outstanding debentures amounting to Y.20,000,000. The power plants in operation and to be erected by this company are licensed for a maximum of 200,000 kilowatts, of which 120,000 kilowatts are now under construction. At the end of the first business term 1922, the amount of power actually generated was 38,000 kilowatts. It is reported that costs of all construction to date have reached Y.16,470,000, an averages of Y.427 for each kilowatt generated. The head office of the company is in Nagoya. M. Fukuzawa is president, K. Miyazaki, vice-president, and S. Mitsume, engineer in chief. This company has received permission to supply power to Osaka and Sakai and their outlying districts.

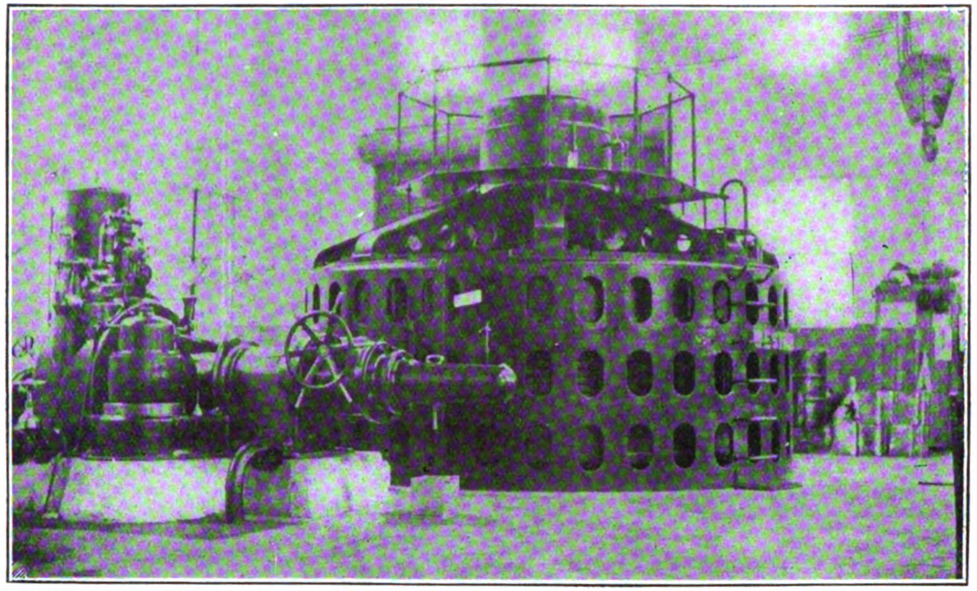
## New Electric Supply Company

Promoted by M. T. Honda, and Mr. C. Takatsu, with a capital of Y.1,000,000, of which one-fourth had been paid up, the Watarase Suiden K. K. (Watarase Hydro-Electric Co., Ltd.,) was organized on September 27, 1922, to engage in the sale of electric machinery, and build power plants for the account of other concerns. This is a Tokyo company but its office has not yet been announced. It can be addressed in care of the electric bureau, department of communications, Tokyo.

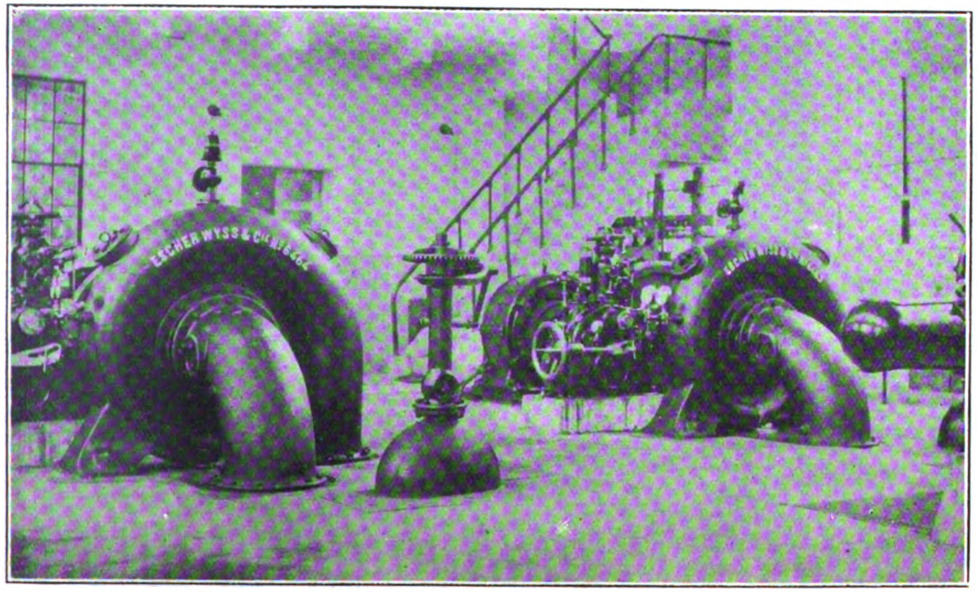
# SUHARA POWER STATION OF THE DAIDO ELECTRIC COMPANY.

2 Units, 7·200 H.P., Escher, Wyss & Company Water Turbines and Westinghouse Generators

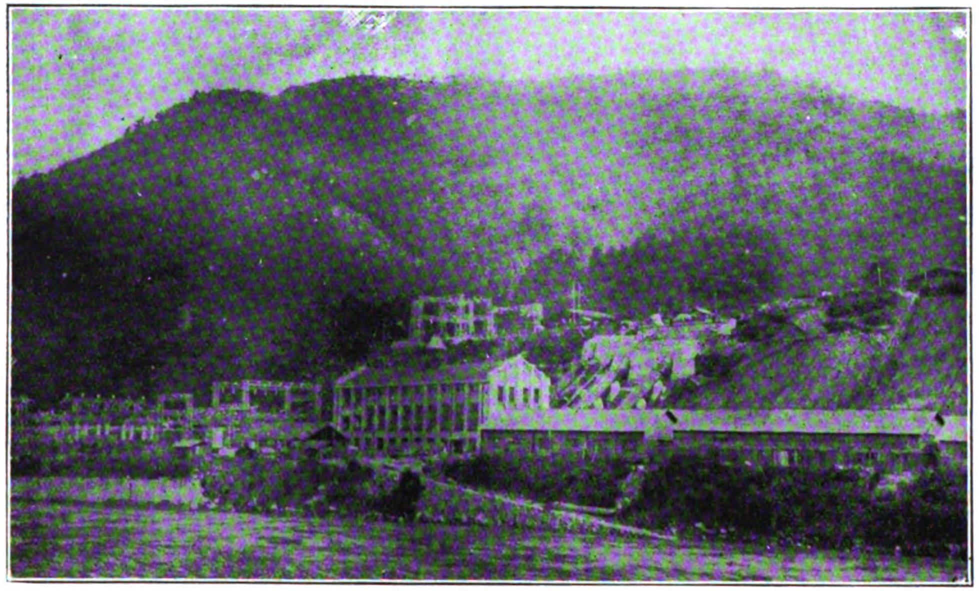




Views of Generating Room




Exciter Turbines

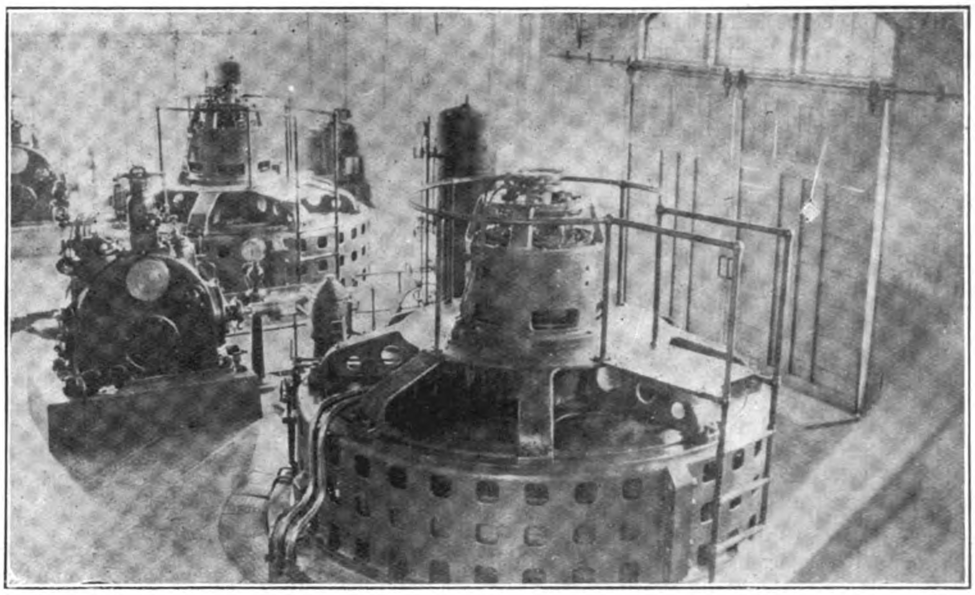


Suhara Power Plant

## Osaka Power Supply

In 1909, the Ujigawa Hydro-Electric Company applied for a license to sell power in Tosei-gun, Nishinari-gun, Kita Kawachi-gun, Mishima-gun, and Hone-gun, in the districts around the city of Osaka. This license has only just been granted by the minister of communications. The Osaka Electric Company has also been licensed to supply power in Nishinari-gun, and Naka Kawachi-gun, in the same district about Osaka.

The second large power plant of the Osaka Electric Company at Kusagade, has been completed, enabling this company to be the first of these three competitors to increase its supply to the important Osaka commercial centre. As soon as the power plant on the Kiso River at Dokosho is finished the Daido Denryoku will be able to transmit power to Osaka, and the Ujigawa Suiryoku K. K. will start supply as soon as its Number 2 power plant on the Ujigawa is completed. Severe competition for large company accounts is anticipated to the benefit of power consumers in the Kwansai.



**The Ogawara Power Plant of the Kyoto Electric Company, equipped with two 2,750 Escher, Wyss Water Turbines and Westinghouse Generators.**

## Kyushu Hydro-Electric Equipment

The Kyushu Suiryoku Denki K.K. has recently acquired and is now electrifying the Hokuchiku tramway. In February, 1922, the Japan Electro-Chemical Industrial Co., Ltd., was taken over and the paid-up capital of the Kyushu Suiryoku increased to Y.32,700,000. The company now supplies a total of 46,000 kilowatts to power users, and 552,000 ten candle-power electric lights.

It has under construction four great power houses; at Namazuda, one steam plant of 10,000 kilowatts, at Chinda, a hydro-electric plant of 5,500 kilowatts, at Imahata, a hydro-electric plant of 2,200 kilowatts, and at Joshihata another hydro-electric plant of 6,000 kilowatts. It is expected that these will all be completed during 1923, when the company will have a total generating capacity of 60,000 kilowatts, inclusive of present equipment. The coal power plant is to be held in reserve in case there is disastrous fall in water levels during the dry seasons. It is reported that another 10,000 kilowatts coal-burning plant is now under consideration.

## Hydro-Electric Company

During the first business term of 1922, this company generated a total of 81,750,000 kilowatts, a decrease of about 1,350,000 kilowatts compared to the second half of 1921, due to the seasonal decrease in water head at the Shimotaki power plant. A coal burning plant is maintained near the city of Tokyo, so that there is no dimunition in the supply of power to the city. The cost of generating power from coal is, however, about twice the cost of generating water power, amounting to about 3.4 sen per kilowatt. This company has a contract with the city of Tokyo whereby it may charge the net cost of any coal generated power it must supply due to the fall in water head. Naturally the need of a new hydro-electric plant is keenly felt.

In 1921, construction was commenced on a plant at Takenosawa, which is nearing completion. Its maximum capacity is 6,700 kilowatts, but when the river is low only half that amount can be generated. The total cost of construction is Y.4,000,000, and the construction cost generate and transmit one kilowatt to the city of Tokyo averages Y.600.

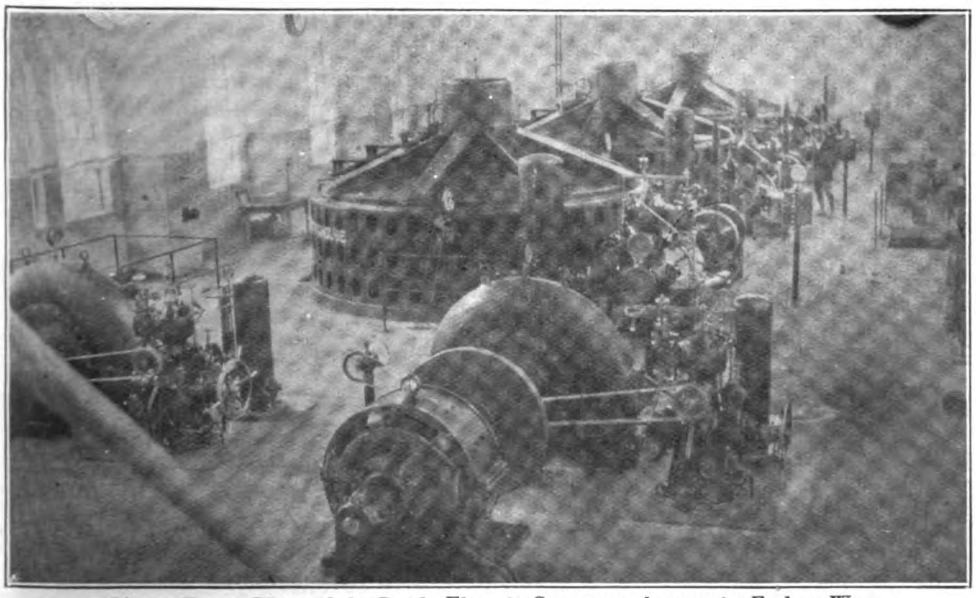
The Kanazawa Electric Tramway Co., Ltd., in Ishikawa prefecture operated its first line of track between Shin Nonoichi and Nomachi, 1.3 miles, and between Nomachi and Nishi Kanazawa, ½ mile, on September 1, 1922.

## Tokyo Electric Bureau's Plant

To mitigate the overcrowding on all the trams in Tokyo city, the electric bureau is planning to replace all the small old type tram-cars with bogie carriages. This will call for the rebuilding of the bridges in Honjo and Fukagawa districts.

It is planned to build an elevated system for the municipal cars. The routes selected are between Tsukudo Hachiman Mae, and Edogawa Funakawara Bashi, and between Hongo, Masagocho, and Koshikawa, Tomizaka. The lines in these districts are always congested, and the elevated will greatly relieve the pressure of traffic.

The city has just completed a double track line bridge over the Sumida River at Eitai Bashi. This will relieve the pressure of traffic crossing the river, which is daily becoming more and more difficult to handle with the exsiting bridges.

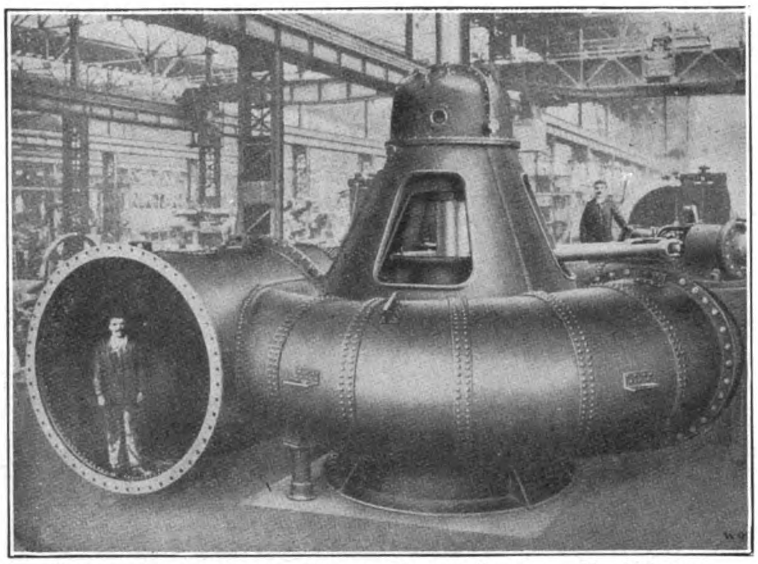


**Okuwa Power Plant of the Daido Electric Company, three units Escher, Wyss Water Turbines and Westinghouse Generators.**

## Electric Express Railway between Kobe and Homeji

The construction of the Meiki Denki Tetsudo K.K., between Himeji and Akashi, is expected to be completed in April, 1923. The promoter of this company Seibei Kawanishi, has obtained a license to construct a high speed railway between Akash

and Hyogo (Kobe), thus completing the line between Kobe and Himeji. As soon as this new line is built it will seriously affect the business of the existing line between Kobe and Akashi, the Hyogo Denki Kido K.K. (Hyogo Electric Tramway Co., Ltd.), which is unable to transform its line into a high speed railway. It is, therefore, confidently expected that a merger of the two concerns will shortly be effected.



Turbine Supplied to the Ujigawa Electric Company, No. 2 Power Plant, 17,000 H.P. by Escher, Wyss & Company, Ltd.

## Karatsu Electric Railway

The town assembly of Karatsu, in Shiga prefecture, approved the construction of an electric railway within the town boundaries. The work will be carried out on a three-year program, at a total cost of Y.418,000. The main line of the tramway will be over two and a half miles long.

The department of communications granted on October 2, 1922, a license for the amalgamation of the Sagami Denryoku K.K., and the Fuji Suiden K.K. The Fuji Suiden will issue 200,000 shares of stock to be handed the shareholders of the Sagami Denryoku, at the rate of par for par. It is reported that the Odawara Electric Railway will probably be annexed by the Fuji Suiden in the near future. The election of Mr. T. Nakano, president of the Odawara Tramway Co., to the directorate of the new Fuji Suiden points that way.

## Tokyo Assembly Approves New Municipal Power Plant

The Tokyo Municipal Tramways consume daily 189,167 kilowatts, a total of 69,042,403 kilowatts a year. The lights and power furnished by the municipal electric bureau consumes another 71,501,627 kilowatts a year. For its own enterprises the city uses another 3,740,262 kilowatts, a grand total of 144,284,242 kilowatts a year. The city owns no hydro-electric power plants of its own but purchases power from the Kinugawa and Katsuragawa power plants of the Tokyo Dento and Kinugawa electric companies.

In 1919, the city assembly approved a plan for erecting a municipal power plant on the Tama River near Tokyo, but only recently provided the necessary funds. The cost of construction of Y.9,900,000 has been approved.

But a complication has arisen in the license recently granted the Tamagawa Hydro-Electric Power Co., to exclusive power rights on the Tama River. Negotiations are now going on which are expected to have a happy result.

## Ujigawa Denki K. K.

The Ujigawa Denki K.K. recently effected a merger with the Kumano Denki K.K., and the Taisho Suiryoku K.K., and increased its authorized capital to Y.85,000,000, of which Y.52,270,000 is paid up. The company took over construction of the Taisho Suiryoku power plants at Otaki, on the Yoshino River, to generate 3,600 kilowatts, and at Miyataki on the same river, to generate 3,000 kilowatts. When these two plants are completed this company expects to enter the Kobe district for the supply of power and light.

A coal-burning power plant at Fukuzaki to generate 10,000 kilowatts, will be completed in April, 1923. By August, 1923, another 26,000 kilowatts of generating capacity will be added. Thereafter, it will be an active competitor of the Daido Denryoku K.K., and the Nihon Denryoku K.K. for business in the Kwansai district.

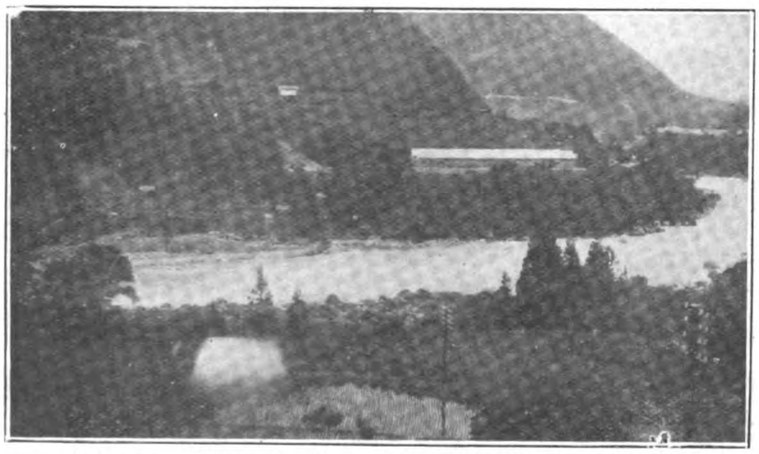
## Nihon Denryoku K. K.

This company was originally organized to engage in power supply, with a capital of fifty million yen. It has a hydro-electric power plant at Seto, which will be completed in 1923. It has also applied for licenses to construct power plants at Kosaka, Kukuno, and Masegawa, on the Miyagawa River. A coal burning plant was licensed in May, 1922, to be built at Amagasaki, near Osaka, and the foundation work has been completed.

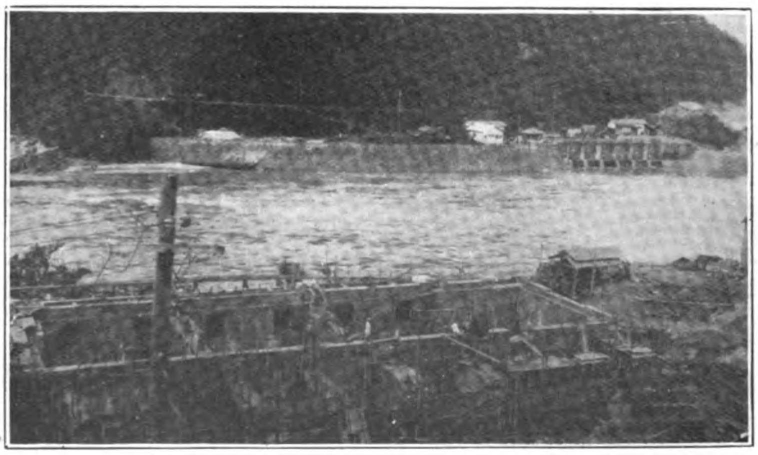
The company has also obtained permission to build transmission lines to Osaka, Kyoto, Shiga prefecture, Toyama prefecture and Gifu prefecture. Eighty per cent. of the land for the transmission towers, and transmission stations has been purchased. The two transformer stations at Osaka and Sasatsu have already been commenced, and the superstructures are now being erected.

## Ikegami Denki Tetsudo K. K.

The Ikegami Electric Railway Co., completed a part of its construction program in September and the line was opened to business October 8, 1922. The purpose of the company is to carry passengers between Omori on the imperial government railways' electric line between Yokohama and Tokyo, and the Honmonji temple of the Nichiren sect of buddhism, at Ikegami. An enormous number of pilgrims annually visits this shrine, and the horse car line formerly operated was absolutely inadequate. The company's rights extend from Omori to Meguro, on the Yamate line outside



Kisogawa (River), Location of the Daido Electric Company's Power Plants.



Foundations for one of the Daido Power Plants on the Kisogawa.

Tokyo city, running through Ikegami, with a branch line between Kamata and Ikegami. It is this branch line, 1 mile 80 chains long which has been opened to business.

The company has two cars of the bogie type, to carry 65 passengers, now in operation, and five other cars being built by the Toyo Denki Seizo K.K. (Toyo Electric Machine Manufacturing Co., Ltd.). The cars weigh 13.5 tons. The motors are also manufactured by the Toyo Denki Seizo K.K., and each car is equipped with two of 50 h.p. each. The air brakes used are from the Westinghouse Air Brake Co.

The power for operation is obtained from the Tokyo Dento station at Ikegami. The company owns one transformer station with a capacity of 700 kilowatts, but only one machine unit of 100 kilowatts is now installed.

The authorized capital is Y.1,850,000 of which Y.533,940 has been paid up. Debentures amounting to Y.63,200 have been issued. The officers are: President, J. Takayanagi; Managing Director, K. Yagi; Directors, K. Ishiguro, Y. Toyama, S. Takei, S. Tanabe, H. Kobayashi and S. Kono; Chief Engineer, T. Kumagai.

Head Office; No. 1, 3 chome, Yuraku Cho, Kojimachi Ku, Tokyo (Hibiya Building).

Capitalized at Y.8,000,000, of which Y.2,000,000 has been paid up, the Azumagawa Denryoku K.K., was established in December, 1922 to supply all the power it generates to the Tokyo Dento K.K., which owns 30,000 of the shares issued. The president of the company is Mr. Tetsuo Usui.

The department of home affairs has licensed the project of Miyagi prefecture to unify all the electric enterprises in that prefecture under government control. The costs of purchase and construction are estimated at Y.7,270,000, to be obtained by floating public loans. Interest on the bonds issued will be 8 per cent. During this year Y.4,480,000 will be raised.

It is reported that the Tobu Denryoku K.K., and the Daido Denryoku K.K., two of Japan's largest electric light and power supply companies, have succeeded in raising capital abroad for the extension of their enterprises, through the intermediary of Messrs. Sale & Frazer, of Tokyo.

## New Electric Companies

The Tashirogawa Suiryoku Denki K.K., was registered on August 26, 1922, with a capital of Y.5,000,000, one-fourth paid up, to engage in the sale of electric machinery, and invest in power companies.

Head office, No. 1, 1 chome, Yuraku Cho, Kojimachi Ku, Tokyo. Directors, S. Kubota, M. Soejima, K. Morita and G. Hayase; Auditors, S. Maeda and Y. Maeda.

## Tosa Denki K. K.

By amalgamation of the Tose Electric Railway Co. and the Tosa Hydro-Electric Power Co., Ltd., the Tosa Electric Co., was registered August 9, 1922 with a capital of Y.6,000,000. Of the issue of 120,000 shares, 80,000 are fully paid up, and 40,000, half paid up. The head office is at 331 Honcho, Kochi city, Kochi prefecture. The company will operate electric railways, supply light and power, deal in electric machinery and machine tools, design and contract for construction of electric enterprises, and manufacture electro-chemicals.

The officers are: Directors, T. Uda, K. Nonaka, U. Kataoka, K. Nishiyama, K. Yokoyama, J. Mori, M. Chizu and T. Ueda.

## Imazu Hatsuden K. K.

With the object of supplying power to the Hanshin Kyuko K.K. (Kobe-Osaka Express Electric Railway Co.), and the Ujigawa Denki K.K., the Imazu Power Generating Co., Ltd., was organized in August, 1922, with a capital of Y.3,000,000, all paid up. Its main office is at 325 Sumida-machi, Kitano, Kita Ku, Osaka city, care the Hanshin Kyuko K.K. The officers are: Directors, T. Hayami, N. Ueda, K. Kishi, Y. Oka and S. Kamimura (managing director).

## Yubetsugawa Suiryoku Denki K. K.

With a capital of Y.700,000, one-fourth paid up, this company was established August 16, 1922, to supply light and power and to deal in electric machinery. Its officers are: Directors, Y. Anamizu, K. Anamizu, T. Yajima and K. Oishi; Auditors, T. Takahashi and K. Kondo. Its head office has not yet been selected, but the company may be addressed in care of the electric bureau, department of communications, Tokyo.

## Gyokunan Tetsudo K. K.

Under the provisions of the private railway laws, the Gyokunan Railway Co., Ltd., was established on July 27, 1922, as a co-operating concern with the Keio Densha K.K., operating in the suburbs of Tokyo city. The capital is Y.1,500,000, of which Y.150,000 has been paid up. Its head office is at 66 Honmachi, Hachioji, Tokyo prefecture. The compay will operate a trackless electric tram system in the city of Hachioji, and transport both passengers and freight. The officers are: Directors, T. Inouye, T. Shimada, Z. Morikubo, S. Shibuya, T. Watanabe and S. Aoki.

## Suwa Denki Kido, K. K.

The Suwa Denki Kido K.K. (Suwa Electric Tramway Co., Ltd.), was licensed on October 7, 1922, to built an electric railway between Hirano-mura, Suwa-gun, Nagano prefecture, and Miyagawa-mura, Suwa-gun, Nagano prefecture, a distance of 9 miles. The line will be 3 feet 6 inch gauge, and the cost of construction is estimated at Y.2,400,000.

## Minobu San Denki Tetsudo K. K.

A license to construct an electric railway between Ono, Minobu-mura, Minami Koma-gun, Yamanashi prefecture, and Minobu, of the same district, a distance of two miles, was granted to the Minobu San Denki Tetsudo K.K., (Mt. Minobu Electric Railway Co., Ltd.) on October 12, 1922. The gauge of the track will be 3 feet 6 inches, and the cost of construction is estimated at Y.600,000.

## Seiho Tetsudo K. K.

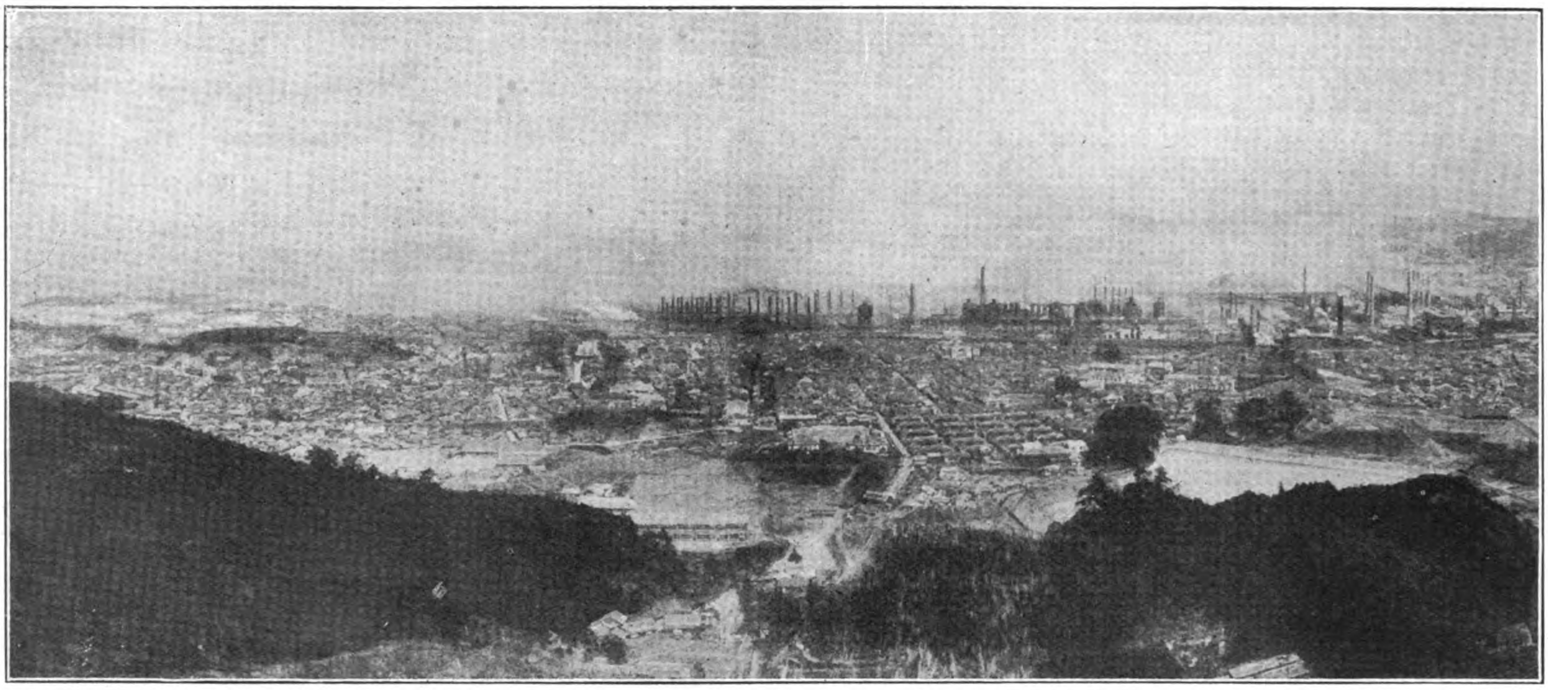
(Seiho Railway Co., Ltd.) Licensed October 16, 1922, to construct an electric railway between Sakae-machi, Imadate-gun, Fukui prefecture, and Oda-mura, Niu-gun, Fukui prefecture. Length of line: 10 miles, 5 chains. Gauge: 3-ft. 6-in. Estimated cost of Construction: Y.800,000.

## Nogami Keiben Tetsudo K. K.

Licensed October 16, 1922, to construct an electric railway between Higashi Nogami-mura, Nasu-gun, Wakayama prefecture, and Shimo Kanno-mura, Nasu-gun, same prefecture. Length of line: 4 miles, 30 chains. Gauge: 3-ft. 6-in. Estimated cost of Construction: Y.400,000.

## Osaka Tetsudo K. K.

Licensed October, 1922, to extend its steam and electric railway from Kashiwabara-machi, Minami Kawachi-gun, Osaka prefecture, to Tomorogo-mura, Kita Kawachi-gun, same prefecture. Length of line: 10 miles, 5 chains. Gauge: 3-ft. 6-in. Estimated cost of Construction: Y.1,800,000.



General View of Imperial Japanese Government Steel Works at Yawata, Kyushu

# Japan's Iron and Steel Industry

*By H. C. Huggins*

WITH all the advance in equipment and technique made in her iron and steel industry in the last twenty years, Japan remains practically dependent on other countries for the major part of its iron and steel supplies. This is due entirely to the basic lack of sufficient high grade ore to furnish raw material for an industry of magnitude great enough to produce all the nation's requirements. In 1909, it was estimated that there were only 60,000,000 tons of iron ore fit for reduction by present day processes which could be mined in Japan. There are no recent surveys which could add anything to that estimate. Chosen (Korea) has a visible supply of 30,000,000 tons, but of ore of even lower grade than the average Japanese supply.

The industry is also handicapped by the diminishing supply of coal. The main coal fields of Japan begin to show signs of having reached the end of possible developments. So acute is the coal problem to the iron industry that a bill to provide Y.16,000,000 for the complete electrification of the government steel mills at Yawata, Kynshu, has been prepared by the imperial department of agriculture and commerce, for presentation during the piesent session of the imperial diet. The plan is well considered and favored by the government, so the bill is almost certain of approval. The cost of the change is to be borne by profits of operation. Another disadvantage the industry labors under is the difficulty of transportation from the large mills to the centres of consumption. The Yawata Steel Works (the government mills) are located in Kyushu, 500 miles from Osaka their nearest important market. The principal market of the Japan steel works whose mills are located in the Hokkaido, is Tokyo, some 600 miles from the mills. The principle of the iron trade that the ore seeks the fuel has centered Japan's steel mills in strange places. Cheap transportation to the markets is therefore impossible to obtain, because of the many times each piece of finished material must be handled in transhipments before it reaches its final market.

The supply of iron ore being so limited, there are only four mills in Japan operating on Japanese ores alone, the Kamaishi, Ninita, Sennin and Kuriki. All the other mills depend upon China, Manchuria and Chosen foi an adequate supply of ore, even in this time of depression. The annual deficit in the supply of finished steel materials is between 400,000 and 500,000 tons, which is imported from England, the United States and China.

The domestic demand for iron and steel is nevertheless largely supplied by the domestic mills, and it is steadily increasing year after year. At the end of 1921, the pig iron productive capacity of the Japanese blast furnaces was :

| | |
|---|---|
| Japan Proper .. .. .. | 3,040 tons a day |
| Chosen .. .. .. .. | 300 ,, ,, |
| Manchuria .. .. .. | 800 ,, ,, |
| | 4,140 tons a day |

Estimating 330 operating days a year, the annual capacity amounts to 1,366,200 tons. (There have been no additions to equipment since 1921.)

The productive capacity of the steel rolling mills at the end of 1921 was 2,153,250 tons a year. The Yawata Steel Works possesses rotary retorts which can produce 1,000 tons of steel billets a day. But the greatest part of the annual output is pioduced in single furnaces in small mills. The following table shows the productive capacity of Japan's chief rolling mills:—

| | |
|---|---|
| Steel billets, slabs, etc. .. .. | 787,750 metric tons. |
| Steel plates .. .. .. .. | 396,000 ,, |
| Steel heavy rails .. .. .. | 90,000 ,, |
| Steel wire .. .. .. .. | 114,500 ,, |
| Steel tubes .. .. .. .. | 61,000 ,, |
| Total .. .. .. | 1,449,250 tons a year |

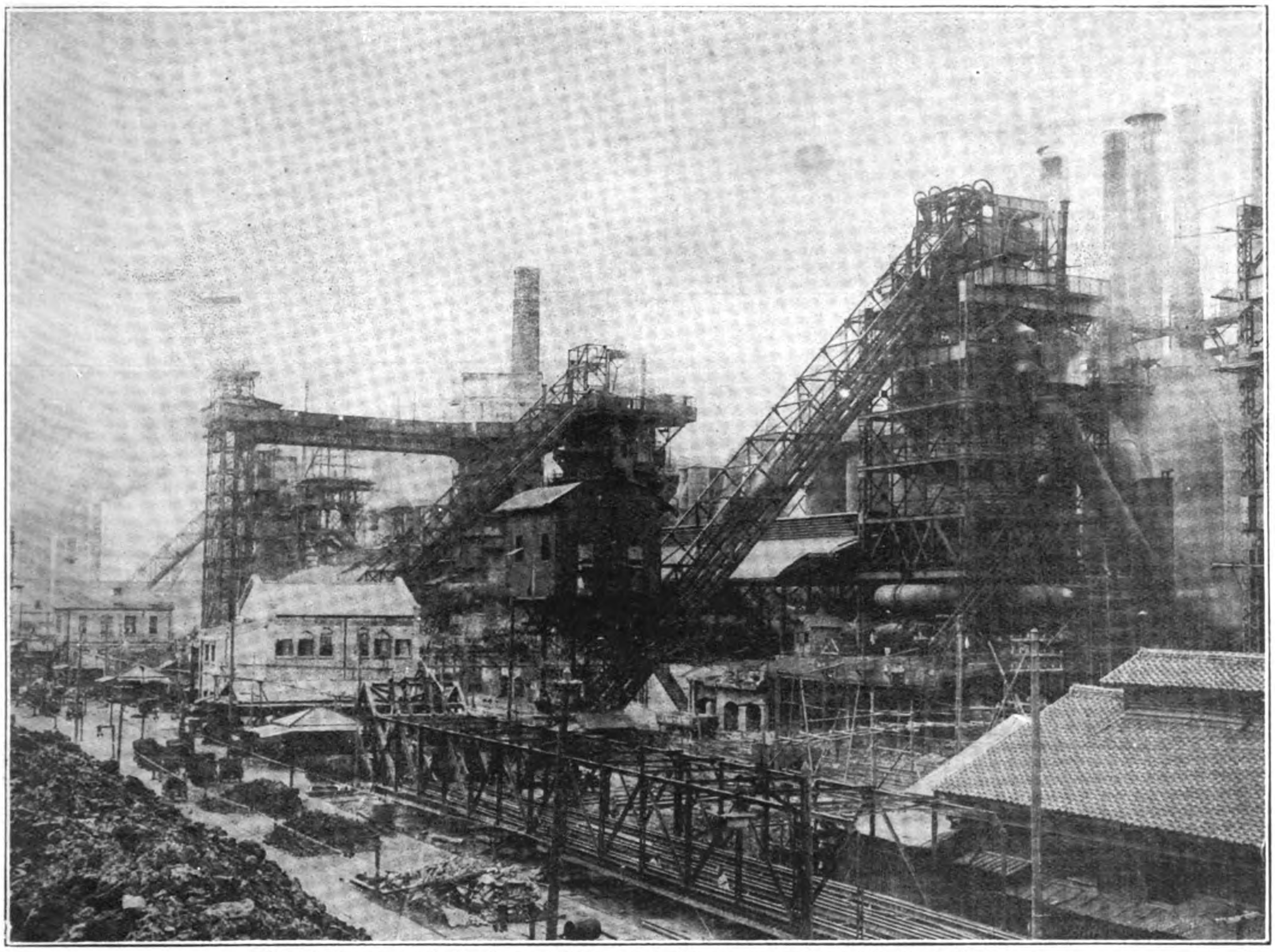
It can be seen that Japan's mills are able to produce all the iron and steel the nation needs and even more. The department of agriculture and commerce made a survey of steel operations in

1921, and published the following forecast of future production :—

| | Pig Iron Tons | Steel Billets Tons | Steel Shapes Tons |
|---|---|---|---|
| JAPAN PROPER | | | |
| 1921 .. .. .. | 1,060,000 | 1,920,000 | 1,400,000 |
| 1922 .. .. .. | 1,110,000 | 2,000,000 | 1,470,000 |
| 1923 .. .. .. | 1,150,000 | 2,030,000 | 1,490,000 |
| CHOSEN | | | |
| 1921 .. .. .. | 100,000 | 50,000 | 40,000 |
| 1922 .. .. .. | same | | |
| 1923 .. .. .. | same | | |
| MANCHURIA | | | |
| 1921 .. .. .. | 250,000 | 60,000 | 50,000 |
| 1922 .. .. .. | 250,000 | 60,000 | 50,000 |
| 1923 .. .. .. | 350,000 | 60,000 | 50,000 |
| TOTAL | | | |
| 1921 .. .. .. | 1,410,000 | 2,030,000 | 1,490,000 |
| 1922 .. .. .. | 1,460,000 | 2,110,000 | 1,560,000 |
| 1923 .. .. .. | 1,500,000 | 2,140,000 | 1,580,000 |

PIG IRON

| Domestic Output Tons | Imports Tons | Total Tons | Exports Tons | Balance Tons | Percentage of domestic demand satisfied by domestic manufacture % |
|---|---|---|---|---|---|
| 1914..299,461 | 172,134 | 471,595 | 1,388 | 471,408 | 63 |
| 1917..462,792 | 135,082 | 697,874 | 3,322 | 694,552 | 62 |
| 1918..606,428 | 267,741 | 874,169 | 1,146 | 873,023 | 70 |
| 1919..612,609 | 352,151 | 964,760 | 1,894 | 962,866 | 64 |
| 1920..529,875 | 390,298 | 920,173 | 2,201 | 917,972 | 58 |
| 1921..483,701 | 276,284 | 759,985 | — | — | — |
| STEEL SHAPES, ETC. | | | | | |
| 1914..282,516 | 408,467 | 670,983 | 29,622 | 661,361 | 43 |
| 1917..513,445 | 673,210 | 1,186,655 | 51,735 | 1,134,916 | 45 |
| 1918..539,637 | 650,780 | 1,190,417 | 61,007 | 1,129,410 | 48 |
| 1919..552,601 | 725,244 | 1,277,845 | 105,240 | 1,172,605 | 47 |
| 1920..537,461 | 1,039,452 | 1,576,913 | 70,761 | 1,496,152 | 36 |
| 1921..557,800 | 636,801 | 1,204,601 | 85,218 | 1,119,383 | 50 |



**Blast Furnaces of the Imperial Japanese Government Steel Works at Yawata**

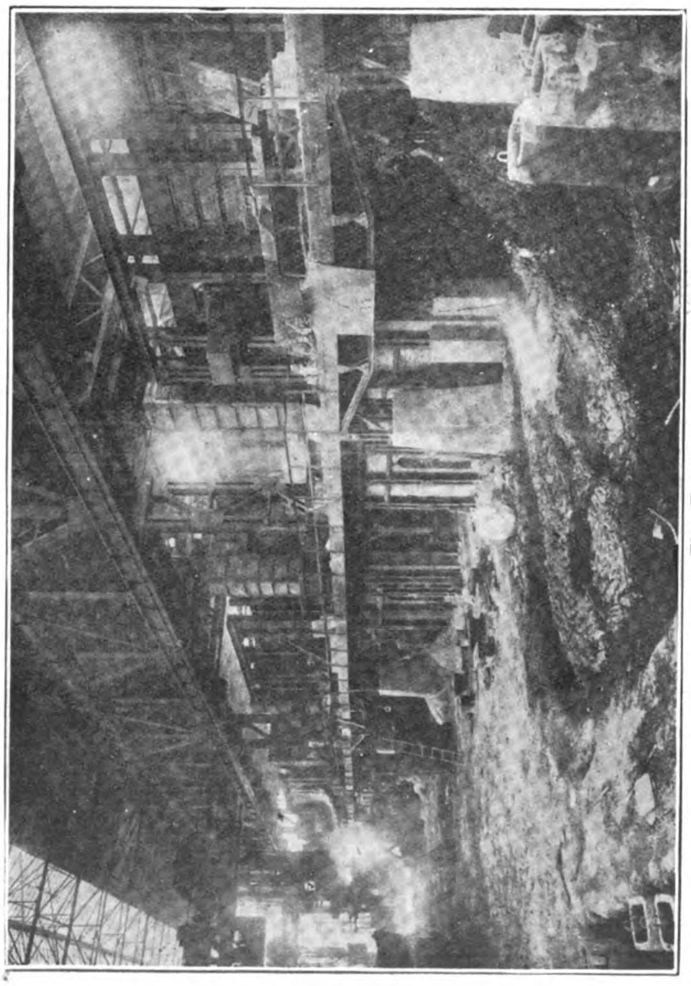
This table shows a very marked increase in production each year, but it is to be doubted if these figures have been any where near reached by the business of the past two years, and with the continuing depression in industrial circles there will not be any such production in 1923 as this table indicates.

Another table prepared by the department of agriculture and commerce makes an estimate of the Japanese demand for pig iron and finished steel materials, and shows the percentage of demand satisfied by domestic production, from 1914 to 1921.

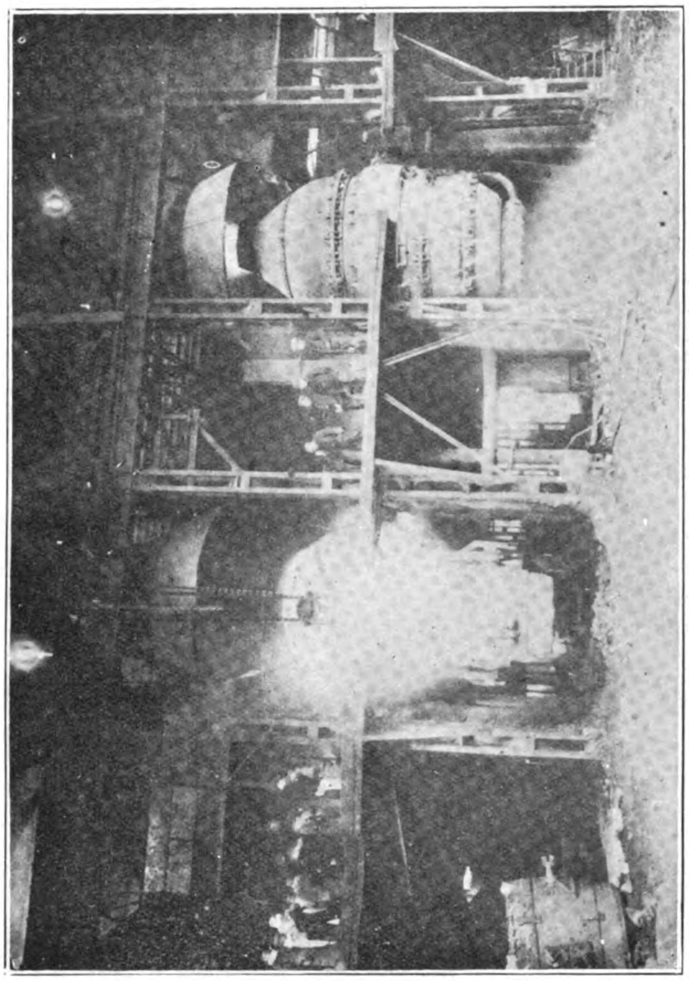
During the war and because of the great profits to be made in steel speculation, Japanese imports of steel were greatly in excess of any need of the country itself. Therefore these figures are to be taken at their face value only, and should not be construed as offering any real guide to the Japanese actual domestic demand for pig iron and finished steel materials.

The United States during the war became the principal seller of steel to Japan. Despite feverish post-war competition with English and German manufactures, the United States still continues

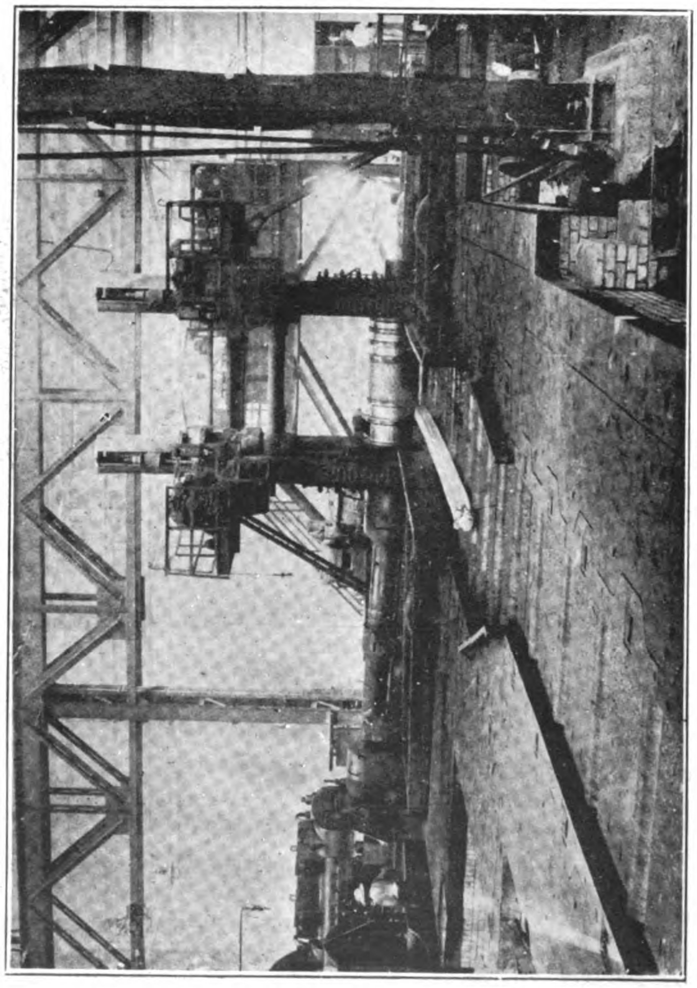
# IMPERIAL JAPANESE GOVERNMENT STEEL WORKS AT YAWATA, KYUSHU



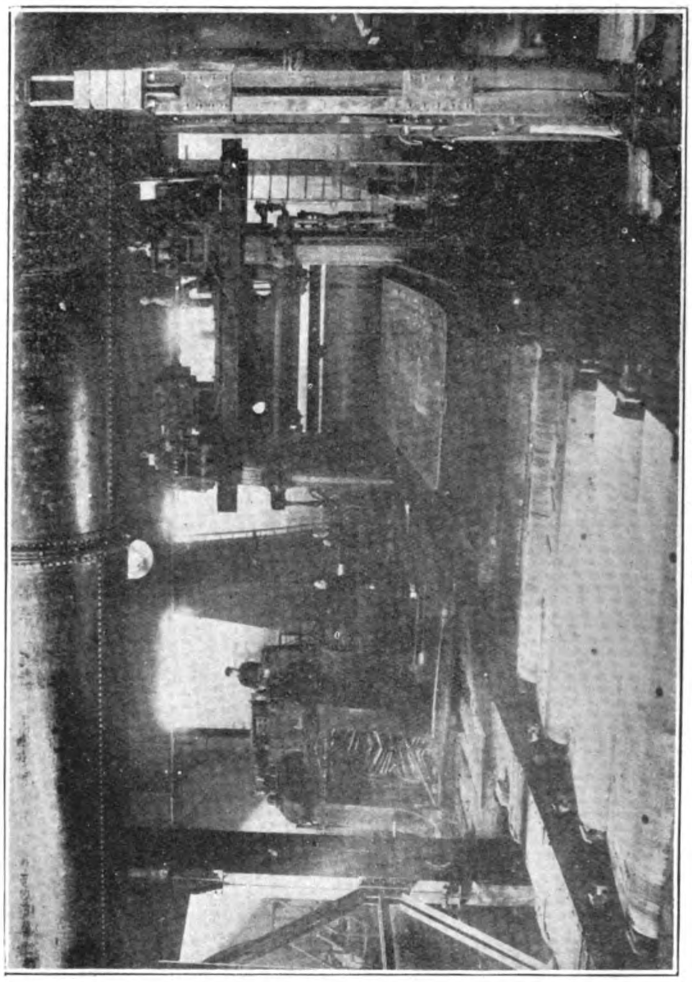
Flat Furnaces



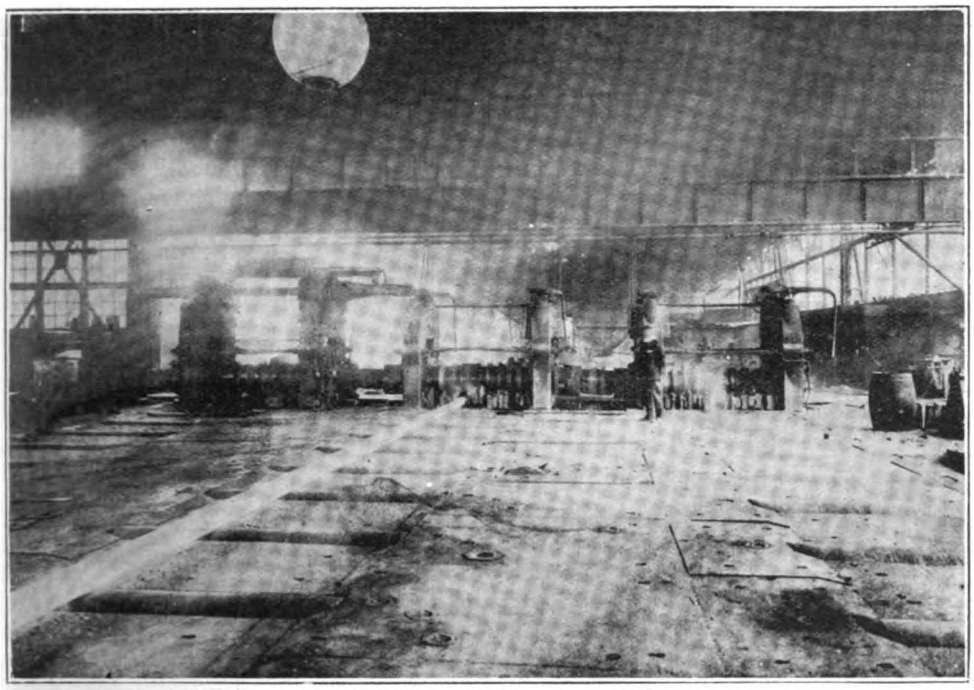
Rotary Furnaces



Ingot Mill



Heavy Plate Mill



Yawata Steel Works: Rail Mills

to supply about two-thirds of the Japanese steel requirements, and bids fair to retain its position as a seller to Japan for many years to come. Imports of iron and steel into Japan according to countries of origin for 1919, 1920 and 1921 are given below (in tons):

| | 1921 | 1920 | 1919 |
|---|---|---|---|
| China | P 76,160 | P 14,740 | P 95,189 |
| | S 1,174 | S 12,397 | S 1,071 |
| Great Britain | P 22,628 | P 58,565 | P 44,762 |
| | S 98,517 | S 140,568 | S 69,882 |
| Germany | P 3,444 | P 500 | — |
| | S 39,252 | S 1,885 | |
| Sweden | P 18,065 | P 14,158 | P 10,783 |
| | S 4,064 | S 3,661 | S 3,474 |
| United States | P 1,247 | P 35,512 | P 35,560 |
| | S 455,015 | S 857,822 | S 645,520 |
| British India | P 34,351 | 47,921 | 28,860 |
| Others | P 71,196 | 51,252 | 68,011 |
| | S 27,607 | 8,410 | 1,714 |
| Total | P 227,092 | 348,648 | 283,165 |
| | S 625,629 | 1,024,743 | 721,761 |

(P=Pig Iron. S=Steel).

There is no chance of mistaking the fact that Japan's steel industry is equipped to produce at least twice the actual present day requirements of the country's industries and builders. It is therefore little to be wondered at that the industry as a whole is now facing a period of reaction and adjustment. Loud cries are heard for a merger of all interests, both private and official. But such a merger stands little chance of success unless it includes the Yawata Steel Works, which supplies practically 75 per cent. of all Japan's domestically produced iron and steel materials.

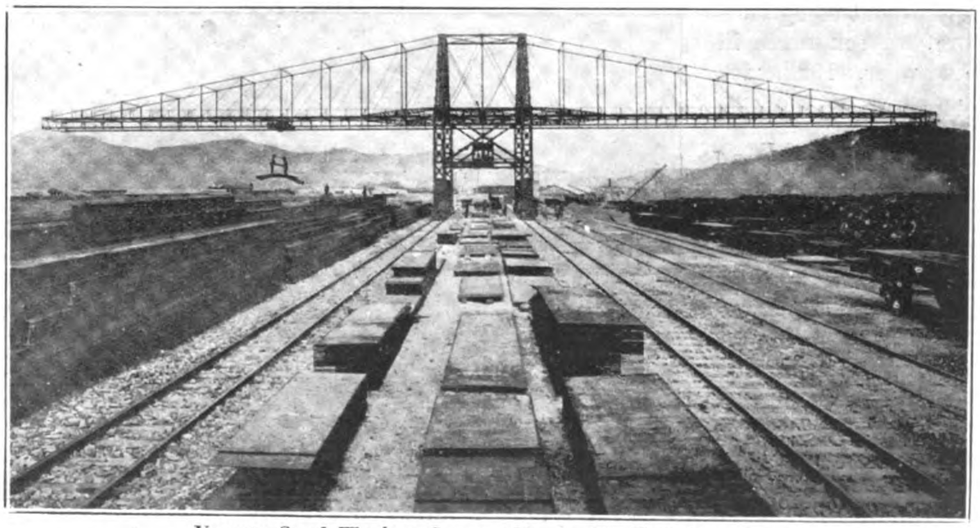
Historically considered, except for the period of the European war, the Japanese iron and steel industry has always been more or less on or near the rocks of complete collapse. The first iron works in Japan were government owned, and rapidly proved a hopeless failure. They were then transferred to private interests, which were no more successful than the government had been. In 1896 the Yawata Steel Works were approved by the diet, and were completed and opened to business in 1901 in time to prove of immense service to the nation during the Russo-Japanese war.

The general stimulation of manufacturing industries brought about by the Russo-Japanese war boomed iron and steel manufacturing and especially shipbuilding and the manufacture of arms. During the war the Kobe Steel Works, the Sumitomo Steel Works, the Hyogo mill of the Kawasaki Dockyard Co., the Japan Steel Works, were all established to meet the demands of the day. Except the last named, these were all on a small scale, and not one of them was equipped with rolling mill machinery. In 1913 the whole production of pig iron in Japan amounted to 243,000 tons, of steel 255,000 tons. Seventy per cent. of the pig iron and 85 per cent. of the steel shapes were produced in the Yawata Steel Mills, the government property.

The European war, with its embargoes on steel, exports, drove the Japanese to increasing their steel productive capacity. High prices of steel materials made capitalists run a mad race to share in the profits, and equipment utterly unsuited to the technical ability of the workmen, and the managers even, was hastily installed in existing mills, and new steel companies sprang up over night to share in the glorious business of war-time. Under war-time pressure the productive capacity of Japanese blast furnaces had increased to 612,000 tons by 1919, and the steel mills had a rolling capacity of 552,000 tons. Adding the productive capacity of Japan, of Chosen and Manchuria, the total pig iron capacity rose to 787,000 tons, and the steel shape productive capacity to 557,000 tons. More than Y.500,000,000 were invested in steel mills, and over a half million men were employed in the industry.

But the after the war reaction very materially affected the prosperity of Japan's steel mills. Small companies established in a period of prosperity at high costs of equipment, were hurriedly closed down. Many mills had not even completed installing their equipment. The heavy purchases of iron and steel made in the winter of 1919 and spring of 1920, largely contributed to cause the panic of April, 1920. And the huge stocks on hand after that brought prices down to panic levels, and all the mills still operating reduced production to the very lowest possible. And then on top of all these troubles came the Washington conference which limited armaments, and also the sales possibilities of the Japanese mills.

The pig iron producers were the hardest hit. There are 19 furnaces in Japan with a capacity of more than 100 tons each.



Yawata Steel Works : Storage Yard with Traveling Crane

Only ten are now in operation, and at reduced outputs at that. There is only one furnace of less than 100 tons, out of a total of 23 now in operation.

The following table shows the number of furnaces owned by the principal pig iron producers, and their capacity, at the end of 1921:—

| Mill | Capacity | Number Furnaces | Number in operation. |
|---|---|---|---|
| Yawata Steel Works .. | 100 tons | 6 | 5 |
| Toyo Steel Works .. | 100 | 2 | 1 |
| Kamaishi Mining .. | 100 | 2 | 1 |
| | Under 100 tons | 7 | 0 |
| Wanishi Works .. .. | 100 tons | 3 | 0 |
| | Under 100 tons | 1 | 1 |
| Others .. .. .. | Under 100 tons | 13 | 0 |
| Total, in Japan Proper : | | | |
| | 100 tons and over | 13 | 7 |
| | 100 tons under | 21 | 1 |
| Kenjiho, Manchuria .. | 100 tons over | 2 | 2 |
| Honkeiko, Manchuria .. | 100 tons over | 2 | 0 |
| | 100 tons under | 2 | 0 |
| South Manchuria Railway | 100 tons over | 2 | 1 |
| Total, all .. .. | 100 tons over | 19 | 10 |
| | 100 tons under | 23 | 1 |

Depression has not been so severe in the steel shape industry as it has been in the pig iron industry. The Japanese navy bought Japanese-made materials up to the limit of possibility, and the boom in building in Tokyo and Osaka helped largely to dispose of great stocks of building shapes, and opened a new market for new materials of domestic manufacture. The steel manufacturing interests are therefore able to make both ends meet, so that most of these mills are able to operate on part time. The limitation of armaments, however, dealt a blow from which they have not been able to recover. Particularly severe was this blow to the Nihon Seiko Sha, the Fukuai Mill of the Kawasaki Dockyard Co., the Kenjiho Mill of the Mitsubishi interests, the Kobe Steel Works, and the Asano Shipbuilding Co., plate mill.

Of the thirteen leading companies engaged in iron and steel manufacture to-day, six of them all showed losses in the first half of 1921, and in 1922 also. The total capital of these companies is Y.154,666,000, and their outstanding unpaid obligations amount to more than Y.100,000,000.

With the exception of two 10-ton rotary furnaces owned by the Yawata Steel Works, all the rotary furnaces in Japan are for casting only. These two furnaces produce something like 300,000 tons a year, pouring 50 times in 24 hours, operating 300 days a year. Adding this 300,000 tons to the total produced in the horizontal furnaces, the grand total of steel production (potential) in Japan at the end of 1921 was 1,782,600 tons in a year of 300 days.

Number and Capacity of Furnaces, end 1921

| Capacity | Number | Capacity | Number |
|---|---|---|---|
| 300 tons | 1 | 35 tons | 1 |
| 270 ,, | 2 | 30 ,, | 2 |
| 250 ,, | 3 | 25 ,, | 4 |
| 220 ,, | 2 | 20 ,, | 13 |
| 215 ,, | 1 | 18 ,, | 1 |
| 150 ,, | 2 | 15 ,, | 3 |
| 130 ,, | 2 | 12 ,, | 1 |
| 120 ,, | 2 | 10 ,, | 1 |
| 100 ,, | 3 | 7 ,, | 2 |
| 60 ,, | 1 | 5 ,, | 14 |
| 50 ,, | 2 | | |
| | | Total | 64 |

This number, however, does not include 102 electric furnaces of varying capacity, in use in many different industries.

Number and Capacity of Steel Converters

*Horizontal Type.*

| Capacity | Number |
|---|---|
| 60 tons | 4 |
| 50 ,, | 10 |
| 40 ,, | 1 |
| 25 ,, | 52 |
| 15 ,, | 13 |
| 10 ,, | 7 |
| 8 ,, | 7 |
| 7 ,, | 3 |
| 6 ,, | 3 |
| 5 ,, | 6 |
| 4 ,, | 1 |
| 3 ,, | 1 |
| Total | 107 |

*Rotary Type.*

| Capacity | Number |
|---|---|
| 10 tons | 2 |
| 2½ ,, | 2 |
| 2 ,, | 5 |
| 1½ ,, | 2 |
| 1 ,, | 1 |
| 0.95 ,, | 1 |
| 0.9 ,, | 1 |
| 0.8 ,, | 1 |
| 0.7 ,, | 1 |
| 0.5 ,, | 2 |
| Total | 18 |

## Official Statistics

The latest published report on the iron and steel production of Japan was made by the imperial department of agriculture and commerce in November, 1922, for conditions at the end of 1921.

There were 64 blast furnaces in Japan, December 31, 1921, with a capacity of 1,412,070 tons, figuring 330 working days, to the year; 104 horizontal furnaces for steel refining, capacity, 1,482,600 tons, 300 working days in a year, each furnace working to capacity twice in 24 hours.

Head Gear of the Futase Coal Mine, operated by the Yawata Steel Works

In addition, there are 51 crucible furnaces, and 42 electric furnaces for producing steel. Both of these tables include the furnaces at the Anzan Iron Works of the South Manchurian Railway, in Manchuria. From the end of 1921, to the present time, practically no changes have been made in the equipment of Japanese steel mills.

The table on next page shows the percentage of the total productive capacity which is official and private :—

MANUFACTURING CAPACITY

| | | | |
|---|---|---|---|
| Pig Iron: | | | |
| Total | 1,412,000 | tons | 100% |
| Official Mills | 400,000 | ,, | 28% |
| Private Mills | 1,012,000 | ,, | 72% |
| Steel: | | | |
| Total | 1,783,000 | tons | 100% |
| Official Mills | 750,000 | ,, | 42% |
| Private Mills | 1,033,000 | ,, | 58% |
| Spring Steel | 787,750 | ,, | |
| Plates | 396,000 | ,, | |
| Rails | 90,000 | ,, | |
| Wire | 114,500 | ,, | |
| Tubes | 61,000 | ,, | |
| Total | 1,449,250 | tons. | |

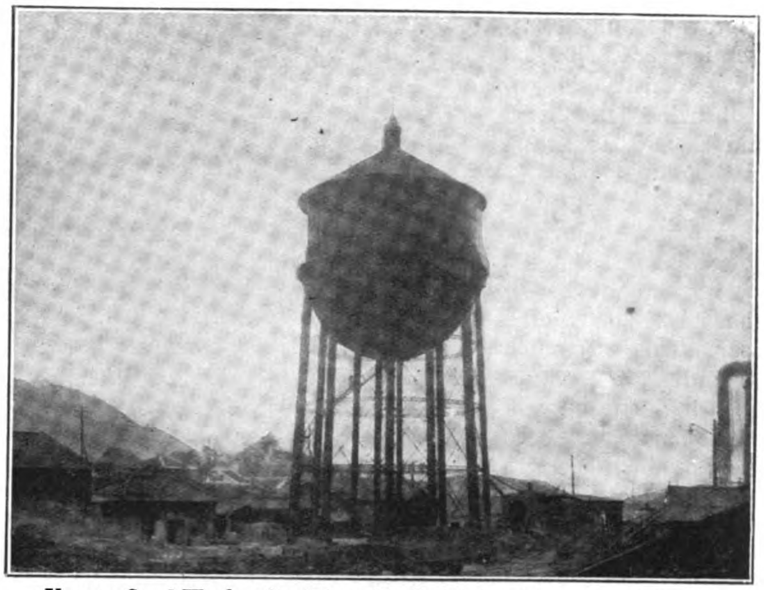
It is instructing to compare these capacity tables with those for actual production in recent years. The actual production of pig iron has not been more than 47 per cent. of the authorized capacity; and the production of steel has been about 40 per cent. of capacity. About 61 per cent. of the pig iron was produced by the government works, and 54 per cent. of the steel. In other words, owing to the depressed industrial conditions more than 70 per cent. of the private capacity lies idle.

OUTPUT OF PIG IRON IN TONS.

| | 1920 | 1921 | First Half 1922 |
|---|---|---|---|
| Japan | 521,036 | 475,947 | — |
| Chosen | 84,118 | 83,010 | — |
| Total | 605,154 | 558,947 | 341,429 |
| Manchuria | 116,037 | 93,951 | — |
| Iron Alloys | 8,839 | 7,574 | 4,633 |
| Total, excluding Manchuria | 613,993 | 566,531 | 346,062 |

OUTPUT OF STEEL IN TONS

| | 1920 | 1921 | First Half 1922 |
|---|---|---|---|
| Rolled Steel: | | | |
| Japan | 456,160 | 479,783 | — |
| Chosen | 26,419 | 30,026 | 292,689 |
| Forged Steel | 48,804 | 35,902 | 13,769 |
| Cast Steel | 29,687 | 30,143 | 19,746 |
| Special Steels | 2,810 | 11,972 | 326 |
| Total | 563,880 | 557,826 | 326,530 |



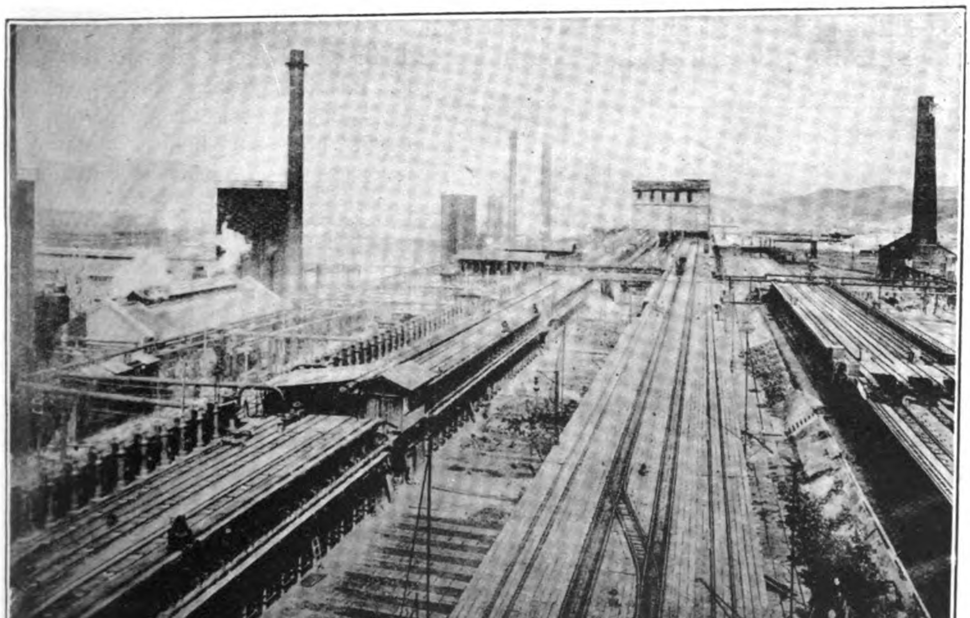
Yawata Steel Works: Sea Water Tank, 2.000 cubic metres capacity

## Japan's Great Government Steel Mills

The necessity of a national steel industry was early apparent to the imperial Japanese government and an attempt was made in 1891 to obtain the approval of the imperial diet for the establishment of a steel mill under government direction. But because of the insufficient data available on the iron deposits of the country the bill was rejected by the diet, which, however, approved a plan for the organization of a society for the investigation of the iron deposits of the nation.

The need of a domestic steel industry was made more apparent when the Sino-Japanese war broke out. In 1895 the imperial diet without opposition approved a bill providing for the construction of a 90,000 tons capacity steel mill to be government operated. The initial budget appropriated Y.4,095,793.40 for the plan. The village of Yawata, Onga-gun, Fukuoka prefecture, Kyushu, was decided on as the site of the mills.

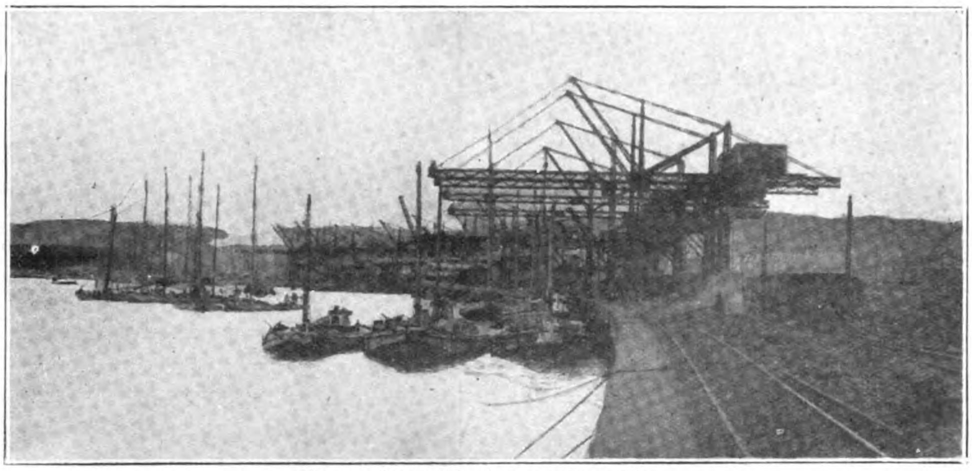
It did not take long to discover that the original appropriation was utterly insufficient for the purpose, and in several later sessions of the diet the sum of Y.15,841,016,851 was voted to defray necessary costs of construction. The first blast furnace was completed on February 5, 1901, and the manufacture of pig iron commenced in May of the same year. Other parts of the complete mill were opened up from time to time, but there were always many difficulties to be overcome, largely caused by the inefficiencies of the management. But because of the needs of the country during the Russo-Japanese war, an extraordinary budget of Y.4,696,126 was granted, and with this many improvements of equipment and technique were effected. During the war the demand for the manufactures of the works increased to an enormous extent, and it was impossible to supply all needs.



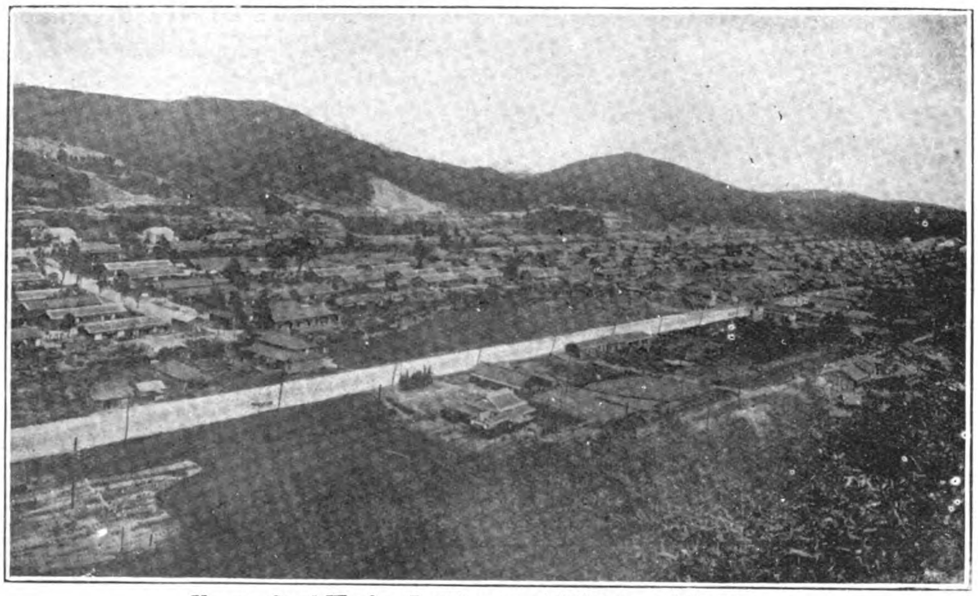
Yawata Steel Works: Coal Washing Plant and Coke Works

The great boom in manufacturing industries after the Russo-Japanese war maintained the demand for steel, and to meet the growing national demand it was planned to increase the works capacity to 180,000 tons. In 1906 the diet approved the costs of the expansion amounting, for the first term of construction, to Y.10.880,000. Work was commenced in 1906, and completed in 1909. Demand increased, and before long the plan for expansion had grown to a 350,000 tons mill. Another appropriation was made to cover construction for a period of five years from 1910, a total of Y.12,389,929 being approved by the diet. Later the government

approved an appropriation of Y.3,760,000 for the construction of a benzine distillery, and the No. 2 heavy plate mill.


Yawata Steel Works: Loading Pier

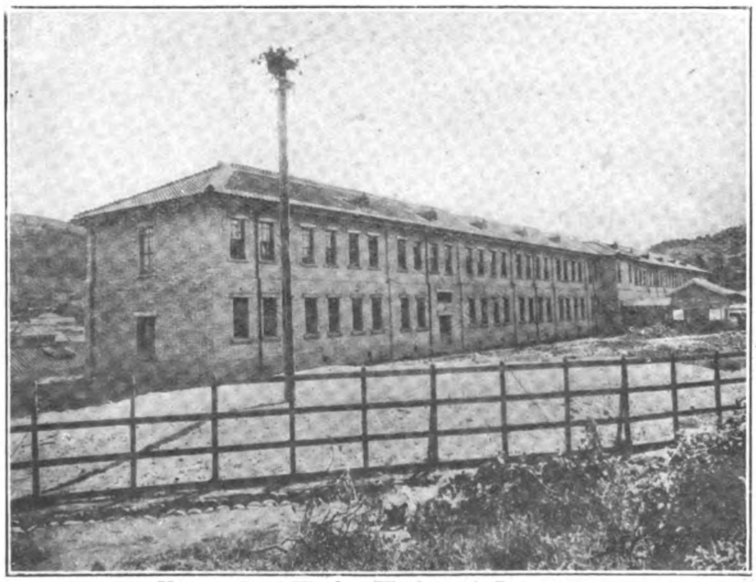
Before the European war the domestic demand for iron and steel amounted to about 1,300,000 tons a year. This was much beyond the manufacturing capacity of the Japanese mills. To bring production up to demand the Yawata Steel Mill authorities planned to increase the equipment to produce 650,000 tons. The diet approved a sum of Y.34,515,450 to be used in six years for this purpose. Construction was begun in 1916. But meanwhile the demand for steel increased at such a rate that the steel works requested sanction to complete the expansion in less time than the appropriation permitted. The government granted approval for completion in 1920, but the rise in the costs of materials made in impossible to carry out the plans with the sum allowed. Accordingly Y.11,805,500 was granted for the increased cost. Besides these expansions the mills decided to construct a 100,000 tons steel plate mill at a cost of Y.15,672,000.


Yawata Steel Works: Residences of Officials and Employees

With these great expansions of the capacity of the mills, it became necessary to consider a constant supply of ore. In 1919 the diet, therefore, approved the expenditure of Y.700,000 to purchase iron fields abroad, from which ore could be shipped to the mills for reduction, at not too high costs in freight charges.

The difficulties of obtaining workmen during the war, and also delays in obtaining equipment from abroad, retarded all construction plans. The completion was finally postponed to 1922, and the diet allowed Y.108,888 extra for the salaries of officials who would have to be retained until the construction works were completed.

In 1920, the total investment in all the works of the Yawata Steel Works, amounted to Y.98,754,151.


Yawata Steel Works: Workmen's Dormitory

## Process of Manufacture

The smelting operations are carried on throughout the year without ceasing. The ore is fed into the blast furnaces together with the lime and coke, and reduced by hot air blasts. The reduced metal is transferred to the mixing furnaces, where the quality of the steel to be produced is determined, and then is transferred to either a horizontal type, or rotary furnace. The reduced metal which is not transferred to the mixing furnace is poured into pigs, which are used for castings, or steel production in the horizontal furnaces. The slag is made into bricks, and used as raw material for cement.

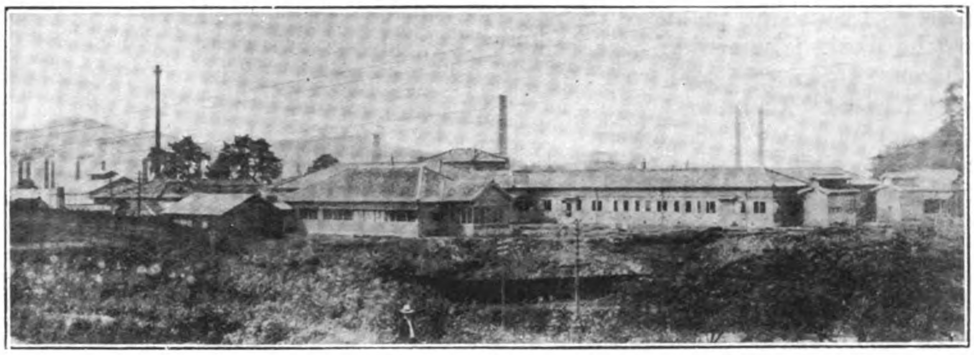
Gas discharged from the furnace is washed and used for operating gas furnaces, gas boilers, and hot air furnaces. Gas produced in the coke making furnace is used for the production of ammonium sulphate, tar, benzine, etc. From the coal tar, bye-product, tar oil, napthalene, etc., are manufactured. The same gases used to heat the coke furnace are also used for heating the steel ingots and steel plates for rolling. Part of the gas is further refined, and is used in the research laboratories, and hospital for illuminating. A slight surplus is sold in the city.

Ordinary steel is produced in the rotary and horizontal furnaces. Special steels are manufactured in crucible, or electric furnaces. At the rotary furnaces, the mixed metals are subjected to a hot air blast, and the refined material is cast into desired shapes, such as rails, etc. At the horizontal furnaces, cold pig is mixed with the hot mixture from the mixing furnaces, lime and scrap-iron, and refined by gas produced in the gas furnace; the product is cast into desired shapes. At the crucible furnaces, a special steel which is used in the manufacture of arms, machine tools, etc., is produced.

The steel ingots are transferred to another mill, where they are rolled and cut into preferred sizes, and then

delivered to the other shape making mills. The rolling machines used are of two and three roll types, made of cast-steel, and tempered steel, and they are operated by both steam and electricity.

The rail rolling mill uses the ingots without previous heating. The other mills all heat the ingots before rolling. Steel ingots for the thick plate mill are delivered direct from the furnace to the mill, where the ingots are again heated and rolled. Although the variety of shapes produced is great, the process of manufacture in all the mills is practically the same. The leading products of the mills are heavy and light rails, tees, channels, bars, plates, wire, shaft steel, arms, machine tools.



Yawata Steel Works: Hospital, Exterior and Interior

## Business Results

During the first year of its operations the Yawata Steel Works made a profit of Y.229. But in following years it sustained heavy losses regularly, until 1909. In 1910 a profit of Y.52,003 was made, and the next year operations showed a profit of Y.1,546,286. The greatest profit, practically paying the costs of construction to date, was Y.57,727,296, made in 1918. The following table shows the income, expenditure and profit of the Yawata Steel Works for the years 1918-1920:—

| Year | Income Yen | Expenditure Yen | Profit Yen |
|---|---|---|---|
| 1918.. .. | 107,781,793 | 56,406,511 | 57,727,296 |
| 1919.. .. | 85,733,924 | 76,533,789 | 5,094,823 |
| 1920.. .. | 56,699,684 | 82,080,723 | Loss 25,381,039 |

## Output of Iron and Steel

During the first year of operation the Yawata Works produced 876 tons of pig iron. Steel was manufactured in 1901 for the first time, and production amounted to 4,956 tons. In the same year 30,041 tons of pig iron were produced. The record production of pig iron was made in 1916, when it reached 302,058 tons. The largest output of steel was made in 1917, when it was 351,738 tons. Since the works were opened to business in 1901, something like 3,061,232 tons of pig iron and 3,330,742 tons of steels have been manufactured (up to 1920). For the five years ended 1920, the production of pig iron and steel is given in the following table:—

| Year | Pig Iron | Steel |
|---|---|---|
| 1916 .. .. | 302,058 tons | 276,944 tons |
| 1917 .. .. | 298,836 ,, | 351,738 ,, |
| 1918 .. .. | 269,185 ,, | 313,550 ,, |
| 1919 .. .. | 267,265 ,, | 287,253 ,, |
| 1920 .. .. | 243,571 ,, | 297,369 ,, |

Production of Manufactured Articles

| | 1918 Ton | 1919 Ton | 1920 Ton |
|---|---|---|---|
| Steel plate .. .. .. | 78,086 | 66,099 | 76,622 |
| Galvanized sheets .. .. | 2,558 | 1,472 | 1,780 |
| Steel bars .. .. .. | 63,103 | 67,051 | 75,234 |
| Heavy rails .. .. .. | 55,105 | 38,105 | 56,830 |
| Light rails .. .. .. | 52,449 | 53,299 | 36,616 |
| Rails accessories and rivets .. | 8,602 | 6,460 | 5,652 |
| Wheel rims .. .. .. | 4,507 | 4,573 | 5,003 |
| Wheel axles .. .. .. | 1,256 | 2,203 | 2,137 |
| Steel ingots and slabs .. .. | 10,258 | 20,639 | 8,638 |
| Tempered materials .. .. | 293 | 343 | 179 |
| Electric furnace steel .. .. | 553 | 249 | 309 |
| Others .. .. .. .. | 7,836 | 7,332 | 7,014 |

In recent years the proportion of the manufactures of the works which have been purchased by government departments has been on the increase until in the last year for which figures are obtainable, 1920, they were more than half of the total output. The following table shows the quantity and value of the sales to private and official works:—

Disposition of Output

| | Quantity 1918 Ton | 1919 Ton | 1920 Ton |
|---|---|---|---|
| Officially .. | 133,262 | 137,644 | 160,781 |
| At the Works .. | 24,608 | 18,344 | 15,475 |
| Private (public) . | 152,497 | 112,248 | 117,636 |
| Total .. | 310,367 | 268,236 | 293,892 |

Value

| | 1918 Yen | 1919 Yen | 1920 Yen |
|---|---|---|---|
| Officially .. | 36,690,499 | 37,276,991 | 38,117,451 |
| At the Works .. | 2,808,982 | 2,641,926 | 3,214,167 |
| Private .. .. | 66,696,732 | 26,466,873 | 86,206,403 |
| Total .. | 108,196,213 | 66,385,790 | 127,538,021 |

Naturally, the value of sales to private persons is much greater than that to official departments to whom only a small profit charge over and above the cost of production, is made.

Property owned by, and equipment of, the Yawata Steel Works: *Total Area of Works*: 1,717,262 *tsubo* (*tsubo* = 36 sq. ft.); inside yards, 575,516 *tsubo*; outside yards, 1,143,747 *tsubo*.

*Mines Owned.*—Iron Mines: Niigata prefecture, Akaishi Iron Mine, and Kurigatake Iron Mine. In Chosen, Kokaido. In-ritsu, and Sainei Iron Mines. Collieries: Fukuoka prefecture, Futase Coal Mine; Nagasaki prefecture; Shikamachi Coal Mines. Silica Mines: Ehime prefecture; Yokobayashi Mura, Fukuoka prefecture, Matsugawa Mura. Lime Deposits: Fukucka prefecture; Matsugae Mura, Oita prefecture; Tsugumi Mura and Aoe Mura. Zechstein Mines: Kwantung Districts, Shusuiton, etc.; Fukuoka prefecture, Katsugae Mura; Oita prefecture, Tsugumi Mura.

The coal mined is used as raw material for the coke furnace for making gas, and for heating ingots, and ordinary heating pur-

poses. Because the quality of the coal mined in the mines owned by the Works is somewhat poor, being high in sulphur and phosphorous content, the coal from the three mines is mixed for the coke furnace. There are five pits in the Futase Mine, and it produces about 750,000 tons a year. Of this total, 380,000 tons are used for coke, the balance for direct fuel. The Shikamatsu coal mine was opened in April, 1920, and production that year amounted to only 43,682 tons.

*Water Supply.*—The Works own five reservoirs, with a total capacity of 364,000 cubic metres. Another is now under construction, and another planned. The capacity of these two will be more than 8,300,000 cubic metres.

*Power.*—The Yawata Main Works: Potential horse power, 103,725 h.p.

*Details of Power Plant.*—Steam Plant: 247 boilers, 71 steam generators, with a total of 98,455 h.p., of which 57,395 is used direct for motive power, 4,830 in hydraulic work and 36,320 h.p. for producing electric power.

*Gas Plant.*—Uses exhaust of the blast furnaces: 3 gas generators, with a total potential power of 5,270 h.p.; 1 generator is used for supplying air to furnaces, 810 h.p.; 2 generators are used for producing electric power, 4,460 h.p.

*Electric Plant.*—Supplies 1,630 electric motors, using 63,562 h.p. electric furnaces; 5, using 1,940 k.v.a.; electric lights, 23,795, converted into 10 candle power, some 138,000 lights. Besides this some 700 k.w. are purchased from outside.

*Futase Branch Works.*—Steam Plant: total h.p. 11,753; used for transportation, 4,156 h.p.; generating electricity, 7,540 h.p.; other uses, 57 h.p. Generator: 5,131 kilowatts. Electric generator, total h.p: 12,062 h.p. Details: For transportation, 3,131 h.p.; for ventilation, 1,547 h.p.; for pumping, 5,525 h.p.; coal grading, 370 h.p.; other uses, 1,489 h.p.

*Transportation Equipment.*—Main Works: *Docks*: 1,759 *ken* (*ken* = 6-ft.). Of this total, 462 *ken* have a depth of 20-ft., so that vessels of 3,000 tons can be moored. *Basin*: 3 places with total area of 20,423 *tsubo.*

*Steamers Owned.*—4 vessels, *Keizan Maru*, *Chirin Maru*, *Konan Maru*, *Shiokubi Maru*. Total tonnage 29,723 tons.

*Small Vessels.*—14, total tonnage 569, in addition to 8 barges. Factory railways, 82 miles; steam locomotives, 102; electric locomotives, 9; steam cranes, 38; freight cars, 1,602.

*Factories*

| Name of Building. | Present Equipment | Equipment when expansion planned is completed. |
|---|---|---|
| Blast furnaces .. .. | 5 | 6 |
| Other furnaces .. | 13 | 13 |
| Gas refining apparatus | 3 | 3 |
| Gas tanks .. .. | 2 | 2 |
| Air drying apparatus .. | 1 | 1 |
| Pig iron casting equipment .. .. | 1 | 2 |
| Cooling towers .. .. | 4 | 4 |
| Casting mill .. .. | 2 | 2 |
| Coal washing plant .. | 3 | 3 |
| Coke furnaces .. .. | 1 | 2 |
| Sulphite mill .. .. | 1 | 1 |
| Ammonium sulphate mill | 2 | 2 |
| Benzine factory .. | 1 | 1 |
| Boilers .. .. .. | 210 | 339 |
| Power Plants: | | |
| Kawachi Power Plant | 1 | 1 |
| No. 1 ,, ,, | 1 | 1 |
| No. 2 ,, ,, | 1 | 1 |
| No. 3 ,, ,, | 1 | 1 |
| Laboratories .. .. | 2 | 2 |
| Lime factory .. .. | 1 | 1 |
| Fire proof brick factory | 1 | 1 |

*Factories*

| Name of Building. | Present Equipment | Equipment when expansion planned is completed. |
|---|---|---|
| High furnace, cement factory .. .. | 1 | 1 |
| Ore storehouses .. | 2 | 2 |
| Air supply room .. | 1 | 1 |
| Solution mixing mill .. | 1 | 1 |
| Dolomite factory .. | 2 | 3 |
| Pumping rooms .. | 7 | 7 |
| Rotary furnace mill .. | 1 | 1 |
| Horizontal furnace mill | 2 | 3 |
| Crucible steel mill .. | 1 | 1 |
| Electric furnace mill .. | 1 | 1 |
| Steel ingot mill .. | 3 | 6 |
| Rail mill .. .. | 1 | 1 |
| Large shape mills .. | 2 | 3 |
| Moulding mill .. .. | 1 | 1 |
| Medium size shape mill | 2 | 2 |
| Small size shape mill.. | 3 | 3 |
| Wire mill .. .. | 1 | 1 |
| Steel sheet mill .. | — | 1 |
| Thick plate mill .. | 2 | 2 |
| Medium plate mill .. | — | 1 |
| Tin plate mill .. .. | 1 | 1 |
| Flat bar mill .. .. | 1 | 1 |
| Compressor house .. | 1 | 1 |
| Tempering mill.. .. | 1 | 1 |
| Wheel rim mill .. | 1 | 1 |
| Bolt mill .. .. | 1 | 1 |
| Zinc refining mill .. | 1 | 1 |
| Iron alloy mill.. .. | 1 | 1 |
| Coal storage plants .. | 2 | 2 |
| Coal tar storage tank .. | 1 | 1 |
| By-products storage tanks | 5 | 5 |
| Transformer stations .. | 7 | 7 |
| Tempering mill.. .. | 1 | 1 |
| Can making mill .. | 2 | 2 |
| Wood working mill .. | 1 | 1 |
| Repair works .. .. | 2 | 2 |
| Testing plant .. .. | 1 | 1 |
| Warehouses for manufactures .. .. | 10 | 10 |
| Warehouses for miscellaneous goods .. | 28 | 28 |
| Round houses .. | 4 | 4 |
| Sea-shore cranes .. | 36 | 36 |
| Sea water tanks .. | 1 | 1 |

The manufacturing capacity of the different plants belonging to the steel works is given in the following table:—

| Pig Iron. | Present. | After expansion |
|---|---|---|
| Blast furnace .. .. .. | 5 | 6 |
| Manufacturing capacity .. | 400,000 tons | 500,000 tons |
| Steel Ingots: | | |
| Horizontal furnaces.. .. | 24 | 33 |
| Rotary furnaces .. .. | 2 | 2 |
| Crucible furnaces .. .. | 7 | 7 |
| Electric furnaces .. .. | 1 | 1 |
| Manufacturing capacity .. | 525,000 tons | 750,000 tons |

Rolling capacity after expansion works are completed:

| | |
|---|---|
| Rails .. .. .. .. | 90,000 tons |
| Bars, steel shapes, large .. .. | 330,000 ,, |
| medium .. | 96,000 ,, |
| small .. .. | 139,600 ,, |
| Steel plates, thick .. .. .. | 150,000 ,, |
| medium .. .. | 40,000 ,, |
| thin, and hyndulate .. | 47,500 ,, |
| flat bars .. .. | 37,000 ,, |

(*Continued on page 204*).

# The Bangkok Water Supply

## Description of the Works for Supplying the Siamese Capital with Potable Water

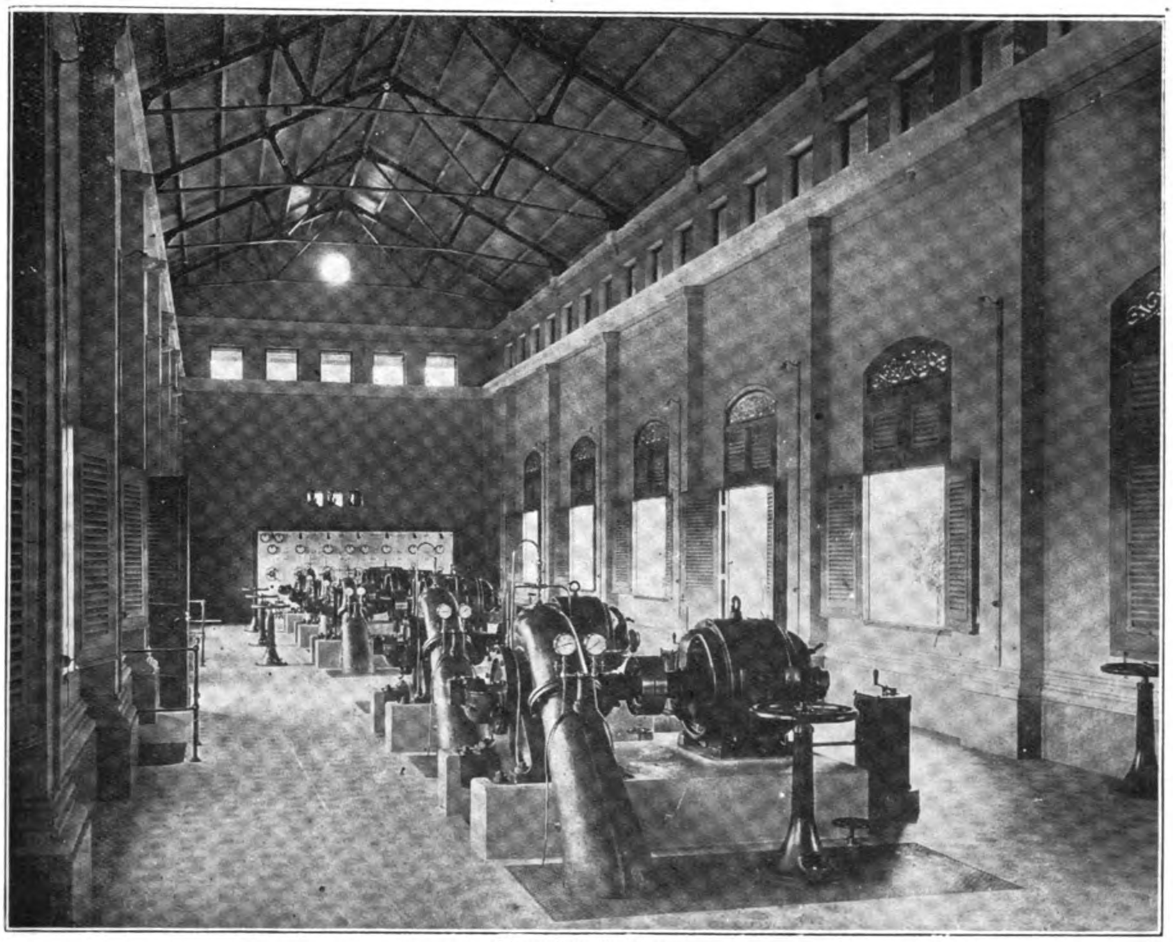
*By Fernand Didier, Ing. E.C.P., M.S.I.C., France, Chief Engineer of the Bangkok Waterworks*

OLD PREVAILING CONDITIONS.—The works for the supply of Bangkok with potable water were solemnly inaugurated, by His Majesty Rama VI on the 14th of November, 1914, and the service was commenced from that date.

Before that memorable event, the population of Bangkok, numbering about 330,000 inhabitants* had only very poor resources in water supply.

Rain water collected from the roofs was used during the west season, and stored by those who had the means to do it.

When rain water was no longer available, water had to be taken from the river, from the numerous klongs (canals) intersecting the town, and from the ponds and ditches excavated around the habitations. Only those who have seen the old Bangkok klongs can imagine to what extent this water was polluted.



Pumping Station

An old company pumping the water from the most polluted part of the river in the Chinese quarter, distributed this watei without any treatment, by intermittent service, to the few quarters of the southern part of the town where klong water was not easily obtainable.

Among the middle classes of the population, the water was clarified, if not purified, by treating it with alum in earthenware jars by the old process in use in ancient Egypt.

A few artesian wells bored during the preceding ten years supplied a comparatively pure water to a few fortunate establishments, but the amount of water deiived from this source was practically negligible as compared with the needs of the population.

The conditions regularly turned to the worse during the dry season when, as is explained later, the water becomes and remains brackish for several months, the pollution from the town being at the same time much aggravated by the ebb current in the river.

As soon as the new supply was started, the street fountains became very popular, and were well patronized.

All classes of the population eagerly availed themselves of this commodity, quite new to Bangkok, which contributed so much to the improvement of the conditions of life in the Siamese capital.

SOURCE OF SUPPLY.—No other source of supply being available, the only alternative was to take the water from the River Menam Chao Phya at a suitable place, and to have it conveyed to Bangkok and treated by the most approved process before being distributed.

The Menam Chao Phya is fed by four large tributary streams.

For a distance of about 200 kilometres, this river passes through a low-lying alluvial plain, and is tidal on about half this part.

Towards the end of the rainy season, it overflows its banks over the greater portion of this alluvial plain.

Owing to the influence of well marked dry and wet seasons, the condition of the river water varies greatly, not only during the year, but also from one year to another.

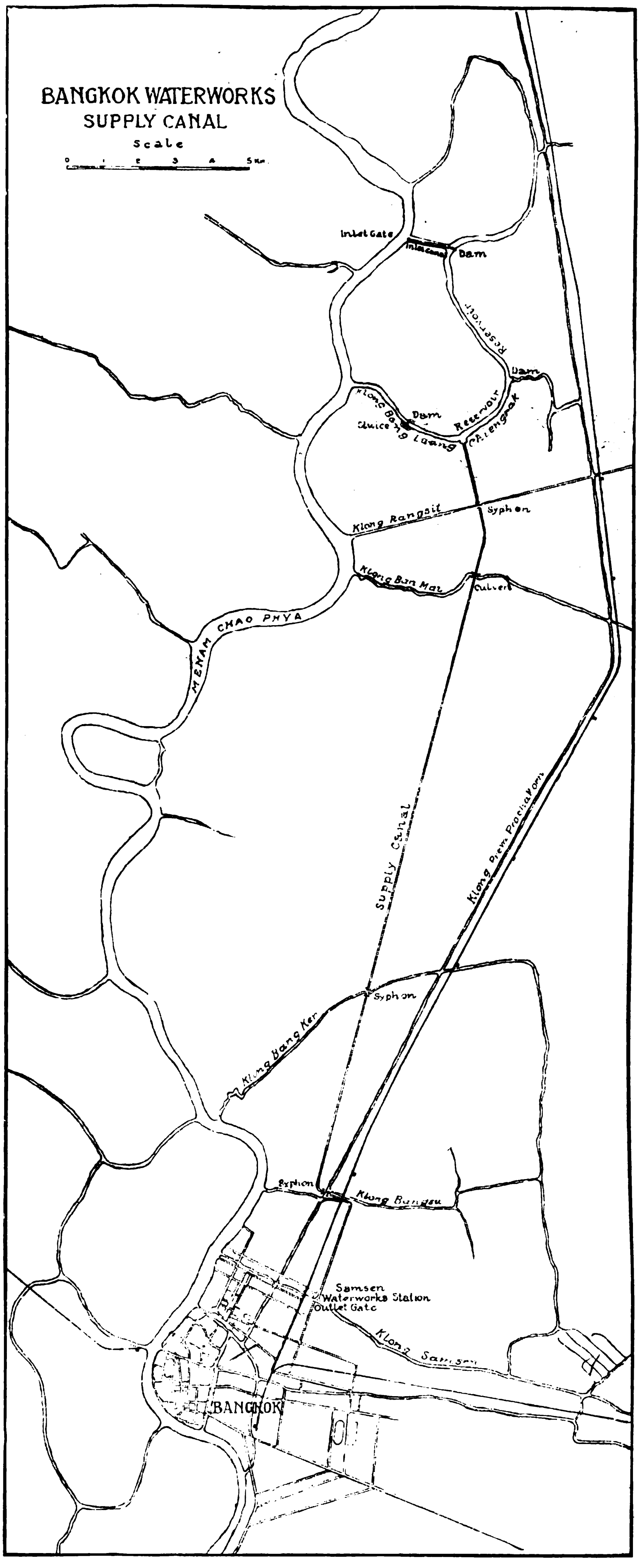
Bangkok is situated on the Menam Chao Phya, chiefly on the east side, about 52 kilometres from the sea following the windings of the river.

Salt is found in the river water at Bangkok, in quantities exceeding the usual limit during about two months and a half, from March to May, in normal years, and during five or even six months from January to June, in exceptionally dry years. Quantities exceeding 2 grammes sodium chloride per litre are quite usual, exceptionally rising to 4 grammes.

The brackish water in ordinary years goes up the river 24 kilometres above Bangkok, and even 30 kilometres in very exceptional years.

The intake gates situated at War Samle, 41 kilometres above the royal palace and far from any agglomeration are therefore safely out of reach by either the brackish or the highly polluted water.

*The population on the east bank is approximately 280,000, and about 50,000 inhabitants are spread over a large area on the west bank.




Supply Canal.—The Klong Bang Luang Chiengrak, an old branch of the river, has been converted into a large reservoir throughout a great part of its length, by erecting two earth dams across its bed.

An intake sluice with three gates 4 metres wide, opening and closing automatically, has been provided at the mouth of an intake canal 1,200 metres long, 18 metres wide on the surface, 4 metres deep, for the filling of the reservoir at high tide.

A diverting canal round the south dam, provided with a navigation sluice allows the access of boats and eventually of dredgers into the reservoir.

This reservoir has a length of 8 kilometres, widths varying between 60 and 100 metres and depths from 2 to 6 metres. Its normal capacity, which depends upon the possible variation in the water level, is approximately 200,000 cubic metres.

From Klong Bang Luang Chiengrak, the water is conveyed by means of a supply canal 26 kilometres long, 13 metres wide on the surface, and about 3 metres deep, to the waterworks station on the north-east boundary of Bangkok.

Two automatic gates, 4 metres wide, opening themselves at low tide, provide an outlet to the river, through Klong Samsen which has been deeply dredged accordingly. The closing of these gates at high tide prevents the river water from entering the supply canal.

The lower part of this canal is thus emptied during low tide to a very low level, and at the same time thoroughly flushed.

The filling of this emptied section during the closing of the gates at high tide contributes to maintain an efficient and fairly constant velocity in the upstream part of the canal which is fed continuously from the high level water in the reservoir.

The water in the whole system is thus kept in good condition, and no silting up of the supply canal has yet been noticed.

Great precautions have been taken to protect this supply canal against pollution, in order to take full advantage of the natural purification of the water flowing for 26 kilometres exposed to the action of the air and the sun.

Two earth embankments running along the banks prevent any flow of water from the adjoining fields or gardens.

As it was necessary to interfere as little as possible with the irrigation, drainage and navigation through the existing klongs crossed by the supply canal, three reinforced concrete syphons have been built under the waterways of Klong Rangsit, Klong Bangsue and Klong Prem.

A reinforced concrete culvert has also been laid under the supply canal at Klong Ban Mai for irrigation and drainage purposes.

Seventeen bridges have been erected, giving full facilities for crossing the canal.

A royal decree forbids, with proper penal sanctions, navigation, fishing, bathing, washing and any action which would cause a pollution of the water.

Seven stations for the canal-keepers and coolies are erected at the main works along the whole system.

The canal-keepers are under a responsible chief inspector stationed at Chiengrak with four gendarmes at his disposal.

The organization is completed by a telephone line connected with the waterworks central office.

Owing to these precautions, the water reaches the waterworks station in a much less polluted condition than at the intake.

An emergency reinforced concrete pipe 1.10 m. in diameter could be used to take water temporarily from the river at Samsen, during the high water season, for the few days

which would be required for diverting the supply canal in case of the syphons needing repairs.

A flushing tank is provided for the thorough flushing of this pipe before use.

Pumping Plant.—Electric power is supplied by a government power station established for centralizing the production in view of lowering its cost.

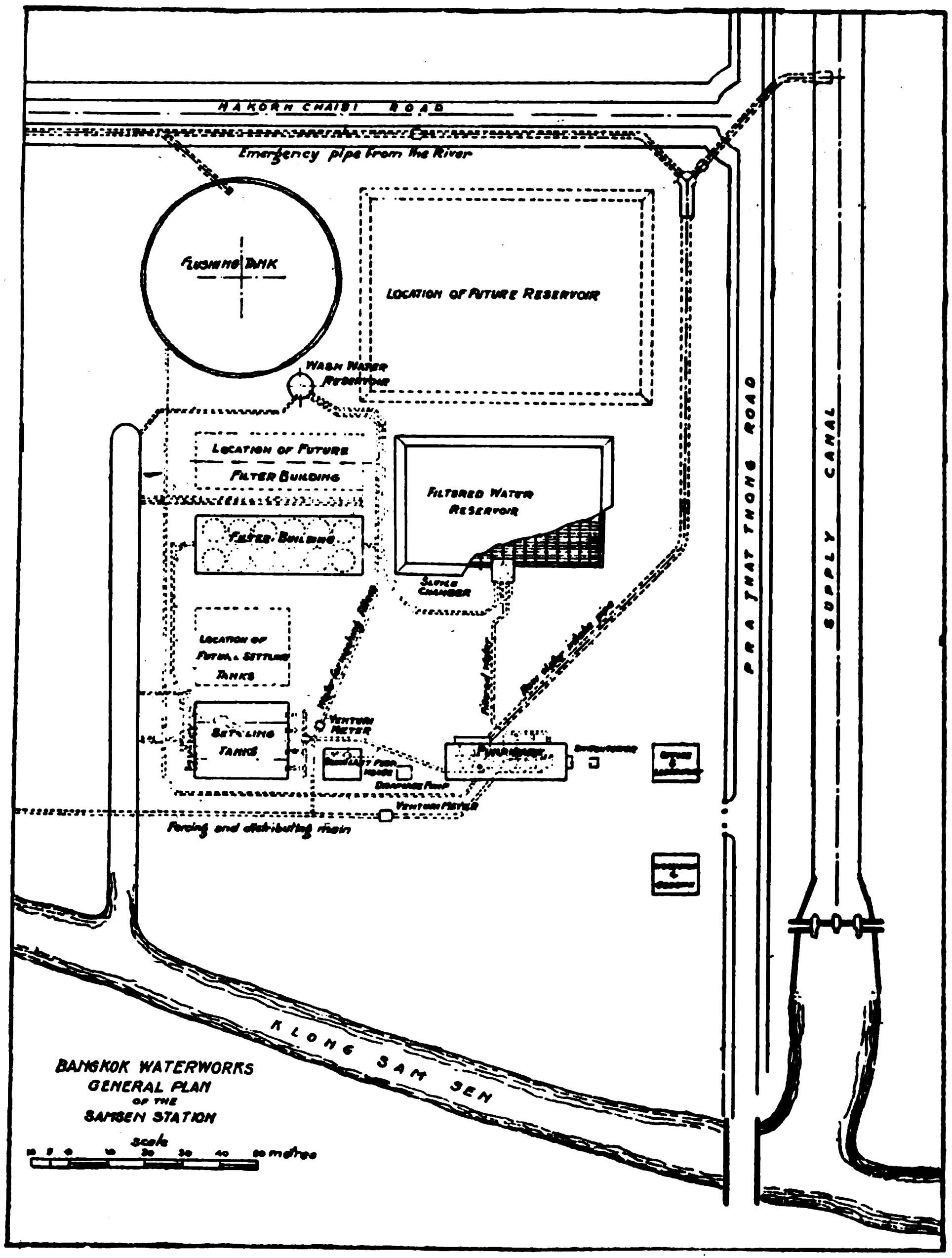
Power being available in that form, centrifugal pumps were adopted, as a matter of course, driven by asynchrone motors fed with the primary three-phase 50 periods 3,500 volts current without transformation.

A transformer reduces the tension to 100 volts for the small auxiliary motors and the light.

The raw water is pumped from the canal to the settling tanks by two low-lift centrifugal pumps, each having a capacity of 320 litres per second against a total head of 9 metres, driven by 60 h.p. motors at a speed of 720 revolutions per minute. One pump is normally in use while the other is in reserve.

The filtered water is pumped from a low storage reservoir and forced in the distributing main by three high-lift centrifugal pumps, each having a capacity of 250 litres against a head of 30 metres, driven by 160 h.p. motors at a speed of 960 revolutions per minute.

The total capacity of the plant is 26,000 cubic metres per day, with two pumps working during the day, one pump only working during the night, the third unit being in reserve.




A small air pump 200 m.m. in diameter 200 m.m. stroke driven by belt by a 3½ h.p. motor is provided for priming the pumps when necessary.

Room is provided for the addition of two more pumping units.

The pump house is 33 metres long and 8 metres wide, inside measurements. All electric cables and water pipes are located beneath the floor.

The electric switchboard is situated at one end. A cabinet at the other end contains a complete set of recording or registering instruments, including two Venturi water metres, for the hydraulic control of the whole installation.

Coagulation, Sedimentation and Rapid Filtration.—The turbidity of the raw water is subject to great and sudden variations, the most noticeable increases occurring after the heavy rainfalls at the beginning of the rainy season.

From October to April or May, the turbidity, measured with the scale of the U. S. geological survey, averages 80 to 100, with frequent increases to 150, and the amount of suspended matter ranges from 20 to 80 parts per 1,000,000.

From May or June to September, the turbidity averages 120 to 170, but 250 or 300 are frequent figures, and 400 has been recorded once. The amount of suspended matter during the same season averages 200 to 300 and has exceptionally reached 500 parts per 1,000,000.

In November or December, the turbidity is not in proportion to the amount of suspended matter, owing to the degree of fineness of the latter.

It would not have been possible to filter this water without a preparatory treatment.

The system of treating the water with a coagulant, for a quick sedimentation and a rapid filtration, known as the American system of filtration, has been selected as the most suitable for treating the raw water available.

The coagulant used is sulphate of alumina.

The following reaction takes place :

$$Al_2(SO_4)_3 + 3CaCO_3 + 3H_2O = Al_2(OH)_6 + 3CO_2 + 3CaSO_4$$

In plain words, the acid contained in the sulphate of alumina unites with the alkaline bases of the carbonates of the water thereby liberating the carbonic acid which is absorbed by the water, and setting free the insoluble aluminium hydrate which is precipitated.

This hydrate coagulates into gelatinous particles which aggregate the suspended substances of the raw water, mud, organic matter and also bacteria, and carry them down to the bottom of the settling tanks.

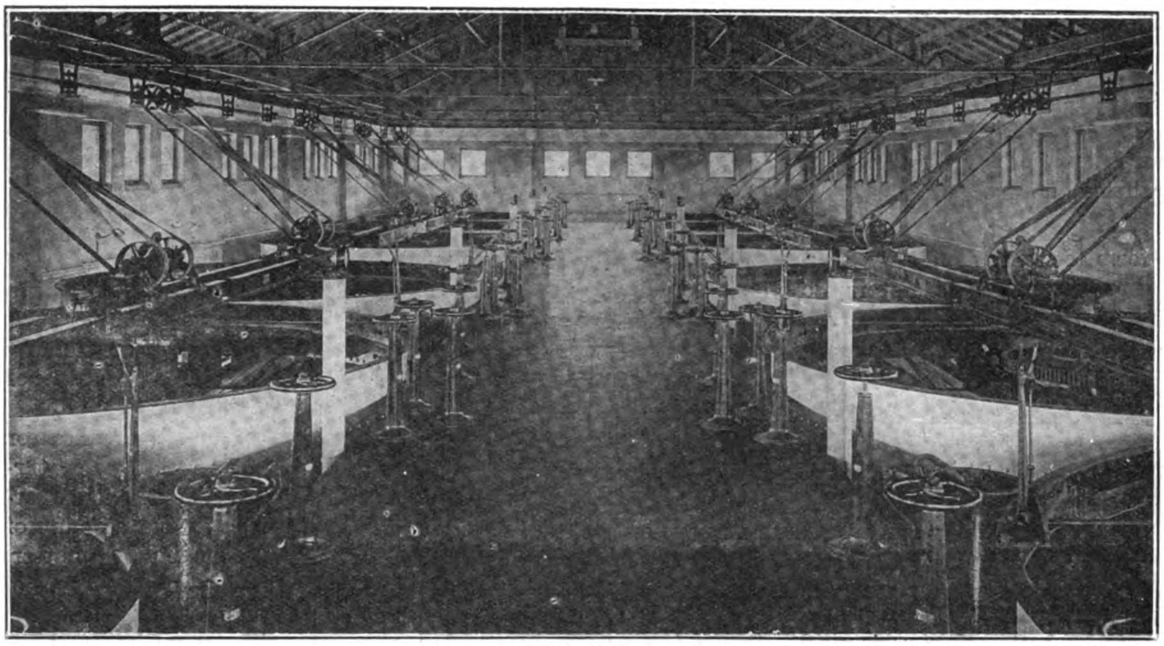
The alkaline carbonates of the water are partially changed into sulphates, the amount of bases being not altered.

The amount of sulphates in the water after treatment remains well within the limit quantities usually admitted in potable waters.

The total hardness of the water is not changed during the process.

The sulphate used is a very pure preparation absolutely free from arsenic.

The amount of carbonates in the raw water is liable to decrease below the required amount for the precipitating of the alumina.



Filter Plant

The settling tanks, built in reinforced concrete, are divided into four sections, each having a capacity of 760 cubic metres. Each section is provided with five baffle partitions. Two sections are kept in use during ten days, after which they are replaced by the two others and cleaned.

The water flows from these tanks to the filters by gravity.

There are twelve circular steel filters of the Jewell gravity low type.

The filter-bed, 5.18 m. in diameter is composed of a fine sand bed 1 metre thick, resting on a thin layer of gravel.

The collecting system embedded in this gravel consists of drain pipes provided with small brass strainers.

Such a decrease is very exceptional, and up to the present has occurred during five days only in October 1918, and during 16 days of the present rainy season. At such times this deficiency has been made good by adding exactly the required amount of sodium carbonate of a very pure quality.

These details are given with the purpose of showing that all precautions are taken to prevent even the smallest amount of alumina remaining in the filtered water.

The water after about two hours sedimentation contains only some fine coagulated particles and bacteria which are retained by the sand filter-beds.

The most efficient part of the filter-beds is the thin gelatinous layer formed upon the top of the sand by these particles, which allows a rate of filtration of 120 metres in 24 hours, or 40 times the usual rate in the slow sand filters treating uncoagulated water, with an equally high efficiency.

This very high rate fully justifies the term of " Rapid filtration " applied to this system.

Description of the Plant.—We shall now see how the above described operation are carried out in practice.

A weak solution of sulphate of alumina made in wooden tubs on the third floor of the coagulant house is distributed through regulating cocks fed from a constant level gravity box, at the uniform rate of one litre solution per minute for each working filter. A lead pipe conveys the solution by gravity into the raw water forcing main.

A very good mixing of the coagulant with the water is ensured by the flow of the latter in this main up to the settling tanks.

The quantity of coagulant used per cubic metre of water ranges from 24 to 34 grammes of sulphate containing 18 per cent. $Al_2O_3$, according to the condition of the raw water.

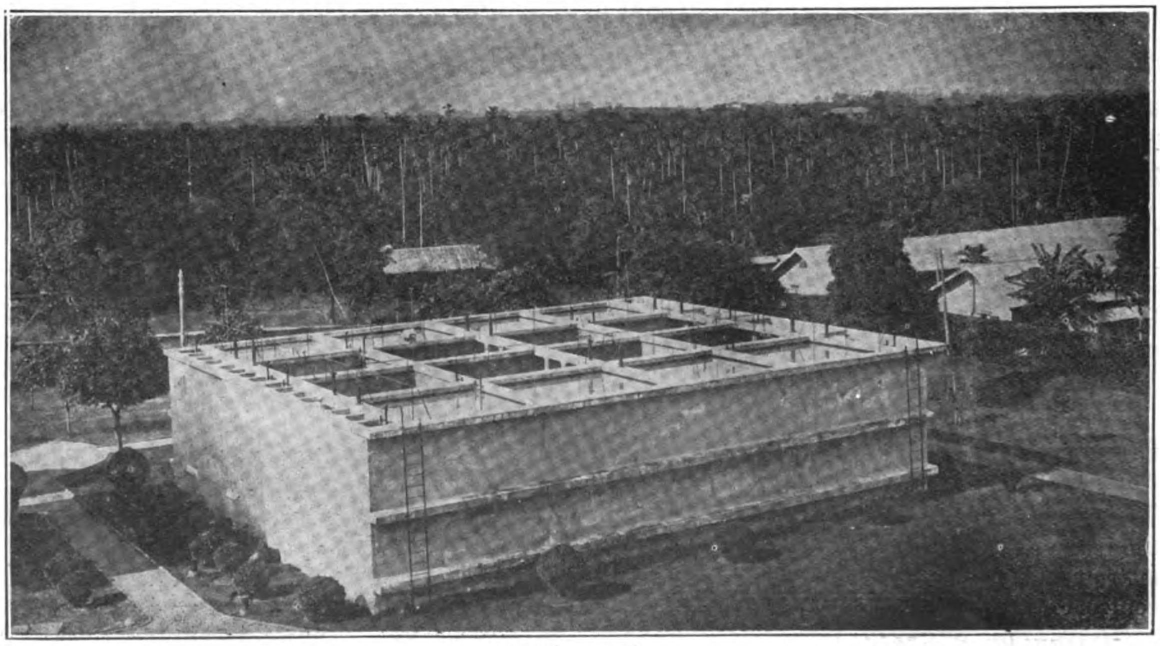
The water flows through the inlet into an annular space around the filter. An automatic inlet regulator maintains a constant level over the sand bed.

An automatic controller, of the Weston type, regulates the rate of filtration and maintains it perfectly uniform whatever be the condition of the filter-bed.

The loss of head through the filter varies from 0.80 to 3 metres approximately. A wash indicator shows this loss of head, and the point of washing the filter. In case of this point being accidentally passed, the Weston controller closes the outlet automatically and stops the filter.

The washing of a filter is carried out by forcing filtered water from a special reservoir through the collecting system and the filter-bed, while the sand is thoroughly stirred to its entire depth by agitators electrically driven. The water is evacuated through the inlet annular space. This operation takes about 6 or 7 minutes with a water consumption of about 60 cubic metres.

The filter is then put in " rewash," or in plain words the first filtered water is wasted for a period of 30 minutes. This rewash allows the formation of the gelatinous film with an ample margin



Settling Tanks

of security, the usual time required for this being about 10 minutes. Then the filter is put again into normal working.

A filter works from 15 to 60 hours according to the condition of the raw water.

The twelve filters, including all the mains, valves, indicators, the 15 h.p. electric motor and shafting for driving the agitators, etc., are sheltered in a spacious building 44 metres long by 16 metres wide, inside dimensions.

From the Weston controller's outlet, the filtered water falls into a masonry flume and goes by gravity to the low filtered water reservoir. This fall contributes to a certain extent to the aeration of the water.

The low filtered water reservoir, measuring 54 metres by 36 metres with a total capacity of 5,700 cubic metres is entirely built of reinforced concrete, and is covered with a thick layer of earth. It is divided into two sections for cleaning, and all its ventilation openings are lined with wire gauze ensuring a perfect protection against mosquitos, flies, insects, lizards, etc. The overflow drain is, for the same purpose, water sealed.

From this reservoir the water is pumped into the distribution system.

The efficiency of the plant is closely checked by daily observations of the turbidity of both the raw and the settled water, and of the color of the filtered water.

The figure found for the turbidity of the settled water shows at once if the amount of coagulant used is correct.

The alkalinity is measured twice a day when a deficiency is noticed.

Bacteriological examinations are made daily at the laboratory of the medical officer of health, and the chemical analyses are carried out monthly at the laboratory of the ministry of commerce.

Elevated Reservoirs

Advantages of the Rapid Filtration Over Slow Sand Filtration.—After this description, it is well worth pointing out the advantages of this system and the reasons which have lead to its adoption.

1. The preliminary treatment of the water by a coagulant is quite simple and the two hour sedimentation is carried on in settling tanks which can be very easily cleaned. Without coagulation, the removal of suspended matters is a most difficult problem requiring the passing through several stages of roughing filters with shallow beds of various grades of gravel and coarse sand filters before the final filtration. The cleaning of these various roughing filters is a most difficult and expensive operation.
2. The rapid filters take a considerably smaller area than slow sand filters, forty times less, not counting the roughing filters required with slow sand filters. Their first cost is therefore much smaller.
3. The rapid filters are well sheltered, and consequently protected from the sun from the wind or rain storms which are causes of evaporation or disturbance of the filtering film.
4. The rapid filters require a smaller staff and are operated from outside, without any risk of pollution.
5. The time for cleaning rapid filters is indicated mechanically without any doubt, and there is no necessity of waiting the results of bacteriological examinations.
6. The system is easily adaptable to the variations in the character of the water, by varying the amount of coagulant used.

Summing up, the rapid filtration system has an indisputable superiority over slow sand filtration which is still more marked in the treatment of turbid waters subject to great variations in character.

Distribution System.—The filtered water is forced by the high lift pumps into a distributing main 700 m.m. in diameter and about 4 kilometres long which is connected to the bottom of the elevated reservoirs near the centre of the distribution system.

These reservoirs, two in number, have each a capacity of 1,000 cubic metres, with overflow 24 metres above ground. They are built entirely in reinforced concrete, covered and provided with ventilation openings lined with wire gauze.

The offices, workshops, godowns, laboratory for testing metres, etc., are located on the same site.

The distribution system, spread over a large area, includes 95 kilometres of cast iron mains from 700 to 80 m.m. diameter.

The rubber ring joints, adopted on account of the soft nature of the ground and of the unavoidable presence of surface water in the trenches, have saved greatly in the cost of laying, and have proved very efficient in numerous cases of sinking of the mains.

A very wise policy has been adopted for the distribution of the water to the poorest classes of the population, in the erection of not less than 390 public street fountains. 235 of these fountains are fitted with a 100 m.m. fire hydrant enclosed in the body.

These hydrants have on numerous occasions played an important part in controlling fires at the outbreak.

The water is sold through metered services at the reasonable price of 25 satangs or about 6d. per cubic metre. Decreasing rates are applied to large consumptions.

The development of the metered services has been greatly handicapped not only by the scarcity of and the high prices paid for material during the war, but chiefly by the facilities given to draw free water at the street fountains. Nevertheless, the number of customers has recently reached 3,000. All wharves are equipped with hydrants for supplying water to shipping.

Extensions to the distribution system are carried every year, and a scheme is under consideration for the distribution of water on the west bank. The naval establishments are already supplied through a 100 m.m. syphon laid across the river. The want of proper roads in these quarters has been the cause of the delay in carrying out a general scheme.

The daily consumption is in constant progression. It varies from 10,000 to 13,000 cubic metres, the highest figure being reached during the dry season, when people from outer districts come in

great numbers with their boats laden full of jars, drawing water day and night from the fountains standing near the waterways.

The highest consumption corresponds to about 47 litres per head and per day. This low figure shows that there are still good prospects for the development of the sale of water.

The present daily capacity, as explained, is 26,000 cubic metres, and everything has been foreseen for an easy duplicating of the plant, providing an ample margin for the future.

Quality of the Water Distributed.—The results attained in the purification of the water are well summarized in a yearly report issued at the end of November 1921 by the medical officer of health which is reproduced hereafter :

*Bacteriological Analysis.—This is done daily. The water has always been well within the margin of safety as laid down by all competent authorities both in respect to the actual bacterial content and the number of c.c. which must be examined before intestinal organising are found. The former figure has usually been in the neighborhood of* 12 *which is very low and invariably well below that of* 100 *which is permissible. The latter figure has seldom been below* 20 *and frequently been* 30 *and over which is two or three times better than the figure* 10 *which is in this case permissible.*

*The efficiency percentage which is not so important a matter as the two factors already referred to has usually been* 98 *per cent. (a high standard) and seldom less than* 96 *per cent.*

*Chemical Analysis.—This is done monthly. Not only has there never once been any chemical evidence of harmful pollution but on the contrary every analysis shows a high state of purification. The water has always been a soft water.*

*These two analyses have been systematically carried out on all the waters commencing at the raw water as it enters the filter station and ending at the various taps throughout the city.*

*Conclusion.—This inspection shows that not only is the filter plant doing its work very efficiently but that water supplied to Bangkok is an excellent potable, washing and commercial water and compares most favorably with that supplied to most of the cities throughout the world.*

This report, confirming as it does the efficiency of the safeguards employed, forms a fitting conclusion to the description of the methods in use in the Bangkok Waterworks.

This somewhat detailed description has been prepared with the hope that it may contribute to the confidence of the public in the daily use of that great commodity which is now at its disposal, namely, a pure and abundant water supply.

# Japanese Ice Combine

## The Nitto Ice Manufacturing Co., Ltd.

THE Nitto Ice Manufacturing Co., Ltd., has acquired its principal plants by amalgamations with other companies. It has built very few new plants of its own. As a consequence its fixed property investment is low, and as its policy has been to make large sales at low prices, its business has expanded year after year. The smaller ice manufacturing companies have been obliged to follow its lead, and their operations are now contingent upon those of the Nitto Seihyo.

Owing to the slack organization of most of the ice manufacturing companies in Japan, for many years the banks refused to accept their shares as securities for loans. But with the establishment of the Nitto Seihyo, and its continued prosperity, the banks now accept ice manufacturing shares as tangible securities.

The Nitto Seihyo is a national concern, with branches in Taiwan, Kyushu, in the east and in the north of Japan, as well as many plants in the great centres. It is now operating all over Japan, and is able to regulate supplies according to the demands of different communities. Production is practically the same year after year, and average business results have been unvarying for the past five years.

The most recent development in ice using in Japan has been the steadily growing demand for cold storage plants. It is recognized that the need of cold storage plants in Japan is daily growing more and more acute, as the country's food supplies are more and more being imported from China and Australia, while the fish consumed in the big cities must be transported from the farthest ends of the empire. Ice manufacturers have recently turned their attention to building cold storage plants and the profits earned on them have stimulated competition on all sides. The Nitto Seihyo has recently adopted the policy of equipping all its new plants with cold storage facilities.

The Nitto Seihyo K.K. was formed by the amalgamation of the Nihon Seihyo K.K., and the Toyo Seihyo K.K., in April, 1919, with a capital of Y.9,200,000. Later, other mergers were carried out, and the capital increased to Y.15,251,200, at which figure it stands to-day. The company owns and operates 77 ice plants, located in all parts of Japan.

The total ice manufacturing capacity of all these plants is 2,799.5 tons a day with cold storage capacity of 263 tons a day. Besides these 77 factories the company operates in co-operation with 29 other concerns in the same line of business. These companies produce 503.5 tons of ice a day, and have cold storage capacity for 95 tons. The largest unit produces 165 tons a day, the smallest, 3 tons, but the average plant has a capacity of more than 25 tons a day.

The head office of the Nitto Seihyo K.K. is at 171 Narihira Cho, Nakano Go, Honjo Ku, Tokyo city. The company was originally established in May, 1907, but the present organization was effected in 1919. The officers of the company are : President, E. Wago ; Managing Directors, T. Takagi and Y. Masutani ; Directors, S. Hara, T. Hashimoto, K. Yoshihiro, S. Uru, T. Kume, T. Makita, H. Kato, K. Aoki, S. Sawayama and T. Shigei.

## JAPAN IRON AND STEEL INDUSTRY

(*Continued from page 198*)

| | |
|---|---|
| Wire .. .. .. .. .. | 50,000 tons |
| Steel sheets .. .. .. .. | 100,000 ,, |
| Tempered steel, wheel rims, etc. .. | 40,000 ,, |

| Coke. | Present. | Future. |
|---|---|---|
| Coke furnace .. | 490 units | 590 units |
| Capacity .. .. | 500,000 tons | 570,000 tons |

By-products, after expansion is completed :

| | Present. | Future. |
|---|---|---|
| Brick .. .. | 140,000 tons | |
| High furnace cement | 18,000 tons | |
| Pitch .. .. | 14,000 tons | 24,000 tons |
| Tar oil .. .. | 7,000 | 10,000 |
| Ammonium sulphate | 6,000 tons | 9,000 tons |
| Benzol .. .. | 3,000 tons | 4,200 tons |

It has just been announced in the imperial diet that attempts which have been made by interested private concerns to effect a combination with the Imperial Government's Yawata Steel Works, will not have the support of the government at this time. So for some time to come it may be taken that these mills will continue under government management. As the business world becomes more confident the business results of the Works will improve. Since the great war they have been a very paying investment for the government.

# Petroleum in Borneo

*By Arthur H. Redfield*

*Concessions.*—The concessions range in size from 8,670 to 334,085 acres and most of them have been granted for periods of 75 years, in consideration of an annual royalty of \$.201 per cubic meter of petroleum, coal, or other hydrocarbons produced. Usually a minimum yearly royalty is stipulated, ranging from \$1,000 to \$7,612.

*Production.*—The production of crude oil in metric tons in Koetei by the Royal Dutch-Shell group, 1910-1920, is illustrated by the following table :—

TABLE II.

| | Louise Concession. | Nonny Concession. | Moeara Concession. | Total. |
|---|---|---|---|---|
| 1910 .. .. | 373,086 | 1,180 | 32,087 | 406,670* |
| 1911 .. .. | 495,124 | 53,396 | 28,284 | 576,804 |
| 1912 .. .. | 370,278 | 53,852 | 26,715 | 450,845 |
| 1913 .. .. | 394,339 | 69,131 | 77,595 | 541,083† |
| 1914 .. .. | 417,410 | 120,240 | 74,854 | 612,504 |
| 1915 .. .. | 419,053 | 164,288 | 68,150 | 651,491 |
| 1916 .. .. | 461,923 | 198,199 | 63,944 | 724,066 |
| 1917 .. .. | 398,841 | 152,559 | 65,901 | 617,301 |
| 1918 .. .. | 419,423 | 169,243 | 76,815 | 685,481 |
| 1919 .. .. | — ¶ | — ¶ | — ¶ | 770,000‡ |
| 1920 .. .. | — ¶ | — ¶ | — ¶ | 744,119§ |

In addition to the output of the Royal Dutch companies the Nederlandsche Koloniale Maatschappij, a Standard Oil subsidiary, produced 188 metric tons in 1914; 217 tons in 1915; 371 tons in 1916; 139 tons in 1917 and 252 tons in 1918. No figures for later years are available. The production of the Koloniale Maatschappij came almost entirely from its Sadjau concession.

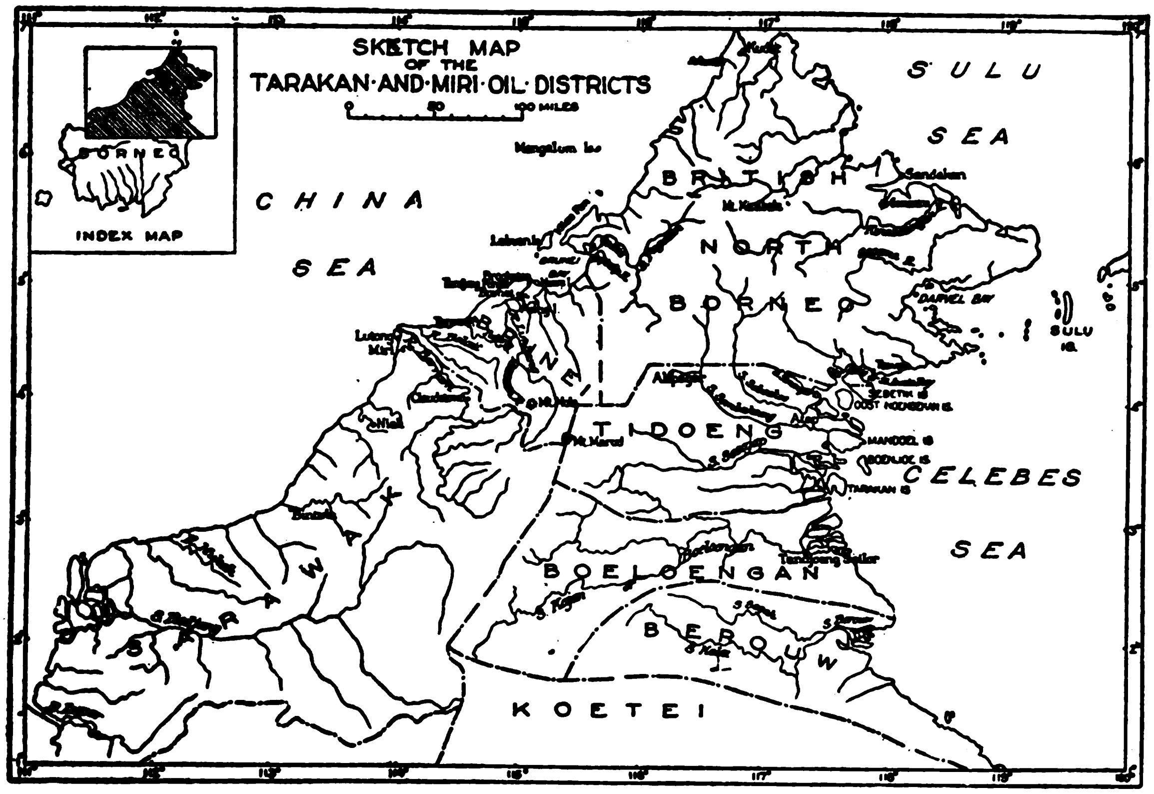



FIG. 36.

*Character of Oil.*—Three types of oil were won in the Sanga Sanga oil field, from a single structure, such as the Sanga Sanga dome or the Sambodja dome, a heavy asphalt-base petroleum, alight asphalt-base oil, and a "paraffine oil." The specific gravity of the heavy oil ranges between 0.96 and 0.89; that of the light oil between 0.88 and 0.85; and that of the paraffine oil between 0.86 and 0.84. These oils are from definite horizons in the Sanga Sanga beds. In a vertical section taken along the anticlinal axis, the heavy asphaltic oil horizons are found to occur in general at depths of 30 to 150 metres (98 to 490 feet) below sea-level; the light asphaltic oils generally between 240 and 300 metres (between 790 and 1,080 feet) below sea-level; and the light paraffine oil horizons for the most part between 330 and 385 metres (1,080 and 1,260 feet below sea-level, although horizons of this oil have been found as low as 512 metres (1,680 feet) below sea-level. The mouths of the wells occur at altitudes varying from sea-level to 60 metres (196 feet) above sea-level.

The heavy asphalt-base oil has an average specific gravity of 0.9630. The boiling point ranges between 194° and 212° C. The kerosene fraction averages 35.5 per cent., and the lubricating oil fraction 50 per cent. The fraction over 300° C. gives an average of 26.5 per cent. of thick fluid paraffine, indicating an average paraffine percentage of 13.17 in the crude oil. The sulphur content of the crude oil varies between 0.101 and 0.159 per cent.

The specific gravity of the light asphaltic-oil averages 0.8688. This oil has a lower boiling point than the heavy asphaltic oil, varying between 61° and 78° C. The average yield of benzine and light oils is 25 per cent.; of kerosene is 49 per cent.; and of lubricating oils is 20.25 per cent. The sulphur content averages 0.11 per cent. The distillate over 300° C. contains on an average 35.5 per cent. of thick fluid paraffine, indicating an average paraffine content of 7.5 per cent. in the crude petroleum.

The average specific gravity of the light paraffine oil is about 0.8564. Its boiling point ranges between 55° and 84° C. The benzine fraction averages 22.6 per cent.; the kerosene fraction 46.5 per cent.; and the lubricating oil fraction 25 per cent. The distillate over 300° C. contains 40 per cent. of solid paraffine, indicating a paraffine content of 10.1 per cent. in the crude oil. The sulphur content averages 0.07 per cent.

* Includes 317 metric tons produced on the Mathilde Concession.
† Includes 13 metric tons produced on the Toenkoedasing Concessiou and 10 metric tons produced on the Mintoet Concession.
‡ Estimated.
§ Hoofd van het Mijinwezen, Batavia.
¶ No data.

In Table III. the analyses* typify the three groups of heavy asphaltic oil (I.), light asphaltic oil (II.), and light paraffine oil (III.) from Sanga Sanga.

TABLE III.

| | I. | | II. | | III. | |
|---|---|---|---|---|---|---|
| | % | Spec. Gr. | % | Spec. Gr. | % | Spec. Gr. |
| Up to 150° C .. | 2.4 | 0.804 | 17.5 | 0.815 | 33.05 | 0.7957 |
| 150° to 300° C .. | 33.8 | 0.896 | 78.1 | 0.872 | 44.05 | 0.8426 |
| Over 300° C .. | 63.8 | 0.994 | 4.4 | 0.980 | 18.55 | Solid distillate |
| Loss .. | — | — | — | — | 4.35 | — |

The oil-bearing horizons of the Sambodja field have been redivided into four groups of horizons, according to the character of the oil they produce. These oils are named respectively the kerosene-asphalt oil; the residum-asphalt oil; the asphalt-base kerosene oil; and the paraffine-base kerosene oil.

TABLE IV.

Analyses of Typical Crude Oils from Sambodja East Borneo.†

| | Number of Analysis | Fractions Oo—150° C. % | 150°–300° C. % | Over 300 % |
|---|---|---|---|---|
| Kerosene-asphalt oils | | | | |
| Horizon A1 .. .. .. | 5 | 6.5 | 58.5 | 35 |
| Horizon A2 .. .. .. | 1 | 1.5 | 43.5 | 35 |
| Residum-asphalt oils | | | | |
| Horizons B1 and B2 .. .. | 3 | — | 23 | 77 |
| Asphalt-base kerosene oils | | | | |
| Horizon C1 .. .. .. | 15 | 26.5 | 49 | 24.5 |
| Horizon C2 .. .. .. | 5 | 22.5 | 53 | 24.5 |
| Horizon C3 .. .. .. | 1 | 26 | 41.5 | 32.5 |
| Horizons C4 and C5 .. .. | 4 | 26.5 | 54 | 19.5 |
| Horizons C6 and C7 .. .. | 10 | 25.5 | 53.5 | 21 |
| Paraffine-base-kerosene Oils .. | | | | |
| Horizons D1 and D2 .. .. | 10 | 17.5 | 55 | 27.5 |
| Horizons D3, D4 and D5 .. | 24 | 20 | 50 | 30 |
| Horizon D5 .. .. .. | 1 | 16 | 51 | 33 |

*Transportation and Refining.*—For many years the oil of the Sanga Sanga and Moeara fields was transferred by tank-boats down Mahakkam River by sea to the refinery at Balikpapan. Now a pipe line through the tropical jungle carries the oil directly to Balikpapan. This refinery is said to be the largest in the world, but exact data as to its capacity are not available.

## The Tarakan District

*Location and Extent.*—The Tarakan district lies in the extreme northeast corner of Dutch Borneo, extending across the boundary line into British North Borneo. It includes principally the islands of Tarakan and Sebetik and portions of the immediately adjoining mainland.

*Physiography.*—From Tandjoeng Seilor to the northwest end of Cowie Bay the coastal region of Boeloengan and Tidoeng consists, save for a few isolated hills, of mangrove swamps. The same is true of the banks of the larger rivers for a considerable distance inland. Inland from the coastal and riparian marshes the country is rolling and hilly.

*Areal Geology.*—The areal geology of northeastern Dutch Borneo has not been thoroughly worked out. Geologic investigations have been made of the coastal region from Kaniongan (or Mangkalihat) peninsula up to Soengei-Boeloengan (or Kajan). North of Soengei-Boeloengan only reconnaissances have been made of the coastal region, which is 20 to 40 miles wide, and practically nothing is known of the interior.

Quaternary alluvium forms the coastal marshes of Tidoeng in an almost unbroken zone from Tandjoeng Seilor to the British boundary. It also occurs along Sembakoeng River as far as Atap and on the inside bends of the meanders.

Except in the narrow fringes where Quaternary coastal swamp occurs, Upper Tertiary sediments are shown in the larger coastal islands, as Tarakan, Boenjoe, Oost Noenoekan, and Sebetik. The narrow Quaternary, coastal, alluvial deposits are succeeded by a zone, 7 or 8 miles wide, of steep hills which are composed of Upper Tertiary beds.

The Upper Tertiary zone is succeeded to the west by a zone, 5 to 10 miles wide, underlain by the Upper Eocene. A broader zone (15 to 22 miles) of the Lower Eocene occurs to the west. The Sembakoeng beds (Cretaceous?) form a zone 30 to 32 miles wide chiefly in the upper vally of the river of that name. This zone bears generally north-northwest-south-southeast parallel to the upper source of Sembakoeng River. Beds of the lower stage of the Eocene recur, beyond the Sembakoeng beds, near Alipagar.

*Stratigraphy.*—The oldest sediments observed in Tidoeng are the Sembakoeng beds, which from their petrographic similarity to the Alino and Waringin beds (Middle Cretaceous) and from their stratigraphic position below the Eocene, are considered to be Cretaceous or at least pre-Tertiary. The Sembakoeng beds consist of very hard, silicified, dark-colored shales, alternating in many cases with equally hard silicified sandstone and conglomerate beds. Through the whole formation run bands colored red by *Radiolaria*.

The formations which overlie the Sembakoeng beds conformably have been provisionally referred to the Eocene upon the basis of the presence of nummulites. The lower stage of the supposed Eocene consists of dark-colored clay-marls which alternate with hard sandstones. The clay content of the marls is somewhat low; this stage apparently forms the transition from the Sembakoeng shales to the upper marls. The upper stage is composed of soft gray-green to gray clay-marls, which are in many cases concretionary, fracturing in nodules. The bedding of the marls can be definitely determined only where the marls alternate with sandstone beds.

The Upper Tertiary of Tidoeng has not been subdivided. It consists principally of light-colored loose or poorly consolidated sands alternating with well-bedded conglomerates, white to light-yellow in color. Thin coal-seams occur here and there through the complex. The bedding is generally indistinct. In many places it can be distinguished only by the occurrence of the conglomerate strata or coal-seams, or by the occurrence of bands of clay or bituminous layers.

Quaternary alluvium overlies the Upper Tertiary beds unconformably.

*Geologic Structure.*—The coastal region of Tidoeng is in general gently folded. The axes of folding bear generally N. 30° W. The anticlines are represented by the islands, while the synclinal basins are occupied by broad estuaries and sea-straits between the islands and the mainland.

Five anticlines, whose axes trend in a northwestward direction, have been observed in the Tarakan district. The first or Tarakan anticline crosses Tarakan Island from south-east to north-west and may be followed across the British-Dutch frontier. A second anticline, parallel to the first, crosses Boenjoe and Mandoel Islands to the mainland and extends to the international boundary. The Poeloe Oost Noenoekan anticline, crossing the island of that name, and the two anticlines of Poeloe Sebetik, follow the same direction.

These anticlines are separated by corresponding synclines. The first of these is marked by the strait between Tarakan Island and the mainland. The second is occupied by the central mouth of Soengei Sesajap and the strait between the islands of Boenjoe and Tarakan. The third is occupied by the mouth of the Simengaris and the strait between East and West Noenoekan. The fourth is occupied by the strait between Sebetik and Oost Noenokan. The last is filled by Cowie Bay between Sebetik and the mainland near Tawao.

* Analyses by James Kewey, The Crude Oils of Borneo
† Escher.

The principal anticline of the Tarakan district, that of Tarakan Island, consists mainly of two domes, separated by a structural depression. The axis of the anticline bears north and south.

*Development.*—The British Borneo and Burma Petroleum Syndicate made an unsuccessful attempt to drill at Tawao, British North Borneo, on the mainland opposite Sebetik Island. No details regarding this venture are known.

The Royal Dutch Co., by arrangement with the British Borneo Petroleum Syndicate, drilled a well on Sebetik Island in 1914. In July of that year the well had reached a depth of 1,437 feet and traces of oil were found. The outbreak of the war caused the suspension of operations. As only small shows of oil were met, the well was finally abandoned.

The Bataafsche Petroleum Maatschappij began development of Tarakan Island in 1905. Commercial production began in 1907 with an output of 16,432 metric tons.

*Production.*—The production of crude petroleum on Tarakan Island is illustrated by Table V.

*Character of Oil.*—The crude oils of Tarakan are comparatively uniform in character and show little variation with depth. They are all of asphalt base, with a specific gravity ranging from 0.942 to 0.955. They contain no benzine fractions and have a flashpoint in the vicinity of 100° C. Their viscosity is low; they are quite liquid at 10° C. They contain only 0.6 per cent. of asphalt insoluble in alcohol ether, and have a coking value of 4 per cent. The sulphur content is 0.3 per cent. They are excellent liquid fuels and are used almost entirely for this purpose. They are also used successfully in Diesel engines and can be distilled for lubricating oils.

TABLE V.

PRODUCTION OF CRUDE PETROLEUM ON TARAKAN ISLAND, 1910-1920, IN METRIC TONS.*

| | Tarakan I. | Tarakan II. | Tarakan East. | Tarakan North. | Total. |
|---|---|---|---|---|---|
| 1910 .. .. | 2,327 | 224,475 | — | — | 226,802 |
| 1911 .. .. | 2,954 | 234,925 | — | — | 237,879 |
| 1912 .. .. | 2,613 | 218,979 | — | — | 221,592 |
| 1913 .. .. | 3,157 | 221,004 | 1,318 | — | 225,479 |
| 1914 .. .. | 41,891 | 206,864 | 4,965 | 306 | 254,026 |
| 1915 .. .. | 89,165 | 147,560 | 5,418 | 40 | 242,183 |
| 1916 .. .. | 97,791 | 132,484 | 2,684 | — | 232,954 |
| 1917 .. .. | 117,060 | 133,517 | 1,245 | — | 251,822 |
| 1918 .. .. | 185,757 | 146,758 | 366 | 812 | 333,693 |
| 1919 .. .. | — § | — § | — § | -- § | 600,000† |
| 1920 .. .. | — § | — § | — § | -- § | 711,609‡ |

*Wells.*—The Tarakan oil fields in 1920 contained about 300 derricks. The wells had an average specific capacity of about 100 metric tons per day by pumping. One well flowed about 500 tons a day; and another of equal capacity had become choked with sand; it was expected, however, to come in again flowing. New wells were being drilled.

*Transportation and Refining.*—The oil is pumped from the fields to Linkas, the port of embarkation, where there is a storage plant of 15 tanks of 20,000 barrels capacity. Two more of a capacity of 50,000 barrels were under construction in 1920. The tanks are located about 60-ft. above sea-level and the oil is loaded by gravity through two 8-in. pipe lines. It is claimed that a ship may be loaded at the rate of 400 tons per hour.

For refining, the Tarakan oil is shipped in tank steamers to Balikpapan. Much of it, however, is exported directly as fuel oil, no refining being necessary. Exports of fuel oil from the customs district of Tandjoeng Seilor amounted to 101,204 cubic meters (636,573) barrels) in 1913; 154,266 cubic meters (970,335 barrels) in 1914; 183,695 cubic meters (1,155,440 barrels) in 1915; 185,518 cubic meters (1,166,910 barrels) in 1916; 188,890 cubic meters (1,188,157 barrels) in 1917; 172,200 cubic meters (1,083,139 barrels) in 1918; and 529,379 cubic meters (3,329,794 barrels) in 1919.

## The British Borneo Oil District

*Location and Extent.*—This district includes all the possible oil-bearing territory of the British portion of Borneo, except the north end of Sebetik Island and the immediate surroundings of Cowie Bay, which have been discussed under the Tarakan district. The entire zone of folded Tertiary sediments of the British portions of Borneo may be petroliferous, but the present producing district is a relatively small part of the zone. The folded Tertiary zone includes the coastal region of northern Sarawak, the coastal Tertiary zone of Brunei and the coastal region of British North Borneo northwestward to Cape Sampanmangio and southward almost to the Dutch frontier. The only portion, however, of this zone of which the geologic structure is known with any certainty or detail is the comparatively small area which surrounds Brunei Bay.

The Miri oil field is at present the only producing field in the British portion of Borneo. It is situated on the west coast of Borneo in the Rajahship of Sarawak, along the Brunei frontier. Among other possible oil fields are the Belait district of northwestern Brunei, adjacent to the Miri field; the island of Labuan; the Klias Peninsula; and the valley of Sekuati River, in British North Borneo.

*Physiography.*—British Borneo as a whole may be divided into three physiographic provinces, (1) a central mountain chain, (2) a zone of low hills, and (3) a zone of coastal swamps.

The mountain chain which forms the boundary between British and Dutch Borneo extends from Cape Datu (or Datoe) eastward to about longitude 113° E., thence in a generally northeastward direction to the sea. The mountain chain is quite irregular in elevation, and contains the highest peak in the island of Borneo, Mt. Kinibalu, 13,698-ft. in altitude. The central range varies from 6,000 to 8,000-ft. in elevation, while the ranges which form the boundary between Sarawak and West Borneo are only 2,000 to 3,000-ft. in height. This boundary range extends parallel to the north-west coast of the island at an average distance of 100 miles from the sea.

The hill zone comprises the greater part of British Borneo. It consists of hills averaging 500-ft. in elevation. The coastal swamps of British Borneo, in contrast with those of the Dutch portion of the island, are small in extent and mangrove swamps are largely limited to the coast of Brunei Bay.

*Areal Geology.*—The mountains which form the boundary between the British and Dutch possessions in Borneo consist of granite, diabase, serpentine, and gneissic rocks, and of hard Paleozoic sandstones, quartzites, slates, and massive blue Carboniferous (?) limestones and extends in a generally southwest-northeast direction. Certain peaks, notably Marud and Kinibalau, are composed of granite. The flanking ranges consist largely of Paleozoic sediments. Paleozoic quartzitic sandstones occur on Kapinaga River within ten miles of Brunei Bay, and along Padas River. Mt. Mulu in Brunei is largely composed of Carboniferous (?) limestone.

The coastal part of the hill region is Tertiary. East of Padas Bay, a small indentation at the northeast corner of Brunei Bay, the Tertiary is only 10 to 15 miles in width. At the town of Brunei it is about forty miles wide; and further southward in the valley of Barram River, in northern Sarawak, it is about 80 miles wide.

A belt of Quaternary alluvium averaging about 60 kilometres (36 miles) in width extends along the coast of southern and central Sarawak, narrowing until it disappears at Brunei Bay.

*Stratigraphy.*—The Tertiary, which is the oil-bearing system of British Borneo, is composed in general of sandstones, shales, marls, conglomerates, and limestones, with interbedded lignite seams. The majority of observers have correlated these strata with the Lower Tertiary of the south of Borneo and especially

* Jaarboek van het Mijinwezen in Ned. Oost-Indie, Batavia.
† *Financial Times*, London, January 19, 1920.
‡ Hoofd van het Mijinwezen, Batavia.
§ No data.

with Verbeek's "alpha" and "beta" stages of the Eocene. Later Tertiary, however, in all probability occurs.

A limestone formation occurring along Madalam River between the provinces of Brunei and Sarawak has been identified by its fossils as Eocene. The lignite measures of Brunei and Labuan, which consist of alternating beds of clay, sandstone, and conglomerate, with several good lignite seams, are considered by Evans to be Eocene.

The coal measures of Labuan, as exposed at Kubong Bluff at the northern extremity of the island, consist of a base of blue shale probably 150 to 180-ft. thick, which includes extremely thin layers of argillaceous sandstone, and is overlain by alternating sandstones, conglomerates, clays, and coal seams to a total thickness of over 300-ft. The sandstones vary in color from red and blue to white, and in texture from coarse to fine. The conglomerates are composed of quartz, sandstone and coal pebbles, cemented generally by oxide of iron. The clays are generally blue, and in many cases contain nodules of iron oxide. Fireclay underlies the coal seams. The coals are lignitic, containing 6.1 per cent. of hygroscopic water, and include masses of semi-transparent resin.

Coal measures of supposed Eocene age occur along the coast of northern Sarawak, Brunei, and British North Borneo. Some of the best-known occurrences are those of River Linga, a tributary on the left bank of Batang* Lupar; at the junction of Simunjan and Sadong rivers; along Redjang and Mukah rivers; at Muara Island, opposite Brooketon, and Gaya; on Marudu and Sandakan bays; and on Kinabatangan River. On Sekuati River Hatton found a resinous coal similar to that of Labuan Island.

It is uncertain whether all the coal and lignite seams of British Borneo are Eocene. Some indeed may be of later Tertiary age. The succession of Tertiary rocks has not been worked out with the same degree of precision in British Borneo as in Dutch Borneo. Miocene coal-measures are extensive in Dutch Borneo, as well as in Sumatra, and like the coal measures of British Borneo have proved to be petroliferous.

The Oligocene is represented by bluish-gray clays, and by shales and marls. Orbitoid limestones of supposed Miocene age have been found on Madalam River, and on Gomanton Hill near Kinabatangan River in the northeast part of the island. Nummulitic limestones, whitish or bluish in color, occur at the coastward edge of the hill zone of central Sarawak.

The lower Quaternary sediments consist of conglomerates of quartz-pebbles or of pebbles of Tertiary rocks, chiefly sandstones and coral limestone, in places interspersed in a clayey earth, or cemented in other places by a hard siliceous cement. The upper beds are composed of a somewhat sandy clay, which becomes less sandy toward the top.

Late Tertiary volcanic activity is evidenced in the south of British North Borneo by hills of basalt and feldspathic and pyroxene andesites, notably on the north of Cowie Harbor. The extent of the Cowie Harbor volcanic region is unknown, but it may embrace the Darvel Bay region.

Intrusive and extrusive igneous rocks occur locally throughout western Sarawak. The intrusives, particularly quartz-porphyry dikes, have penetrated and disturbed the coal measures of the Bau and Bidi gold district in Upper Sarawak subsequent to the Miocene folding. In central Sarawak igneous rocks, particularly basalts, hornblende-augite-andesites and feldspar porphyries, have also disturbed the coal measures and occur as hills and peaks. These intrusions are accompanied by deposits of tuffs and volcanic agglomerates.

*Structure.*—The Tertiary of the Brunei Bay region and of nothern Sarawak is strongly folded. The axes of folding bend considerably in their courses but trend in general in a south-southwest to north-northeast direction, parallel to the coast.

Three anticlines have been determined at Brunei. The westernmost of the three a comparatively closed fold, is exposed on the steep cliffs of Tandjong† Puniet. On its eastern flank the beds strike N. 45° W. and dip 30° to 50° to the east; on the western flank the strike is N. 10° E. and the dip 20° to 50° to the west. The remaining two anticlines occur between Asing Island and the town of Brunei. Their axes bear to the northeast, with strata dipping 50° to 80° on both sides. The Eocene (?) coal measures of Brooketon are exposed in both these anticlines.

The characteristic course of these folds is sinuous. The anticline of Tandjong Puniet may be connected with the southern of the two anticlines of Labuan Island. The two anticlines between Asing Island and Brunei reappear on the Klias peninsula. The northward continuation of these two anticlines appears to be interrupted by a normal fault. The three parallel folds on the northern end of Klias peninsula are probably the northeastward continuation, beyond the fault, of the southern folds.

The possibilities of obtaining petroleum in commercial quantities from the Brunei Bay region are, in the judgment of Schmidt, not especially favorable. The anticlines occur with steeply dipping limbs; only the southern anticline of Labuan and the central anticline of the northern Klias Peninsula have a broad crest with flatlying strata. The nearness of the paleozoic central mountain region postulates this strong folding of the strata, and where the Tertiary foreland farther to the south is broader, less close, folds may be expected.

The geologic structure of the Miri field proper is not so well known as that of Brunei Bay. There is, according to Kewley, a well marked anticline, of which the eastern limb is the steeper. The oil is drawn from the western limb.

The Quaternary beds of the coastal plain are generally horizontal or only slightly inclined as at the border of the Tertiary hillland.

*Indications of Oil.*—Oil seepages, issues of natural gas, and mud volcanoes are situated along the axes of the anticlinal folds, on Klias Peninsula and on Labuan Island. Oil seepages further occur along the anticlinal axes on Brunei Peninsula. A new island, which owed its origin to an eruption of natural gas, appeared off the Klias Peninsula, opposite Labuan Island, on September 21, 1897.

On Labuan Island a thick black oil seeps from a sandstone, 7 metres (23-ft.) thick, which is intercalated in shales. A bore hole drilled 450-ft. into this formation encountered at 391-ft. a high-pressure flow of gas, but no oil. At Kubong Bluff a shaft sunk 20-ft. delivered in 1879 about 12 gallons daily of petroleum of 0.965 specific gravity.

Petroleum seepages have been discovered in British North Borneo on River Sekuati. Not far from the coast the clayey soil of a tidal swamp is saturated with petroleum. A shaft sunk to a depth of 35-ft. revealed beneath 4-ft. of surface clay an oil-bearing ferruginous sandstone inter-bedded with shales. Pieces of coal with resinous inclusions were also found. The petroleum is a thick oil or bitumen, containing a paraffine oil and an oxidizable body belonging to the camphors or turpentine.

The oil of the Miri field occurs in a sandstone formation. The strata are of Miocene age, according to Kewley, and coals, which mark the Miocene elsewhere in Borneo, are absent.

*Development.*—The Anglo-Saxon Petroleum Co., a Royal Dutch-Shell subsidiary, began drilling in the Miri field of Sarawak in 1911. Several wells came in at a shallow depth, below which a second oil stratum was struck. Commercial production began in 1912. The British-North Borneo and Burma Petroleum Syndicate made unsuccessful attempts at drilling along Kinabatangan River. No details are known about this venture.

An arrangement was made by the British-North Borneo and Burma Syndicate in 1912 with the Nederlandsche Koloniale Petroleum Maatschappij, a Standard Oil subsidiary, under which the Koloniale Mij. was to prospect the entire British-North Borneo concession and develop the Klias Peninsula. A similar arrangement was made in 1914 for the Brunei concessions. Four wells

* *Batang* in Malay means "river."

† *Tandjong* or *tandjoeng* in Malay means "cape."

were sunk by the Nederlandsche Koloniale Petroleum Mij. for the British-Borneo Petroleum Syndicate on Klias Peninsula; small shows of oil and gas were struck in Nos. 1 and 2, but these were abandoned at 1,500 and 1,280-ft. respectively. According to the profile drawn by Schmidt, these wells were located in a close syncline. Well No. 4 struck oil at 2,303-ft. and produced at the rate of 1,200 gallons of light oil a day, but the well was capped. After the conclusion of the agreement with the Nederlandsche Koloniale Petroleum Mij., the D'Arcy Exploration Co., which took over the lease, did not attempt to continue drilling on the Klias Peninsula.

On the Mangalum Island, Well No. 1, drilled by the Nederlandsche Kolonial Petroleum Mij. for the British-North Borneo Petroleum Syndicate, reached in 1916 a depth of 1,268-ft. and Well No. 2 a depth of 1,030-ft.

In western Brunei, the oil leases at Rempayoh in the Belait district were worked in 1915 by the Nederlandsche Koloniale Petroleum Maatschappij, by arrangement with the lessees, the British-Borneo Petroleum Syndicate. Well No. 2, in which oil had been found in 1914 at a depth of 1,820-ft, continued to produce at the rate of four tons a day. As no storage was available, no reliable estimate of the well's yield could be made. The well was pumped intermittently for a few days at a time in the daytime only. The yield continued until June, 1916, when it amounted to 1,500 gallons per day. As at that date, the oil was no longer required for fuel and there was not storage for it, the pump was withdrawn and a lead pipe connected to allow the gas and oil to escape.

Well No. 4 had reached a depth of 2,132-ft. by February 19, 1916. Operations were finally suspended on April 5, 1916, because of difficulties with the casing. Work was finally abandoned by the Nederlandsche Koloniale Petroleum Mij. in August, 1916. An agreement was made in 1918 with the D'Arcy Exploration Co., Ltd., for a further examination of the Belait field. Exploratory work was conducted in 1919 by the geologists of the D'Arcy Co., but the results have not been published.

In the East Tutong field, Temuan district, the Anglo-Saxon Petroleum Co., drilled a test well in 1915 at Paya Minuman, near Kampong Ikas, about five miles from Lubok Tibangun on Temuan River. The first well was abandoned in 1917 and a second well was drilled at Sembatang on Tutong River. Well No. 2 was sunk to a depth of more than 2,500-ft. Slight shows of oil and gas were met, but no substantial results were obtained. Operations were suspended in 1919.

The Shanghai-Langkat Co. drilled at Jerudong, but difficulties with sliding formations caused the abandonment of the lease in 1915. A prospecting license to a field lying 25 miles west of Tutong River was obtained. Drilling commenced late in 1916, but was abandoned early in 1917.

*Production.*—Commercial production of petroleum in British Borneo began in 1912 in the Miri field of Sarawak. The development of the industry is shown by the following statistics:

PRODUCTION OF CRUDE PETROLEUM IN SARAWAK, 1912-1920

| | Metric Tons.* | | Metric Tons.* |
|---|---|---|---|
| 1912 | 5,534 | 1917 | 77,604 |
| 1913 | 30,562 | 1918 | 72,511 |
| 1914 | 65,185 | 1919 | 85,695 |
| 1915 | 67,000 | 1920 | 146,729 |
| 1916 | 90,067 | | |

*Character of Oil.*—The crude oil of Miri is a thin fluid oil, brown in color, and translucent. Its specific gravity ranges from 0.890 to 0.925, and its viscosity (Redwood II.) at 10° C. is 45 seconds. It yields about 20 per cent. of a benzine low in volatile factions, about 30 per cent. of kerosene, and a residue of thin oil of a low cold-test. Of the kerosene fraction 25 per cent. is absorbable in 100 per cent. sulphuric acid. The crude oil contains 0.4 per cent. of sulphur and no asphalt insoluble in alcoholic ether.

The benzine fraction was found, on analysis, to contain 80 per cent. of naphthenes 15 per cent. of paraffines, 0.4 per cent. of benzine, 1.9 per cent. of toluene, 1.5 per cent. of xylenes, and 1.0 per cent. of high aromatics.

A dark-brown petroleum from Sarawak, with a specific gravity of 0.924, reported by Redwood, yielded on analysis 94.3 per cent. of lubricating oil, and 3.3 per cent. of coke. A heavy oil from Labuan, with a specific gravity of 0.965 at 76° F., gave 97.1 per cent. of lubricating oil and 2.6 per cent. of coke.

*Transportation and Refining.*—The crude oil from the wells at Miri is delivered by a pipe line to Lutong, where a refinery on the Trumble system was built in 1917 and 1918. It began operations in 1919. Two 8-in. submarine pipe lines from the refinery permit the rapid loading of steamers.

Prior to the building of the Lutong refinery, a part of the crude petroleum from Miri was shipped to Sumatra to be refined. Statistics of these shipments, from official Dutch sources, follow:

IMPORTS OF CRUDE PETROLEUM FROM SARAWAK INTO THE DUTCH EAST INDIES, 1913-1919.†

| | Liters | Barre's |
|---|---|---|
| 1913 | .. | .. |
| 1914 | 7,079,056 | 44,528 |
| 1915 | 27,107,335 | 170,505 |
| 1916 | 12,222,962 | 76,882 |
| 1917 | 1,934,798 | 12,170 |
| 1918 | 2,801,160 | 17,619 |
| 1919 | 2,955,260 | 18,589 |

In 1914 and 1915 these shipments were landed at Palembang, Sumatra, to be distilled at the Pladjoe refinery. A part of the 1916 shipments was sent to Pangkalan Brandan, east coast of Sumatra, and Balikpapan. From 1917 to 1919 the Miri oil was refined at Pangkalan Brandan.

* Annual reports, Royal Dutch Co.
† Statistiek van den Handel en de In en Vitvorrechten in Ned. Indië.

NEW RAILWAY LINE, JAPAN.—The Imperial Government Railways will build a new line during 1923 from Kisarazu on the west coast of Chiba prefecture on Tokyo Bay, to Ohara-machi, on the Pacific coast, passing through Kururi and Okita, across the Boshu peninsula. Chiba prefecture operates a line between Kisarazu and Kururi, a distance of 14 miles, which will be transferred to the department of railways without cost to the central government. The cost of constructing the line is estimated at Y.4,200,000. Something like Y.1,200,000 will be used to improve the existing line, and the balance of Y.3,000,000 in constructing the new line between Kururi and Ohara.

* * *

ASANO CEMENT COMPANY EXTENDS WORKS.—The Asano Cement Company operates five mills, located respectively, at Tokyo, Moji, Kawasaki (near Tokyo), Hokkaido and in Taiwan. The Moji mill is equipped with a 200-ft. furnace with a capacity of 55,000 barrels a month, the others with 100-ft. furnaces with capacity of 20,000 barrels a month. The recent active demand for cement in the Japanese market, which has kept prices up to war-time levels, has determined the company to extend the equipment of the factories. The Moji works will install two additional 200-ft. furnaces before April and the Tokyo Works another 100-ft. furnace by February.

These new additions will increase the manufacturing capacity of the Asano Cement Company from 2,500,000 barrels a half-year to 3,040,000 or 3,050,000 barrels. This company will then produce 64 per cent. of all the cement manufactured in Japan by 23 companies.

The FAR EASTERN MOTORS
MOTORING-AERONAUTICS-MOTOR BOATING

# Tokyo-Yokohama Motor Road

UNDER the direction of the prefectural governments of Kanagawa and Tokyo, a first-class national road 69,868-ft. long is now being constructed between the two cities. The Tokyo authorities are building the section between Shinagawa and Rokugo River, the boundary of the prefecture, and the Kanagawa authorities the section from Aoki-machi, Yokohama city to the Rokugo River.

The district between Tokyo and Yokohama is densely populated, and the only road between the two cities is hopelessly inadequate to the necessities of travel. An automibile trip consumes more than an hour and a half, and the difficulties of driving through the constant stream of traffic in both directions make it far from a pleasure ride. When the new road is completed, however, the motor trip will consume less than a half-an-hour, and the effect of the opening of such a road should be to stimulate the use and sale of automobiles in this part of Japan.

The Tokyo government is now engaged in construction in the neighborhood of Shinagawa, and the Kanagawa government in the vicinity of Namamugi. The actual work has been delayed two years by difficulties in obtaining a right of way. These, however, are now settled, and construction will continue undisturbed until the road is finished.

About 2,580-ft. of the road between Minami Banba, and Kaianji, near Shinagawa, have been completed. Work between Kainaji and Yatsuyama, the starting point in Tokyo city, has recently been started and the entire construction is expected to be fin'shed in 1924.

According to a recent publication of the department of home affairs, July 1922, the road between Yatsuyama and Omori, a distance of 19,080-ft., will be 72-ft. wide, the rest of the distance between the two cities it will be only 60-ft. wide. The central part of the road, exclusively for the use of wheel vehicles, will be 48-ft. wide, and there will be concrete sidewalks on both sides, 12-ft. wide. The centre of the 48-ft. wide roadway, 22-ft. will be finished in asphalt concrete, and the side parts with asphalt. Poplar trees will be planted on both sides of the road, eighteen feet apart.

The total cost of construction has been estimated at Y.7,479,189, to be expended as follows :

| | |
|---|---|
| 1918, fiscal year | Y. 186,000 |
| 1919 „ | 507,740 |
| 1920 „ | 1,684,047 |
| 1921 „ | 2,269,481 |
| 1922 „ | 2,831,921 |

(Fiscal Year=April-March).

The funds are being obtained by public loans, and through subsidies from the national treasury. The central government pays for two-thirds of the cost of re-building the bridge across the Rokugo River, 1,680-ft. long, and one-half of all other construction costs. So far, the following amounts have been expended :—

| | |
|---|---|
| 1919, fiscal year | Y. 86,000 |
| 1920 „ | 150,000 |
| 1921 „ | 320,330 |

Two licenses for construction were issued in 1921. One on March 30, for the distance between Yatsuyama, Kitashinagawa, Shinagawa-machi, Ebara-gun, Tokyo prefecture, and Higashi Sengendai (Kaianji), Minami Shinagawa, Shinagawa-machi, Ebara-gun, Tokyo prefecture. The road to be 48-ft. wide, with sidewalks on both sides, 12-ft. wide. The license provides for the construction of a bridge across the Meguro River, made of steel and concrete, 40-ft. long and 72-ft. wide. The total cost of construction was licensed at Y.620,312.

The license issued on May 5, 1921, was for the district between Kaianji, Higashi Sengendai, Minami Shinagawa, Shinagawa-machi, Ebara-gun, Tokyo prefecture, and Ipponmatsu, Oi-machi, Ebara-gun, Tokyo prefecture. The road to be 48-ft. wide, the sidewalks 12-ft. wide on each side of the road. A bridge is to be built across the Tachiai River, "T" type steel and concrete, 25-ft. long, and 72-ft. wide. The total cost of construction licensed is Y.446,090.60.

*Kanagawa Prefecture.*—Construction in Kanagawa prefecture will be between Aoki-machi, to the bridge across the Rokugo River. The total length of the road in this prefecture will be 34,728-ft. From Aoki-machi to Koyasu-machi, Irie-bashi (Bridge), the road is to be 72-ft. wide, the rest of it will be 60-ft. wide. The forty-eight feet of roadway will be finished in asphalted pebbles. The sidewalks of twelve feet width on each side, will be covered with pebbles. The road where it is 60-ft. wide will have a central roadway of 42-ft. width, finished in asphalted pebbles. The sidewalks of 9-ft. each will be covered with gravel. Three bridges must be built in this prefecture,—but no definite plans for construction have yet been adopted. This section of the road will also be bordered with poplar trees, thirty feet apart.

Costs of construction of the Kanagawa section of the road are estimated at Y.2,834,816, to be expended as follows :

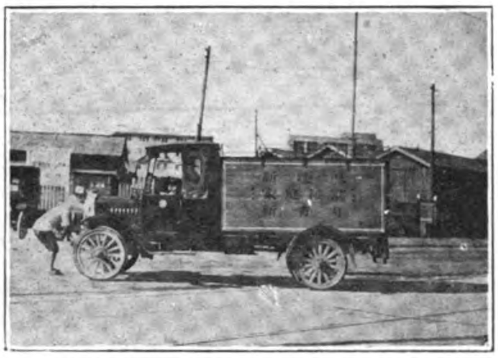
| | |
|---|---|
| 1918, and 1919 fiscal years | Y. 89,289 |
| 1920, fiscal year | 1,095,428 |
| 1921 „ | 915,365 |
| 1922 „ | 915,365 |

The national treasury will pay half the costs of the road construction, and two-thirds of the cost of building the Tsurumi bridge.

So far there has been expended : 1919, Y.94,000 ; 1920, Y. 248,000 ; 1921, Y.249,000.

Harley-Davidson Motor Cycle for Special Delivery of Hand Baggage in City Limits, used by the Tokyo Railway Bureau

Auto Delivery Vehicles in Japan. Tricycle Delivery Wagon



Ford Delivery Truck used by the Hakuban-Kirin Publishing House

# AUTOMOTIVE JAPAN

## Service Facilities

***(Interview with W. I. Irvine, U.S. Trade Commissioner)***

WHEN the question of service is broached to Japanese dealers they always answer in the affirmative but upon examination it is found that in the majority of cases, service by their conception differs radically from the American understanding. As the Japanese see the problem it means principally carrying spare parts. All of the dealers have facilities for making repairs, however, limited, from well-equipped machine shops to a small garage equipped with a few crude machine tools, but this service is only provided where the main office is located. Dependence for repairs outside of these centres is placed upon local garages which are poorly equipped to do good work at low cost.

There is a lack of understanding and appreciation of the value of good service to the sales organization, the attitude being to regard repairs as a highly profitable business. No special effort is made to induce owners to bring their vehicles to the seller for repairs with the result that cars and trucks of every make may be found in almost any dealer's workshop. And it is not uncommon to find spare parts for cars other than those sold by the dealer on the shelves of his stock room.

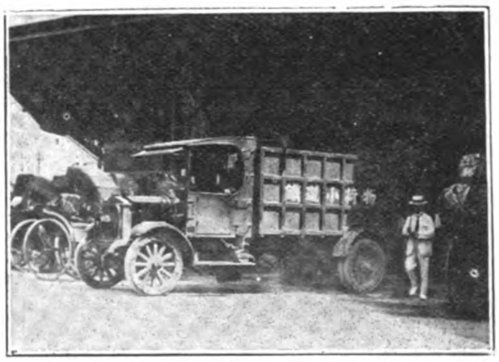
Complaints against this lack of service come only from the foreign owner, especially Americans who have enjoyed the advantages of service in the home country. Japanese owners have not been educated to expect differently from what they are getting and there is no tendency to enlighten them. Were dealers to emphasize their service a beginning would be made in breaking down the chauffeur evil. As the situation now rests chauffeurs take the cars to those shops where charges are highest for them the proportion of the driver is greater. This together with the high prices for spare parts contributes greatly to the truth of the statement that ownership of a car is expensive.

When a man leaves a car for repairs he rarely knows what the cost is to be for the practice of giving estimate is not followed by dealers and even should insistance call forth a figure it is not guaranteed. The only explanation offered by the dealers is that the mechanics cannot tell what the difficulty is until they have made a thorough examination, nor can they judge how many hours it will take to do the work, the time varying 100 per cent. on the same kind of repair in many cases. When the work assumes anything like the proportions of a major repair the idea of the Japanese mechanic is to tear down the whole machine, and during the visits of the writer to the service stations it was not an uncommon thing to find cars completely disassembled with parts scattered around the floor in hopeless confusion, men spending precious time searching for a missing piece.

With but few exceptions the stocks of spare parts are poorly kept. Evidence can be found of systems but the original plan of systematic filing in separate bins has been lost sight of and an examination of bins showed a conglomeration of parts that would give an efficient storekeeper a nightmare. So it is not a matter of wonder that repair jobs are delayed for weeks while a new part is being machined and later to find the part in stock. In some cases stocks are not conveniently stored and one of the largest dealers was found to keep slow moving parts in the emergency stock room in the centre of the city while frequently called for pieces were stored in the shop four or five miles away.

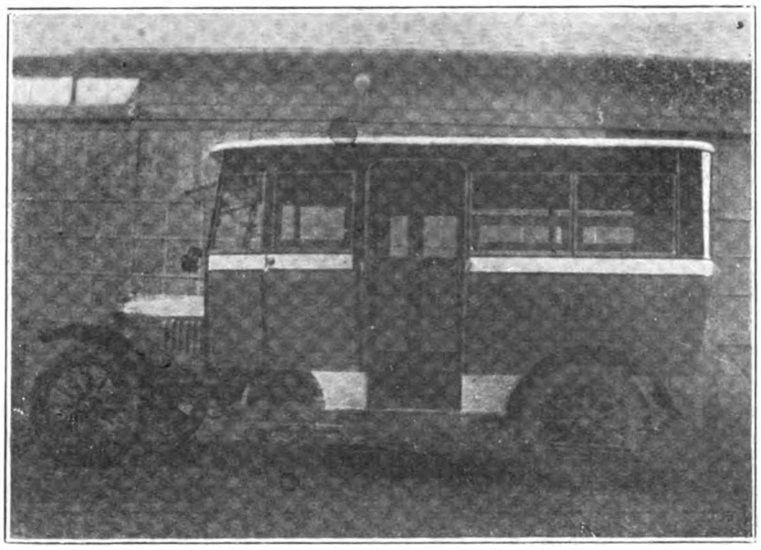
The machining of parts is frequently due not only to the lack of proper storage systems but to the poor selection sent by the

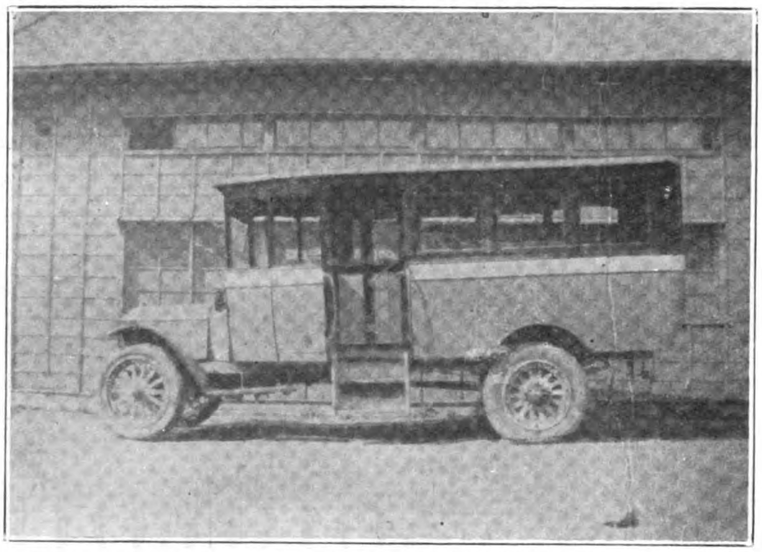
Ford One-ton Delivery Truck : Fuji Brewery Company



Federal Two-ton Small Baggage Truck: Imperial Railway Department

2-ton Diamond "T" Delivery Truck: Asano Cement Company





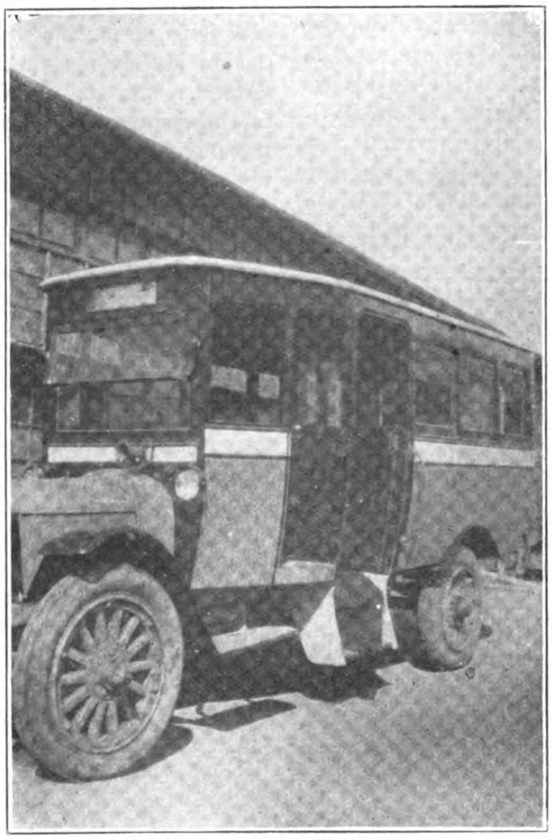
TYPES OF PASSENGER BUSES ON REPUBLIC TRUCKS OPERATED BY THE TOKYO BUS COMPANY

Small Type Bus — Large Type Bus

American manufacturers with the result that at times dealers are compelled to have parts made while carrying a large investment in parts stocks which creates the impression that parts carrying is an expensive and useless procedure, a natural evil to the business selling American cars as European manufacturers do not insist on the same condition.

The statements of dealers as to the charges made for spare parts do not agree with the claims of owners interviewed and from the attitude of some dealers towards the spare parts question it would appear to some extent that the complaints, especially of foreigners, are justified. Many dealers feel that they must charge not only the costs of storing and other natural expenses but add on saleable parts the probable loss on dead stock. Prices for parts run anywhere from 73 per cent. to 300 per cent. above invoice value.

Spare parts stocks are almost without exception kept at the main establishment. Dealers say that they have so few vehicles in each city that it is not profitable to carry an assortment at their branches, which is further evidence that the market would be better served if division of territory were made. With but one exception it was found that the stock record systems are not used outside of Tokyo. The exception was in the case of a distributor of a very low price American car who not only carried parts in every branch but provided bins in which each movement in and out was recorded.

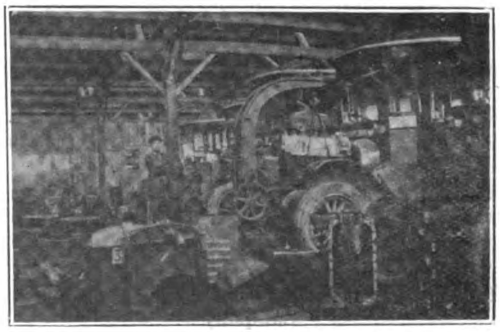


Another View

## Imitation of Spare Parts

In the case of one well-known car, parts are frequently imitated and sold a trifle under the set price of the authorized pieces. The imitations are stamped with a name in the same type as the original. The first letters are the same but the last letter is blurred making it appear as though it were due to faulty stamping. In appearance the parts look like the original but the distributors claim that the materials used are below the manufacturer's standards and do not wear.

Traveling service representative from Europe have yet to make their appearance in Japan, although a few service men from the factories of the high-grade cars arrived with first consignments to instruct mechanics in the car details and to tune up the first cars. Nor are the European manufacturers insisting on the carrying of spare parts, and, as an illustration of their attitude on this point, the experience of one dealer is illuminating. Duiing the war he could not get cars from a well-known French manufacturer and so took the agency for an American car. He was thoroughly convinced on the value of the spare parts policy as he had made an investigation of American automotive rpactices before making his agency selection. He maintained a repair shop and carried in a fairly systematic way a supply of spare parts. Unfortunately the car he selected to sell was not comparable either

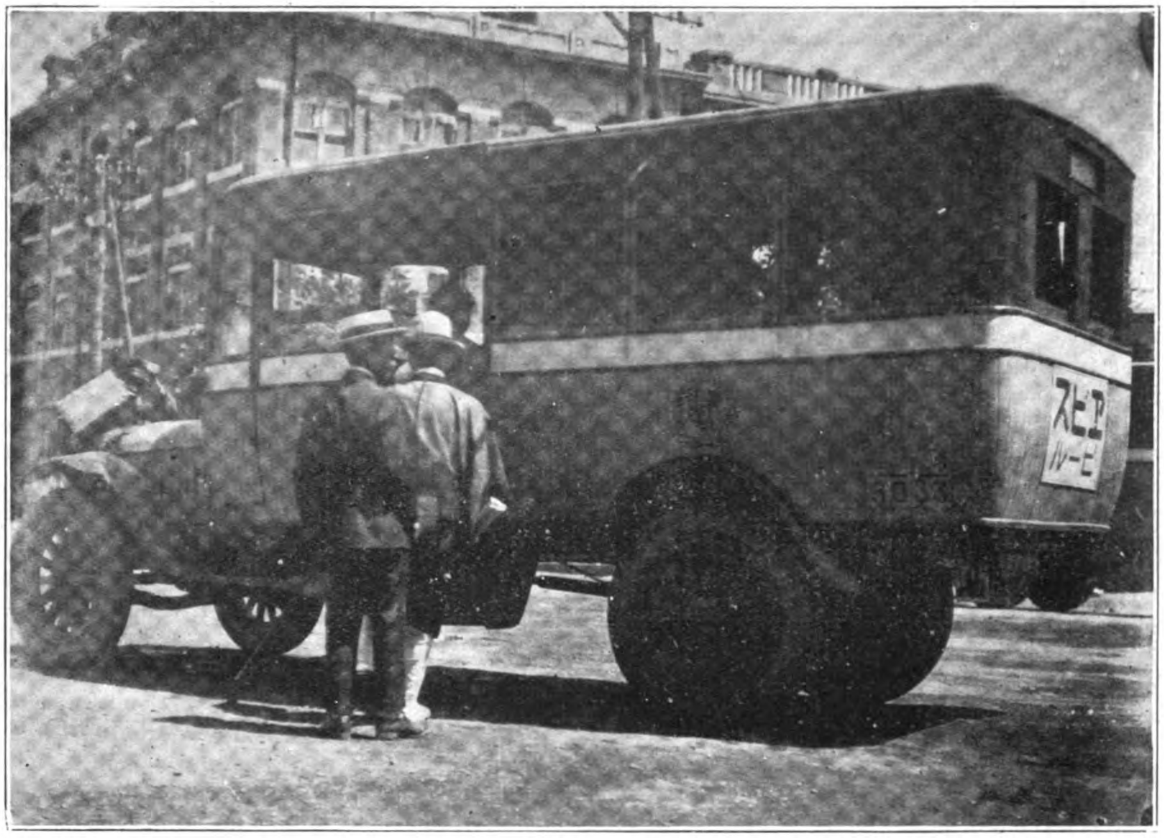


Repair Shops

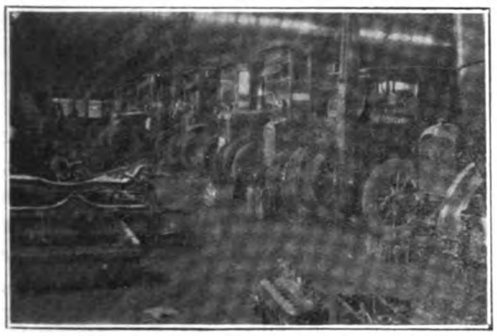
in mechanical perfection or in price with the French car so, when the manufacturer of the latter was again in position to supply, the dealer put his stock of American cars in the hire business and ordered a stock of French cars together with a full supply of spare parts. The manufacturer strongly objected on the ground that the order was an implication on the durability of the car and refused to furnish the parts at once. The parts did not arrive until a year after the cars had been received, according to the dealer's statement.

### Absence of Good Public Garages

Aside from the facilities provided by the dealers there are practically no good garage in Tokyo and other cities. The public garages are merely places to store cars and any repairs made there are done with the most inadequate tools and generally in the street as there is insufficient room in the majority to work freely, the average garage having room for not more than six cars. It would seem, therefore, that there is a splendid opportunity for the opening of a well appointed garages in a central location and it is suggested by some car owners in Japan that American manufactures set up a model, establishment which would not only serve vehicle owners but would demonstrate to dealers how to run efficiently a service station. Unless such a station were directed by Americans and had a few mechanics from the United States it is doubtful if such an experiment would succeed. However, there is no doubt that a useful service could be performed by such an establishment for from the foregoing it can be seen that the inefficiency of this branch of the distributors function is operating as a deterret to the popularization of motor vehicles.




**Type of Passenger Bus on Republic Trucks operated by the Tokyo Noriai Jidosha Kaisha: Passengers Boarding Bus in Front of Shimbashi Station. A Popular Beer Advertisement is shown on Back of Bus.**



**Repair Shops**

## TOKYO PASSENGER BUS SERVICE

**Views of Assembly and Repair Shops of the Tokyo Noriai Jidosha Kaisha (Tokyo Bus Company), Operating a Fleet of Republic Trucks on Tokyo's Main Thoroughfares.**

# Uniform Car Tariffs Favored

SENTIMENT in favor of uniform international tariffs on motor cars is gaining ground abroad, is the opinion of H. H. Rice, treasurer of the national automobile chamber of commerce, who has just returned to New York from Europe.

He found that the new American motor tariff offering lower duties to those countries which favor the United States is creating a receptive attitude abroad. A good deal of protectionist sentiment remains, to be sure, but lower duties for United States automotive products are being seriously considered in many quarters.

Spain, Italy, Belgium and Holland have already benefited from the new motor tariff. Formerly the United States duty was 45 per cent. on automobiles costing over $2,000, but it is now as low as 25 per cent. for the products of all countries which accord the United States equivalent treatment. Moreover, this tariff reduction clause in the final writing of the bill was made automatic, so that any reduction abroad wins immediate favorable treatment here without awaiting executive action.

# Motor Boats in Japan

LAST summer motor boating was all the fashion in Tokyo. Other parts of the country showed a remarkable increase in motor boat registrations both for pleasure and business. The increased interest in motor boating in Tokyo was, however, popularly attributed to the "hard times." In prosperous years one of the favorite amusements of the tired Japanese business man consists in giving elaborate parties at the different popular summer resorts. Because of their cost such parties were exceedingly few and far between last summer. The summer was hot, though, and somehow or other society had to be amused. The daily papers reported that the hard hit merchants had solved the problem of keeping cool and entertaining their friends by riding up and down Tokyo's river, the Sumidagawa, in rented motor boats, at ten yen an hour. So, as long as the "hard times" continue, motor boating bids fair to remain a popular sport, in Tokyo at least, yet in all seriousness, the sport is steadily gaining in favor with those of ample means, while in the business world the use of motor-driven boats is constantly growing.

Until 1917, the only motor-driven boats in Japan were pleasure boats. To-day a great number of launches, tug-boats, and fishing boats are equipped with gasoline motors. The principal demand is for motors of 10 to 40 h.p., gasoline fuel. Popular motors for commercial vessels are the Universal and Doman ; for towing many Fay and Bowen, and Regal motors of 40 h.p. are being sold and, because of its very low price, the Kermath motor of 40 h.p is finding many purchasers.

The types of motor boats in use in Japan may be described as hydro-plane, runabout and cruiser, the V shaped runabout being most popular for pleasure boats. The average length is from 20 to 30-ft., with 4 to 6-ft. beam. The types of inboard motors more frequently seen are the Fay & Bowen, Universal, Hess Mono-Marine, Domon, B.W.M. (German), and Hall Scott, all of which are sold by the Yamato Trading Co., of Tokyo. The Kermath Mfg. Co., the Scripps Motor Co., Knox Motor Associates, T.V.B. Engine Co., Wisconsin Motor Mfg. Co., and Niagara Motor Corporation, are represented by the Motor Boat Shokai of Tokyo. The Elto motor is represented by the Kachi Shokai of Kobe, and the Kaneko Shokai of Tokyo, is introducing the Daimler, the American Regal and Red Wing motors.

Excluding fishing vessels, the number of motor boats in Japan with inboard motor installations is very small. In Tokyo and its vicinity, there are about 50, of which 35 are for pleasure ; in Yokohama, there are 18 pleasure and 5 commercial motor boats ; in Osaka there are 20, and on Lake Biwa, Japan's greatest lake, 12 ; in Kobe, 15, and registered at the Inland Sea ports there are another 20 motor vessels. Kyushu has 20 more. In addition, there are about 140 more in use by the different government departments, the navy and the naval flying corps owning 80. The total is only slightly over 300, and it is said that over 90 per cent. of the motors are of American make.

The motor most frequently seen is the Universal marine, type C3, 12 h.p., which is used in fishing, commercial and pleasure boats. Practically all fishing boats are equipped with this particular make. Many 4 h.p. Hess mono-marine motors are installed in Japanese fishing vessels, while the Domon marine engine is also finding favor in this field. About 20 German B.M.W. motors are installed in tow boats and cruisers. The Kermath motor of 3 and 4 h.p. is found exclusively in pleasure boats, but recently their use has been extended to fishing boats. The Scripps' motors are found usually in cruisers, 40 to 60 h.p. being the favorite sizes. The Scripps, the Wisconsin and B.M.W. 60 h.p. motors are being used with air propellers on passenger vessels of shallow draft on streams with swift current.

*Outboard Motors.*—It is difficult in Japan to sell high priced inboard motors in competition with the less expensive outboard types of 3 to 5 h.p. The Evenrude, Miller, Caille, Ferro, Waterman, Elto and Koban, detachable motors of American manufacture, and the German Hass and Tip-top are all sold in this market. There are more than 1,700 Evenrude motors in Japan, sold through the Hinode Shokai of Tokyo, with only 400 of all other makes. This makes 2,000 as the total number of outboard motors in use, of which 80 to 90 per cent. are American makes.

The outboard motor is used for any and all purposes, but the 2 h.p. motor for use in a 24 by 4-ft. boat is the one in greatest demand. The Miller outboard motor is used chiefly for pleasure boats, and the Hass motor of 2½ to 5 h.p. for small cargo sampans.

Not one per cent. of the total number of motors installed in Japanese boats are of Japanese manufacture, but the boat bodies are all made in Japan. Importers of motors have their own body building departments, and there are many small shipbuilding concerns which specialize in this class of work. The most widely advertised of these concerns is the Nihon Jidotei Kabushiki Kaisha (The Japan Motor Boat Co., Ltd.) of Otsu, Shiga prefecture, on Lake Biwa. This company is capitalized at Y.620,000, and it is now making almost all the best motor boats for the government departments and private persons.

*Fishing Vessels.*—At the end of 1921 there were 6,270 registered fishing boats equipped with motors, having a total of 129,813 h.p., an average h.p. per vessel, of 20.7, and an increase of 689 over the previous year. This increase, in the face of the serious financial depression, is proof that the use of motor power in Japanese fishing vessels is increasing in popularity. The number of steam power fishing vessels actually registered decreased to 4 in 1921. Motor fishing vessels showed an average decrease in tonnage of 0.2 tons, and an average decrease in power of 0.8 h.p., indicating that the fishermen are recognizing the advantages of small motors for smaller fishing vessels. There were remarkable increases in the number of motor-driven fishing vessels registered in Shizuoka, Chiba, Kanagawa, and Fukui prefectures, all centres of the fishing industry.

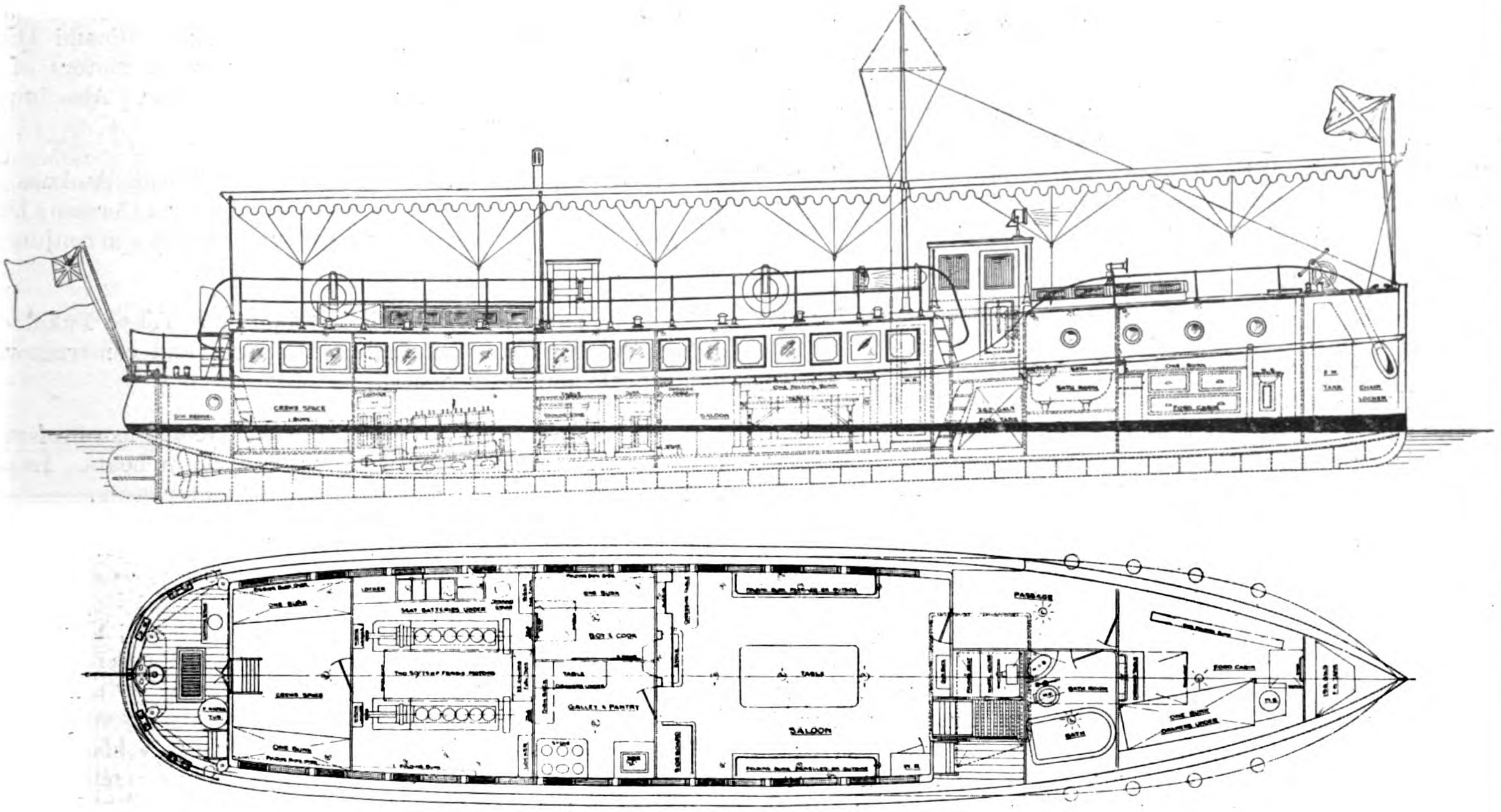
*Cruising.*—Japanese waters are ideal for cruising, except during July and August, and in early September when typhoons are frequent. During the rainy seasons in June and September it is not pleasant to be out at sea, but there is little wind blowing. In the Japan Sea during the winter the waves are extremely high, and cruising even in steam vessels is none too pleasant at times. There are hundreds of fishing villages where landings can be made, but foreigners operating vessels of foreign registry are not permitted to enter other than the so-called "open ports." Several unpleasant incidents have happened in the past, when foreigners not properly acquainted with the Japanese regulations have put into "closed" ports.

For Japanese vessels there can be no more delightful experience than cruising from port to port, particularly in the Inland Sea during the summer months. The excellent and frequent harbors make danger from sudden high winds almost negligible. The Inland Sea is, therefore, the favorite summer cruising ground for Japanese motor boat enthusiasts.

# The Jardine Engineering Corporation, Ltd.

**Builders of steel and wooden craft of any draft to suit inland waterways and harbor service.**

**First-class workmanship and material guaranteed**
**Motors and complete launches in stock.**



*AGENTS FOR—*

| CRUDE OIL | KEROSENE |
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| **WM. BEARDMORE & CO., LTD.** | **GLENIFFER MOTORS, LTD.** |
| **Heavy Duty Engines from 10-600 B.H.P.** | **Kerosene Motors from 10-90 B.H.P.** |

**BRITAIN'S BEST IN MARINE ENGINES**

*WORKS—POOTUNG :*
OPPOSITE THE BUND

TELEPHONE C. 241

*OFFICE :*
8A YUEN-MING-YUEN ROAD

**SHANGHAI**

Even Japanese motor boats and their owners are subject to severe cruising regulations the vicinity of fortified zones enforced by the commandant of each zone. It is therefore very difficult for the cruiser to know in advance just what rule he may infringe when he enters a strategic zone. In fact, it is often only when several such rules have been inadvertantly infringed that the cruiser discovers the fact. The strategic zones are located at Yokosuka, Kure, Sasebo, Maizuru, Chinkai, Takeshiki, Make, including islands of Gyo-e, Hakusa, Hoke, Ominato and Eike. Waters in the vicinity of important fortresses are also under strict regulation for cruising ; these fortresses are : A part of Tokyo Bay ; Hakodate, Yura, Maizuru, Gaiyo, Hiroshima Bay, Shimonoseki, Sasebo, Nagasaki, Tsushima, Keelung, Chichi-jima in the Bonin Islands, Hoye, and Amami Oshima. Natural conditions for motor boating are almost ideal in Japan, but the regulations governing cruising are so restrictive that the pastime is not an unmixed pleasure.

*Regulations for Use of Motor Boats.*—Pleasure motor craft are subject to no particular regulations as regards operation. They must, however, be registered in the prefecture when they are to be used, and are subject to a tax of 20 sen a ton. Commercial motor boats are subject to these taxes in addition to the ordinary business taxes. Commercial boats must carry signal bells or fog horns, and are required to exercise the greatest care in traffic centres. Commercial vessels are those operated by steam, oil or other power motors, operating along the coast of Japan for the purpose of transporting passengers, freight, or engaging in other business. Those who wish to operate such steamers must obtain permission from the police authorities. They must be under charge of a properly qualified captain, engineer, with a licensed crew. Motor boats for rent are subject to no special regulations.

Despite the many suitable waters for cruising the use of motor boats for pleasure is not very extensive, due principally to the many vexatious restrictions on operation and cruising placed on the sport by the military and police authorities. The Nihon Jidotei K.K. is now endeavoring to obtain official support to the organization of a club to promote motor boating in Japan, propagating the use of motor boats as a valuable assistance to life-saving stations, and for use in cases of emergency, such as floods, fires, shipwrecks, etc. This club will probably be organized before this summer.

Opportunities for the sale of motors for pleasure and fishing boats are extremely good. The small motors of not more than 60 h.p. are most in demand, although the 12 h.p. motor is the favorite. The outboard motor is becoming increasingly popular, and a large business awaits the manufacturer of a motor able to compete with the Evinrude in quality and price. As a matter of fact, quality if of no particular interest to the Japanese fisherman, cheap price being the first consideration. Of course, motors whose performance records are poor can hope for little business, but a low price, medium grade outboard motor has a very good chance of doing a large business in Japan.

As for the inboard motors, most of the world's best motor manufacturers are represented in this country already. The market practically belongs to one or two makers. But a new motor coming on the market, capable of competing in price and efficiency with the established makers stands a good chance of making good sales. It is purely a matter of advertisement, and personal sales work among the people interested.

## Companies in Japan Manufacturing and Dealing in Motor Boats, Motor Boat Engines and Supplies

*Motor Boat Shokai Kabushiki Kaisha.*—This is the oldest concern in this business. Office : Tsukiji No. 15, Kyobashi Ku, Tokyo City. Managing Director: Shigeo Yoshida. Dealing in American and German motors. Agents for the B.W.M., Scripps-Booth, Buffalo, Knox, Sterling, etc.

*Yamato Boeki Kabushiki Kaisha.*—Office : 1, 6 chome, Irifune Cho, Kyobashi Ku, Tokyo City. President : Kozo Uchida. Opened to business : 1917. Agents for the Fay, Bowden, Universal and Peerless motors.

*Nakaya Shoten.*—Office : Nishibei Shintaku Building, Kitamaki Cho, Kyobashi Ku, Tokyo City. Owner : Makoto Onomoto, formerly in business with the Denmark Trading Co., of Kobe. Dealing in high-class American marine motors ; motors for use in fishing boats. Agents for N.S.U. and Universal types, Matthews generators, Waterman motors, carpenter's tools for ship use, search lights, and pumps.

*Hosaka Kikai Seisakujo.*—Office : No. 4, 2 chome, Hamacho, Nihonbashi Ku, Tokyo City. Owner : Hosaka. Designer and repairer of motor boats. Sells American and other motors.

*Hinode Shokai.*—Office : No. 14, 3 chome, Minami Denma Cho, Kyobashi Ku, Tokyo City. Importers of motors of the Evinrude type. Agents for the Evinrude motor. Also imports ans sells other motors.

*Kaneko Shokai.*—Office : Hanakawado Machi, Asakusa Ku, Tokyo City. Owner : Ikuhisa Kaneko. Imports German, Daimler, Red Wing, Commerce, Ragal motors. Operates in conjunction with the Nihon Motor Boat Co., on Lake Biwa.

*Sumidagawa Zosenjo.*—Office : Mukojima, Tokyo Fuka. Operated by Shinhachi Takahashi. Designers and constructors of motor boats and other vessels.

*Nihon Jidotei K. K.*—Office : Biwako, Otsu, Shiga Prefecture. Designers and constructors of motors and motor boats. Imports and sells motors for sailing vessels. Rents motor boats.

*Kochi Shokai.*—Office : 105 Edo Machi, Kobe City. Dealers in fixed and detachable motor engines, gasoline, kerosene, etc.

*K. K. Niigata Tekkojo.*—Office : No. 3, 1 chome, Yuraku Cho, Kojimachi Ku, Tokyo City. Engineering Chief, Gisei Nagamoto. Consulting Engineer : Captain Ryueki Onuki, I.J.N.R. Manufacture and sale of internal combustion engines, Diesel and semi-Diesel types. Machine tools, oil well boring machinery, steam engines and boilers. Internal combustion engines, factory located at Kamata, near Tokyo. Factory site covers, 20,040 *tsubo* (*tsubo*=36 sq. ft.) Opened to business, 1921. Equipment is the best so far installed in Japan. Does not manufacture gasoline engines. Its kerosene motors, 15 to 110 h.p., used largely for fishing boats, averaging about 5,000 h.p. in sales per annum. When the Kamata factory is completed, the present production will be doubled.

*Ikegai Tekkojo.*—Office : Mita Shikoku Machi, Shiba Ku, Tokyo City. Established : 1900. Manufacture of machine tools and internal combustion engines. In 1915, received orders from Russian government and completed 500 engines in 5 months. This enhanced their reputation, and the Japanese Navy and Army departments have since been the principal purchasers of their productions. Capital : Y.6,000,000. President : Shotaro Ikegai. Chief of the Engineering Department : Sugiji Ikegai. Machines manufactured : Internal combustion engines ; Gasoline and kerosene burners ; 10-360 h.p. semi-Diesel engines, various types ; 2-320 h.p. About 10 per cent. of the output is sold to the public, official departments absorb the other 90 per cent. The Sumida Gawa Zosenjo uses Ikegai motors. Its semi-Diesel engines are used by fishing boats all along the coasts of Japan, 90 per cent. of those in use to-day being Ikegai manufacture. The company has recently begun the manufacture of 100 h.p. Bentz aeroplane motors. Sales, monthly average 1,500 h.p.

# SOCONY AUTO OILS

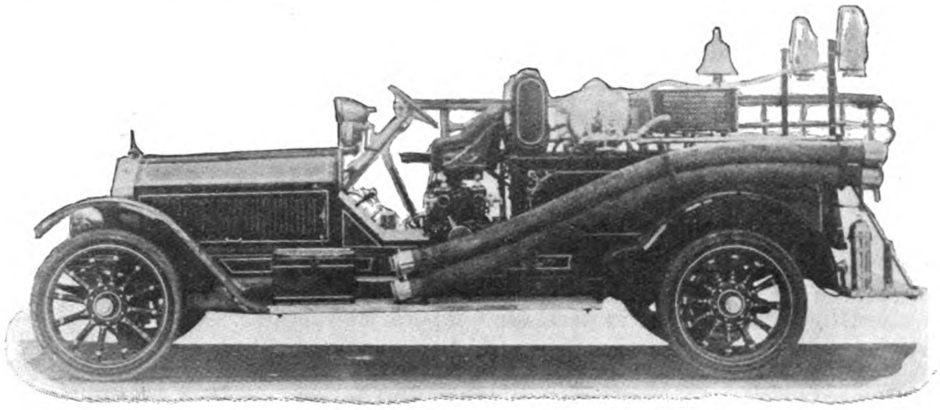
Are manufactured for a simple purpose . . . to lubricate automobile engines. The rich lubricating qualities of our oils afford perfect lubrication to the wearing parts. Not only is this true in summer, it is equally true in midwinter.

We have four grades of Auto Oils to meet every condition and requirement of the motorist.

Auto X Light
,, XX Medium
,, XXX Heavy
,, XXX E. V. Extra Heavy

*Obtainable at any Garage in China*

Type 75 Triple Combination Car, Manila, Philippine Islands.



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In building American La France fire fighting apparatus we have only one standard and that is the best that human skill and perfect materials can produce. Everything that can save a moment's time, that wi l eliminate possible failure is provided for, whether it is a fireman's axe or a complete Triple Combination car like that illustrated our guarantee of fine work is behind our products.

**TYPE 75 COMBINATION CHEMICAL AND HOSE CAR WITH JUNIOR PUMP.**

This very complete car is fitted with six cylinder engine of 105 H.P. It has 1,200 feet of 22 inch hose, Rotary Gear Pump of 350 gallon capacity, chemical tank holding 40 gallons with 200 feet of 3/4 inch chemical hose—and exceptionally complete equipment—full particulars of Type 75 and other American La-France specialties on request.

We are also manufacturers of commercial Motor Trucks and other types of fire apparatus.

Write to-day for further particulars to one of the following:—

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| Mustard & Co. | Shanghai, China. | Dodge & Seymour (India) Co., Ltd. | Calcutta, India. |
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| Richard Johansen & Co. | Hankow, China. | Pacific Commercial Co. | Manila, P. I. |
| Brewster & Co. | Foochow, China. | | |
| Andersen, Meyer & Co., Ltd. | Shameen, Canton, China. | | |

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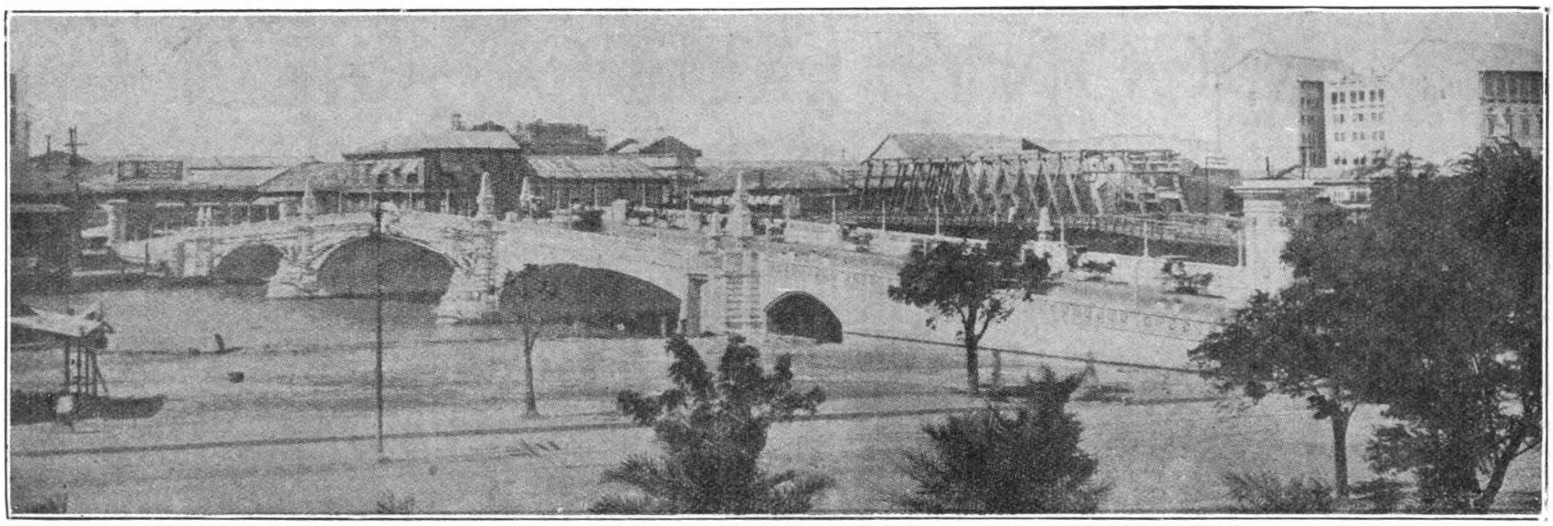


The William A. Jones Memorial Bridge, replacing the Old Bridge of Spain over the Pasig at Manila

# Public Works in the Philippines

## Roads

THE latest report of the Philippine government bureau of public works covering the fiscal year ending December 31, 1921 has just been issued and shows on that date a total length of 9,917 kilometres of roads in the islands, of which 4,863 are first class, 2,044 second class and 3,036 third class. Of the total, 4,906 kilometres were maintained by the bureau under the "caminero" system, a specific agreement between the insular government and each separate province.

The definition fo: road classification is as follows :

*First-class roads.*—Well graded and surfaced, thoroughly drained and constantly maintained. Bridges and culverts are usually complete and permanent, and, when missing, their places are supplied by ferries capable of carrying automobiles weighing two tons or more. These roads are continuously passable at all times with possible exceptions during typhoon periods.

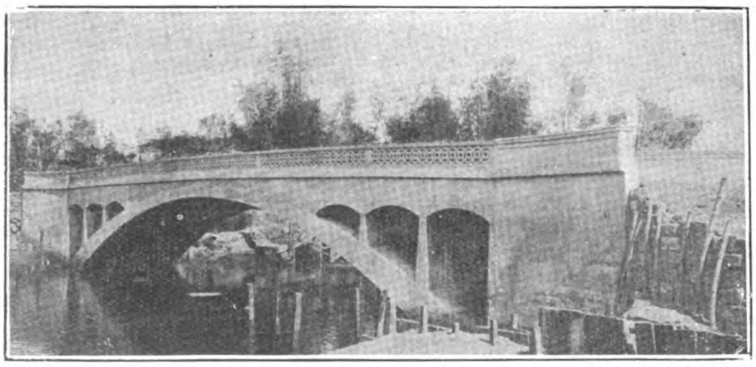
*Second-class roads.*—Fairly graded, partially or naturally surfaced, and generally intermittently maintained. Bridges and culverts are usually complete but, in part, are temporary structures. These roads are continuously passable for vehicle traffic during the dry season, but more or less impassable during the rainy season.

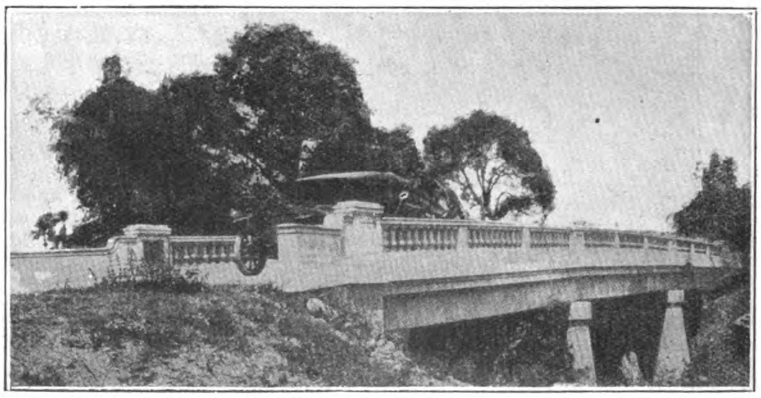
*Third-class roads.*—All traffic routes for carts not included in the first and second-class roads. Such roads are usually narrow, poorly graded or not graded, and generally impassable during the rainy season.

There were 4,906 kilometres maintained by the caminero system and 3,200 by the gang system, a total of 8,017 kilometres at a total cost of Pesos 3,762,218 for the former and Pesos 746,102 for the latter system, or an average cost per kilometre of Pesos 766 for the caminero and Pesos 233 for the gang system. There were 7,481 durable bridges and culverts in existence at the end of the year, a decrease of 83 over the previous period. These include structures of reinforced concrete, steel, brick and all substantial stone structures whether of adobe or other material. Of this class of structures there were 4,314 of reinforced concrete totalling 17,280 metres of span all built during the American *rêgime*, in addition to a large number of steel and other classes of construction.

Greater attention was paid during the year to road maintenance because of the ever increasing volume of traffic and the lack of proportionate increase in provincial road and bridge revenues. Very little new road construction was attempted during the year, and unless additional funds are provided a further curtailment of new construction will be necessary.

Despite the shortage of funds it was possible to construct a few important bridges, of which the following are of special note :



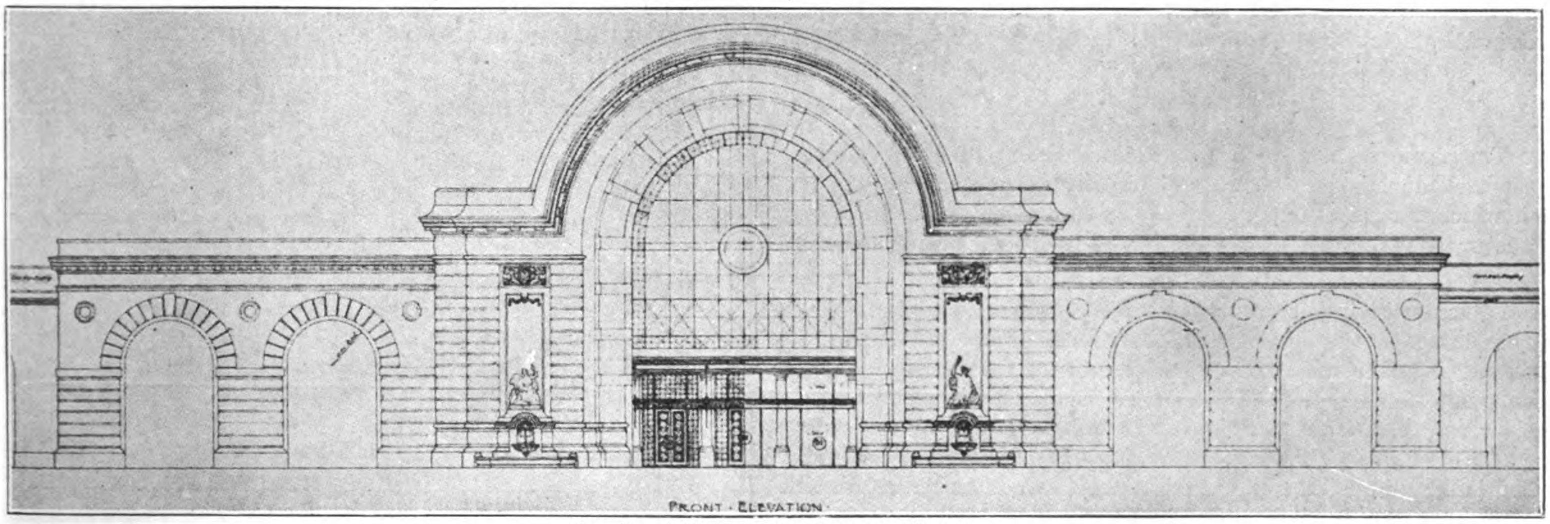


TYPES OF NEW ROAD BRIDGES

Zapote Bridge between Rizal and Cavite Provinces, P.I.
One 30 metre Span: Cost P.73,955

Mango Bridge, Montalban, Rizal, P.I.
Three 9 metre Span: Cost P.22,613

| Province and Road. | Name. | Km. No. | Type. | Spans. | Roadway in metres. | Cost. |
|---|---|---|---|---|---|---|
| Benguet : | | | | | | |
| Damortis R.R.Station–Baguio Road | Bued River suspension bridge | 249.6 | Suspension on steel towers ... | One 61-metre ... | 2.135 | P.24,300 |
| Bulacan : | | | | | | |
| Malolos–Hagonoy–Sto. Rosario Road | Hagonoy River bridge ... | 53.9 | R. C. slab and girder on R. C. pile bents ... ... ... | 5 of 9-metre ... | 4.88 | P.43,823, 95 per cent. complete Dec. 31, 1921. |
| Cavite : | | | | | | |
| Manila-Cavite Road ... ... ... | Imus River bridge ... ... | 20.5 | Wooden Howe truss on R. C. bents. | 3 of 20-metre ... | 2.85 | P.53,727 |
| Occidental Negros : | | | | | | |
| Himamaylan–Cabancalan Road ... | Talaban Diot River bridge (askew). | 78.4 | R. C. slab and girder on R. C. pile bents. | 10 of 7.5-metre ... | 4.88 | P.60,550, 80 per cent. complete Dec. 31, 1921. |
| Pampanga : | | | | | | |
| Angeles–Mabalacat Road ... ... | Abacan River concrete spillway | 92.23 | Reinforced concrete spillway ... | Length: 232 metres. | 5.00 | P.26,310, 80 per cent. complete Dec. 31, 1921. |
| Pangasinan : ... | | | | | | |
| Manila North Road ... ... ... | Bued River bridge ... ... | 176 | R. C. slab and girder on U-abutments. | One 11-metre ... | 4.88 | P.7,431, 2 per cent. complete Dec. 31, 1921. |
| Urdaneta–Calasiao Road ... ... | Catablan River bridge ... | 213.0 | R. C. slab and girder on R. C. pile bents. | 5 of 9-metre ... | 4.27 | P.53,240 |
| Rizal : | | | | | | |
| Malabon–Obando Road ... ... | Dampalit River bridge ... | 14.5 | R. C. slab and girder on R. C. pile bents. | 6 of 9-metre ... | 4.88 | P.49,000 |
| Mariquina–Montalban Road ... | Mango River bridge ... | 32.31 | R. C. slab and girder on R. C. piers. | 3 of 9-metre ... | 4.27 | P.22,613 |
| Manila–Cavite Road... ... ... | Zapote River bridge ... | 15.2 | R. C. arch ... ... ... | One 30-metre ... | 4.88 | P.73,955 |
| Tayabas : | | | | | | |
| Manila South Road ... ... ... | Sampaloc concrete spillway | 123.5 | Concrete spillway ... ... | Length: 70 metres | 4.42 | P.20,623 |
| Total expenditure for permanent bridges and spillways ... ... | ... ... ... ... | ... | ... ... ... ... ... | ... ... ... | ... | P.434,592 |




Pier Head No. 7. Port District, Manila

## Motor Vehicles

During the year there were 1,865 new motor vehicles registered and 11,476 re-registered, or a total of 13,341 as compared with 13,493 registered the previous year. Of the 1917 motor vehicles previously registered which were withdrawn from operation, 88 were reported unserviceable. In the licensing of operators, 2,000 applicants were examined and 1,595 new licenses issued. Including renewals, 16,859 drivers were licensed to operate motor vehicles. The funds collected during the year under the existing laws were P.207,275 as against P.177,263 for 1920. The amount expended for the registration of motor vehicles and for the carrying out of the provisions of motor vehicle laws was P.64,000.

## Benguet Automobile Line

The Benguet automobile line operated during the year eleven touring cars, six passenger trucks and six freight trucks, and handled during the same period 3,776 first-class passengers, 4,886 third-class passengers, 92,160 kilos of hand baggage, 885,142 kilos of expresses and freight and 60,548 kilos of dead head material.

## Buildings

During the year 1921, there were 148 durable buildings erected with a total content in cubic metres of 363,735 of which 71 per cent. was of reinforced concrete. Among the buildings completed in Manila during the year was the executive building occupied by the office of the governor-general. This structure is undoubtedly the finest example of the possibilities of local materials and artisanship in the islands to-day. The unit cost per cubic metre of enclosed space is very high as compared with other buildings, but fully fifty per cent. of the cost is represented by the special marble finish, carved wood work, wrought iron work, imported electrical fixtures and sample furniture. It has been demonstrated by the results obtained in this project that although the special marble finish is preferable to the ordinary cement finish so far as appearance is concerned, the cost and difficulty of obtaining it, however, make its use inadvisable except in very special cases.

Rizal Hall, for the University of the Philippines, was completed at the close of the year 1921, except for minor work on electrical wiring. The building itself is an architectural duplicate of university hall. It has steel roof framing and a reinforced con-

crete roof slab, overlaid with asphalt-impregnated water-proofing, with flat, inter-locking tile roofing.

The foundations for the new post office building were practically complete at the close of the year. The Atlantic Guilf and Pacific Company satisfactorily furnished and drove the 4,800 wooden piles for this job, but were obliged to omit approximately 40 piles because of the non-removal of the Meralco tracks and wires.

The addition to the bureau of printing, which will house the photo-engraving division, the machine shop, and the foundry, was completed during the year.

The maternity pavilion and the dining pavilion for the Philippine General Hospital were practically completed at the end of the year. As a whole, this project presents a very pleasing appearance and is certainly superior to the old units.

The reconstruction of the intendencia building has been carried on by administration throughout the year. The entire second floor, which was formerly of wood, was removed and replaced by reinforced concrete slabs and beams. A new roof framing was constructed composed entirely of steel supported by reinforced concrete pilars and beams. This steel framing was fabricated and erected by contract at a cost of approximately P.60,000. The roofing is of 22-gauge corrugated galvanized iron strapped to the steel purlins with 18-gauge galvanized iron straps. The ceiling joists being of steel, and the ceiling itself of asbestos, practically eliminates all the wood work formerly utilized in this structure.

In the provinces a number of important buildings were erected during the year, most of which were standardized school and provincial official buildings of various uses.

### Port Works

The proposed port works program for the archipelago suffered a set-back during the year, due principally to the financial depression which was severely felt by the government—work on many of the proposed projects for which plans had been prepared being indefinitely deferred.

Of foremost importance of the port projects are the Manila harbor improvements, embracing the construction of Pier No. 7. This pier is to be in every respect a modern marine terminal of permanent construction, designed to meet all requirements of the largest vessels afloat which make Manila a port of call, such as the *Empress of Canada* and the *Golden State*. These vessels are exceptionally high and have very large cargo capacities which require that the pier, to be of real value and modern in every respect, must be of such dimensions as to properly accommodate them ; otherwise the benefits that both shippers and government will derive from this new structure will be greatly impaired.

As planned, the pier is to be 1,400-ft. long from the pier head street line to the harbor limit line. Its facilities for handling freight and dispatching ships will be second to none. When completed and fully equipped, this pier will be the largest and most modern marine terminal in the Orient, capable of berthing four of the largest vessels simultaneously. It will have a freight handling capacity of three times the combined capacities of Piers No. 3 and No. 5.

Studies and reports were made on the feasibility of dredging the lower reaches of the Iloilo River to greater depths than those proposed on dredging plans previously approved. A considerable amount of data was obtained and compiled for the information of the Wood-Forbes mission, relative to the magnitude, type, depths of anchorages, etc., pertinent to ports and port structures throughout the archipelago.

The William A. Jones memorial bridge, over the Pasig River, the construction of which was supervised by the designing division, was thrown open to vehicle traffic August 22, 1921, and was practically completed in November, 1921, and fully commissioned in December, 1921.

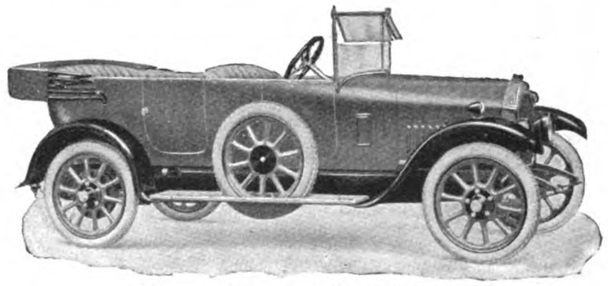

Humber CARS

**Best Quality—Lowest Prices**

Exceptional interest will be centred on the Humber Models for 1923, embodying, as they do, the latest improvements in motoring comfort and economy. Side by side with considerable price reduction, new features in body work and notable refinements in engine details have been introduced.

**Standard Models**

| | | |
|---|---|---|
| 8 | H.P. Light Car .. .. .. | £275 |
| 11.4 | H.P. 2-Seater with Double Dickey Seat .. .. .. .. .. | £510 |
| 11.4 | H P. 4-Seater Tourer .. .. | £525 |
| 11.4 | H P. Coupe with Double Dickey Seat | £615 |
| 11 4 | H.P. Saloon .. .. .. .. | £625 |
| 11.4 | H.P. All Weather .. .. .. | £650 |
| 15.9 | H.P. 5-Seater Tourer .. .. | £750 |
| 15.9 | Saloon de Luxe .. .. .. | £985 |
| 15.9 | Saloon Landaulette .. .. | £985 |



Humber 11.4 H.P. Touring Car

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## ENGINEERING FINANCE COMMERCE

上海仁記路第五號

遠東時報

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Making China Safe for Autocracy

Vol. XIX April, 1923 No. 4

SHANGHAI, PEKING, TOKYO AND MANILA

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Fig. W2622
Flanged Gate Valve

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Fig. W3661
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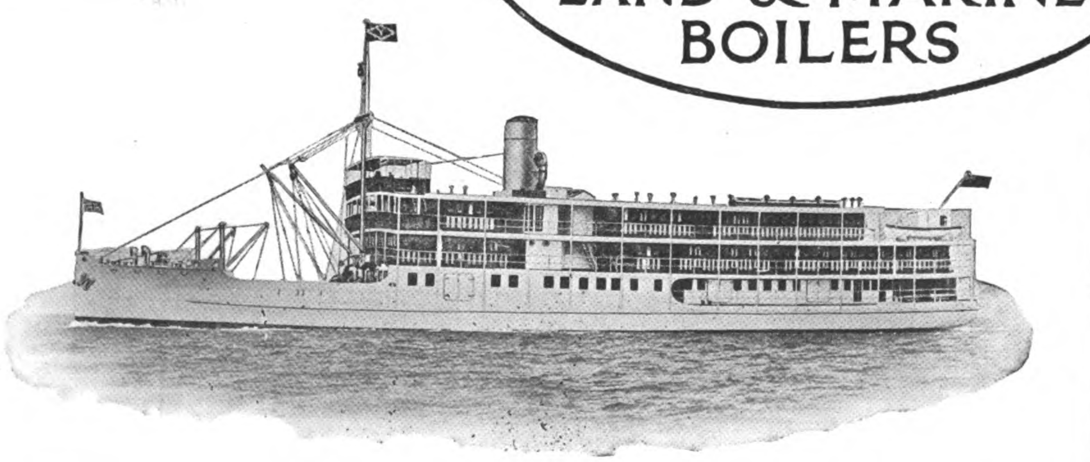


# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, APRIL, 1923 No. 4

# Making China Safe for Autocracy

## The Indifference of the Liberal Powers

ARE the foreign powers sincere in their proclaimed desire to assist China in stabilizing her government ? If so, they must call a halt to the present policy of indifference to principles which is making China the stronghold of Asiatic militarism and betraying the ideals for whose preservation the soil of France was drenched with the blood of their subjects. The powers control the collection of China's most important revenues. By adhering to strict neutrality instead of a thinly veiled friendship for one faction, they can force a compromise that will bring unification in a few months. They should decline to support that military overlord, who, for the moment, dictates the appointment of the Peking cabinet, by retaining all surpluses from the salt and customs revenues until unification is attained. These revenues should be employed to meet legitimate foreign obligations and the surplus held in trust for a unified government. Once the *tuchuns* are deprived of this source of revenue and foreign recognition to their puppets in Peking withdrawn, the game will be played out and the way cleared for a compromise that will give the liberals an opportunity to govern which has hitherto been denied them by foreign financial assistance to the militarists from Yuan Shih-kai to Wu Pei-fu. The continued recognition to the appointees of the Kin-Han overlord is a disgrace to western diplomacy, a proclamation to the people of China that principles which apply in Europe and America cannot be extended to Asia ; that democracy in China can expect no sympathy from those nations who terminated the rule of the autocrat in Europe.

Responsibility for further prolongation of the chaos in China is largely a matter which must be squarely faced by the United States and Great Britain. They must take the lead. France is not particularly interested in the problems of China at the moment. Japan is vitally interested. Her government and the best elements in the empire have come out firmly on the side of liberalism, but their hands are tied. For the present, Japan remains a silent spectator waiting for her partners to apply in China the same methods as were so successful in modifying her own policies. For it is well to keep in mind that Japan has followed the lead of her two great allies in all matters pertaining to China, she has reversed her pre-war program, set her house in order and swept her militarists into the discard in order to prove worthy of our respect and confidence : Japan is now waiting for America and Britain to practice what they preach in China.

Let us not forget that it was public opinion at home and abroad which forced Japan into the ranks of democracy ; that it was the propagandists of China who focussed the spot light upon her policies. The world was successfully humbugged and its attention diverted from the growth of the colossal military machine created for the suppression of democracy in China and the looting of a peaceful people. The time has arrived when the trick should be exposed; time that decent journalism in America and Great Britain should denounce the sham and bring the same pressure to bear upon the militarists of China as was brought to bear upon those of Japan. It is also time that the liberal governments of the west should atone in part for the crime against Asiatic democracy by their many interventions in the past which consolidated the power of the militarists in China under the leadership of the Peiyang group of freebooters.

Owing to the control exercised by the authorities over the news services at Peking, the world remains in ignorance of the fact that time and again the establishment of a liberal government has been thwarted by foreign intervention in one way or the other, and in each and every case the crime against democracy has been supported and vindicated by a powerful claque with no regard for the principles underlying its own system of government or the aspirations of the great masses of China. At all times the militarists have been upheld by a group of journalists whose correspondence has been accepted at home as reflecting the true state of affairs. Rarely indeed, in the ten years of the republic has the liberal element in China been accorded a square deal from the dispensers of Peking news.

The reorganization loan of 1913 supplied the funds which consolidated the rule of Yuan Shih-kai as dictator, enabling him to dissolve the parliament, hound its members into exile, prison or death and advance his conspiracy to restore the monarchy. The liberal leaders protested vigorously against financial support to the man who even then was laying his plans to overthrow the republic and mount the dragon throne. These protests were ignored. The powers desired a "strong man" at the head of affairs. They had their way. They now realize how impossible it is to stop the growth of the republican idea. The leader denounced as a visionary in 1912 retains the confidence of the masses and is backed financially and morally by every Chinese residing overseas.

The coercion of China into severing relations with and declaring war against Germany once more gave the Peiyang gang a strangle hold on the country. They looked forward to a share of the American war loans to consolidate their power and when these were withheld, turned elsewhere for assistance. With Japanese money, advanced in most cases, to enable Peking to discharge its war obligations, the Peiyang group waged a campaign to destroy in China the principles their allies were struggling to uphold in Europe. While the allies were making the world safe for democracy in Flanders and in France, the Peking militarists were ruthlessly suppressing democracy in China. Their participation in the war was the greatest mockery in history, a base betrayal of those who were sacrificing their lives for the perpetuation of democratic ideals. The liberal leaders protested against a step which they clearly forsaw would set back the movement for representative government. In so doing they exposed themselves to the charge of being pro-German and brought down on their heads the full force of a ruthless propaganda which ruined the prestige of any and all who failed to accept the allied view. Their protests were again ignored and democracy in China sacrificed in order that democracy in Europe might survive. The liberation of Europe from the yoke of a predatory military autocracy was celebrated by riveting the chains of a feudal despotism upon the patient masses of China.

Through it all, there was not a foreign voice raised in protest. The Peking claque applauded and redoubled its efforts to discredit the liberal leader. The president-makers controlled the sources of news and moulded world opinion to their view-point. They then hand-picked a *tuchun* of the Yangtze who was to have been propaganded into power at Peking. When he died, they turned to Wu Pei-fu as the next "strong-man," groomed him, boosted him, placed a halo around his head and invited the world to behold the "savior of China." The legations accepted the choice and supported the new aspirant to the mantle of Yuan Shih-kai. And when one of Chang Tso-lin's generals threw the victory in last year's war to Wu, the Peking boosters decided that the time had arrived to throw discretion to the winds, repeat the mistake of 1913 and knife democracy by providing the funds to solidify his control. Liberalism in China was to have been once more betrayed through financial assistance to a military overlord whose one solution to his country's sorrows was unification at the point of the bayonet. Once more, it was the citizens of the liberal nations of the west who urged the immediate advance of funds to elevate a military dictator to supreme power, and strange to relate, it was Japan's refusal to participate in such a loan through the consortium which defeated this third attempt to clamp the yoke of militarism on the necks of the Chinese people. Japan took the firm stand that such a loan to any one faction pending complete unification would constitute a direct and unwarranted intervention in the affairs of China. The liberal government of Japan appeared at this juncture as the one friend of liberal government in China.

Thwarted in their efforts to obtain a foreign loan to bolster up their idol, the hirelings of the feudal system have since placed every obstacle in the way of unification, knowing full well that with the triumph of liberalism their days of usefullness in Peking will be terminated. The liberal leader of China has been reviled, ridiculed, accused of being a bolschevist, a labor agitator and a menace to society. But in spite of the most contemptible campaign ever waged to besmirch the reputation of a political leader, the population of Canton turned out *enmasse* to welcome the return of Sun Yat-sen to power. He emerges from the treason of last year stronger than ever, a proof, if such proof be needed, that the principles he stands for are a vital force in Chinese politics. If he should die to-morrow, the cause of good government will survive. Others will carry on until democracy triumphs over the petty military despots now recognized by the powers as the government of China.

After the unsuccessful attempt to finance Wu Pei-fu, a mistake that resulted in at least one diplomatic transfer, the powers are now waiting, so they declare, for the Chinese to solve their problems in their own way, refusing to take action which may be construed as support to any one faction. On its face, this is sound diplomacy : analyzed, it reveals a determination to support the old order of things and perpetuate the power of the militarists. While professing neutrality, the powers insist upon recognizing the faction, who, for the moment, may dictate the appointment of a cabinet in Peking and of paying into this illegal government the surplus customs and salt revenues collected under their supervision. In this one action, they give the lie to their protestations of disinterestedness, and announce their preference for the " Hope of China " by furnishing him with the surplus salt and customs revenues to assist in carrying out his campaign of pacification at the point of the bayonet,

Eight cabinets have come and gone the past year in Peking and with each kaleidoscopic change the legations have hastened to recognize the new incumbents and to hand over the revenues which enables Wu Pei-fu to impose his will north of the Yangtze. This may be non-intervention in the affairs in China, but it certainly is not considered in this light by Sun Yat-sen or the southern leaders, who characterize it as an open and unwarranted interference in the settlement of China's difficulties, a flagrant violation of international morality, made doubly obnoxious to the liberal leaders by the fact that this continued recognition and payment of surplus into the treasury of the Kin-Han warlord is now the one obstacle to unification.

It is well to face the facts of a situation which has simmered down to a struggle between Wu Pei-fu and Sun Yat-sen, to one between militarism and democracy, in which the forces of reaction are supported and recognized by the powers and excused by the powerful claque controlling the dissemmination of news from Peking. Chang Tso-lin, the "uncrowned king" of Manchuria, Tuan Chi-jui, the Anfu chieftain and Sun Yat-sen, the liberal leader of Canton, have reached an understanding. Negotiations are now being carried on with Tsao Kun, head of the Chihli party, who seems willing enough to join the others, but to do so must subordinate Wu Pei-fu to his authority. The liberals demand the extinction of the satrap who has boasted that he will not rest until his armies have compelled unification by force. To this grievance is added the protest of the labor guilds against the order of the Kin-Han general which resulted in the execution of over a hundred strikers on the Peking-Hankow Railway. The Kuomintang party recently admitted the labor guilds in Canton into its ranks and both are determined that there can be no settlement of China's difficulties unless the power of Wu Pei-fu be broken. As against this decided stand, Wu and his cohorts, supported by the recognition of the powers as the legal government and lauded by powerful press agents, insist that no compromise will be entertained short of unification by the sword. The issue is therefore clearly one between Wu and Sun, between reaction and liberalism, between autocracy and democracy, between the idol of the masses and the despot who ordered the execution of the Kin-Han workers.

The powers are not sincere in their present policy. They remained neutral during the first revolution, when for over a year there was no recognized authority at Peking. Now, instead of standing aside in a spirit of strict neutrality they recognize and pay the customs and salt surplus into the shifting cabinets of Peking nominated by Wu Pei-fu. In effect, they remain in official contact with whoever holds the archives, recognizing as the government of China, the keeper of the pigeon holes of the Waichiaopu. For over a year they have been flouted by officials who have no authority even in their own departments and none whatever outside the walls of Peking and whose sole excuse for being there at all, is to keep alive a fiction that will ensure to their master the customs and salt revenues as it is doled out by the foreign repositories at the command of the legations. The time has arrived to stop a farcical neutrality which deceives nobody. It is time to force a peaceful settlement of the internal issues of China which will bring to the people the blessing of a truly representative government without another armed campaign for unification such as Wu Pei-fu is preparing for the coming summer.

Ordinarily, the withholding of the customs and salt surpluses would provide ample justification for the Peking government to default payment on all loans unsecured by these revenues. But this is the exact situation in China to-day : all loans and obligations not secured on these two revenues have been repudiated or defaulted and the one hope of further financial assistance to the militarists seems to consist in the prospective increase in the customs revenues agreed to by the powers. We hear nothing about employing this increase to pay off outstanding foreign loans: all talk to date centres on how to utilize it to raise new loans to maintain Wu Pei-fu and his faction in power. And just so sure as this customs increase is paid over to the puppets of Wu, it will be employed to push forward his summer campaign to annihilate the southern forces. Once more, the cause of good government in China will face the bayonets of reaction, and if the latter succeed in again ousting Dr. Sun Yat-sen from Canton, the responsibility will go straight up to the legations of the great powers who by their violation of neutrality will have financed the campaign to make China safe for autocracy.

G. B. R.

# Hongkong and Canton

## The New Trend of British Policy in China

WE invited attention last month to the understanding arrived at between the authorities of Hongkong and Dr. Sun Yat-sen on the occasion of the latter's visit to that port while *enroute* to resume control of the Canton government. This understanding, we now learn, has a much wider significance than appears on the surface, amounting in fact to a tardy recognition on the part of Hongkong of its dependence upon the development of the southern provinces for the advancement of its own special interests, in which co-operation and harmonious relations with Canton is essential to success. The future of Hongkong will hinge largely upon its ability to establish and operate profitably various industrial enterprises drawing their raw materials from the mainland. In effect, the understanding is simply the recognition of a new sphere of British interest based on the geographical position of the colony and dependence upon its own immediate hinterland for the supply of raw materials. It marks the end of the traditional British policy in the Yangtze region, made necessary by the Washington treaties which throws this section open to international competition.

Under the new order of things, the future commercial sphere which the British may legitimately aspire to dominate by reason of their natural advantages, is that section of China tributary to the port of Hongkong and the Kowloon Leased Territory. Here they may hope to successfully compete with all others and establish co-operative industries with the southern Chinese, the profits from which will more than repay them for the surrender of any exclusive privileges hitherto enjoyed in northern or central China.

Recognition of these conditions naturally carried with it the necessity for a radical modification of past policies, in which the future of the colony takes precedence over British interests in other parts of China. It brought home to the Hongkong authorities the realization that British policy as advocated by its Peking exponents was highly inimical to the best interests of the colony; that Hongkong could not hope to grow and prosper if the antagonism to Canton was permitted to remain the cardinal feature of a propaganda directed by British writers in the pay of the Peking government.

The shrewd merchants of Hongkong awoke to the fact that this vicious campaign had engendered an intense ill-feeling in the south which brought about the reprisals of last year. In the shipping strike Hongkong paid the penalty in millions of dollars for the long-drawn-out campaign directed from Peking to discredit Sun Yat-sen and the Canton cause.

Furthermore, it may be said without violation of confidence, that the understanding between Hongkong and Canton was hastened by the frank recognition of Mr. A. G. Stephen (head manager of the Hongkong and Shanghai Banking Corporation) that time had proved the justice of Dr. Sun Yat-sen's opposition to the reorganization loan of 1913. Dr. Sun vigorously protested to Mr. Stephen against the issuance of the loan, giving as his reason that the funds would be employed to destroy the republic and instead of unifying and stabilizing the government would split the country wide open. After ten years, the British banker admits that Dr. Sun was right, and so paved the way for a further exchange of views.

The experience of the past ten years has taught Hongkong that its interests have not been advanced by adhering blindly to a conception of British policy dictated by interested parties in Peking; that Canton cannot be easily eliminated as a factor in the Chinese political situation by denunciations of its program or villification of its popular leader. In fact, experience has disclosed that British interests whether in Hongkong or in other parts of China, are exceptionally vulnerable and at the mercy of organized labor now openly allied with the party of Sun Yat-sen. That reprisals against British interests have occurred is traceable directly to the campaign waged by British newspapers to discredit Sun Yat-sen and elevate the Kin-Han war lord to supreme power. When it is furthermore understood that Wu Pei-fu was specially selected by the Peking journalistic group of president-makers as the man best qualified to rule China and it was their propaganda which contributed so largely to Dr. Sun Yat-sen's overthrow, further light is thrown on the reasons underlying the reprisals against British interests by means of strikes. In other words, if British interests have suffered as a result of these labor disturbances, they can thank those British propagandists operating from Peking who have left no stone uncovered to discredit the cause and personal character of Sun Yat-sen. Human nature being very much the same the world over, the adherants of Dr. Sun employed the only weapons at hand to emphasize their disapproval of a campaign which bore all the ear-marks of official British approval.

With these facts before them, it was not such a difficult matter for Dr. Sun and the Hongkong authorities to arrive at a mutual understanding of each other's position and pave the way for the establishment of relations which are bound to have a far-reaching effect on the future of the colony and the success of good government in China. It was realized by Hongkong that much of its present prosperity is derived from the investments of southern Chinese and their overseas relations who prefer the stable government of the colony with its guarantee of property rights to the chaotic conditions existing in the adjacent province. As a result of these conditions, Hongkong is overflowing with Chinese money, bringing down the interest rate of the banks and making it increasingly difficult to find profitable investments within the colony. Property values have soared to unheard of prices and considerable new Chinese capital seeking a fair profit, has been invested in local companies. This influx of wealth has increased prices all along the line, causing embarassment to European residents and merchants, a situation which shows no sign of amelioration until Kwantung is once more freed from political chaos and stabilized under an efficient government.

Here we have another potent reason why Hongkong is anxious to facilitate the establishment of popular government in Canton, it being realized that such government must meet with the approval of the masses and not forced upon them by the bayonets of the north. Peking may compel allegiance to its authority by military occupation, but it would require constant vigilance and the expenditure of huge sums for military purposes to impose these conditions indefinitely. Aside altogether from the drain on the central treasury to subjugate and occupy Canton by northern troops, the situation would remain menacing alike to Chinese and Hongkong interests. Chinese capital in the colony and from overseas would still refuse to embark in any enterprise under their own government and continue to swell the bank balances and unsettle the local financial market, while the establishment of any new industrial enterprise in the colony relying upon Chinese territory for its raw materials, would be out of the question.

One of the principal grievances of Chinese residing in and subject to British laws in Hongkong was the restrictions imposed upon them (due to the consortium pact and British policy as laid down by London and Peking) to their extending open financial assistance to Dr. Sun Yat-sen in his campaign for the implanting of a liberal government. This restriction was also felt by Chinese residing in the Straits Settlements and the Federated Malay States. Such financial assistance as they have been able to extend to Dr. Sun in the past has been frowned upon by the British authorities. Probably the most important feature of the understanding arrived at, is the reversal of the above policy, in which Chinese under British jurisdiction will be free to render financial assistance through the medium of open loans to the Canton government without incurring official disapproval. As a result, Chinese capitalists of Hongkong

are now prepared to furnish Dr. Sun with a loan of six millions to which will be added other loans from their compatriots in Malaya.

This policy has the double advantage of relieving Hongkong of a glut of capital and of recognizing the undoubted right of the Chinese to support the Cantonese leader. Although there is reason to believe that the support tendered to Dr. Sun by Hongkong went even further, this much is acknowledged.

It cannot be said that the hostility of the anti-Sun foreign element in Hongkong is entirely eradicated, but even his worst enemies are remaining neutral and willing to give him a fair chance to work out his plans for unification from Canton without harassing him by further abuse. His critics concede that with five years of uninterrupted tranquility, in Canton, the old city of the dreadful stink will be rebuilt into the most modern metropolis of China. This will call for the establishment of industries, machine shops and other enterprises, the equipment for which, the British merchants of Hongkong will be in the most favorable position to furnish. Hongkong capitalists have planned the erection of steel and iron works in Kowloon where ample iron deposits exist, but they look to Kwangtung for coal and limestone. The cement works are now importing limestone from Haiphong because of the difficulties surrounding its quarrying and shipment by junk from the North River districts to Kowloon. Coal is found in many parts of Kwangtung and could be mined, transported and sold in Hongkong at prices much lower than those now prevailing. Other products of the mainland are indispensable for the future industrial life of the colony, and it is now realized that a spirit of co-operation must supplant the old worn out policy of antagonizing the Cantonese by constantly belittling and besmirching the character of their chosen leader. Hongkong and Canton must pull together.

The understanding between Hongkong and Dr. Sun marks the beginning of a new era for British interests in China, a termination of the petty, undignified and spiteful campaign waged by a few journalists in Peking who have attempted to dictate British policy from the viewpoint of their own selfish interests. From now on, it is to be hoped that Hongkong and Canton will march in complete accord and in full co-operation for the development of that part of China where the interests of both are so intertwined that any other course would be suicidal. So we come to the end of another chapter, placing a period to the ten-year campaign to discredit Sun Yat-sen. If Sun can hold Canton, the cause of good government will triumph in China : if he wins, the support of Hongkong will stand as the turning point in the long-drawn-out struggle. It only remains for the American government to come out on the side of fairplay and its own traditions to bring China into the ranks of the liberal nations. The liberal government of Japan has lined itself against militarism in China, it stands, morally at least, with Dr Sun Yat-sen. What Hongkong says, especially when dictated by the chief of the Hongkong and Shanghai Banking Corporation, sooner or later becomes the corner stone of British policy in China. Hongkong has spoken. The colony stands with Canton, and its popular leader. It now remains for America to speak in tones that will convey to the freebooters of the north that their days are numbered. There is only way that China can be made safe for democracy ; we pointed it out in the preceding article.

G. B. R.

* * *

# Doing Things in Japan

## A Great Opening for American Capital to Co-operate in the Development of an Industrial Nation

JAPAN is doing things, big things. While the rest of Asia is seething with political discontent and the wheels of progress checked, Japan is solving the problem of her scanty fuel supply, her labor troubles, high costs of living and industrial future. Slowly but surely, she is getting back to normal financial conditions and preparing to regain the position she has temporarily lost in the markets of Asia. Japan has made up its mind that it must exist as an industrial nation and employ all the advantages that geography and nature has given to it in order to hold its own in the keen competitive struggle for existence that faces it in the future. Japan is weak in many natural resources, principally coal, which has risen very high in price since the war. However, she is liberally supplied with water power, officially estimated at 10,000,000 kilowatts, of which, 7,000,000 is located on the main island. This source of natural wealth is being developed as rapidly as possible with domestic capital, but the task is so great that unless foreign capital co-operates in this profitable enterprise, many otherwise excellent schemes will have to be indefinitely postponed.

The centre of immediate developments lies in the larger industrial cities of the main island, at Tokyo, Yokohama, Nagoya, Osaka, Kobe and Kyoto, and to meet the demands of the manufacturing establishments in these districts many large and small power plants have been erected and several power combines created. Amongst these are the Tokyo Electric Light Company, the Inawashiro, the Kinugawa, the Ujigawa, the Nippon, the Daido and other companies, while in the western district are found the Sanyo, the Bisaku, the Hiroshima, the Shikoku and the Kyushu companies. In the case of the Daido company the building program for the next ten years contemplates a total output of 640,000 kilowatts. Similar programs have been drawn up for the expansion of other large combines, so it may be said that to-day Japan presents the most interesting market for electrical material in the world, in which the manufacturers of all nations are keenly competing for the business alongside the Japanese concerns whose names are already a household word in the electrical industry.

Japan is leading in the electrical development of Asia in a large way and other nations more advanced in so-called western civilization may learn much to their profit by the problems that are here being tackled in characteristic Japanese fashion and worked out on a practical basis. Not alone in industry is the field for electrical power in Japan most promising and profitable, but the future holds bright for the electrification of not only the state railways but the entire transportation system of the empire. The government has already made the first steps in the replacement of steam locomotives by electrical, the first order for thirty-five having been placed in England several months ago, and some have since ordered from American manufacturers. The task of electrifying the 1,414 miles of main line state lines on the main island, is tremendous, calling for a total estimated power of 226,000 kilowatts to be completed within the next ten years. In addition to this, there are 131 private steam railways with a total of 1,892 miles capitalized at Y.235,000,000, which will call for another 250,000 kilowatts in power and enormous amounts of equipment.

Owing largely to the senseless propaganda calculated to destroy confidence in the business integrity of Japan and the silent, passive opposition to any proposition that savored of American and Japanese business co-operation that might be extended to China, Japanese bonds have had a hard time securing a foothold on the American financial market. These conditions are, however, changing. The corner has been turned and several minor loans and co-operative enterprises have resulted from the clearing of the political atmosphere in the Pacific, and there are bright hopes that American capital will now see its way more clearly to participate with Japan in the development of its many resources.

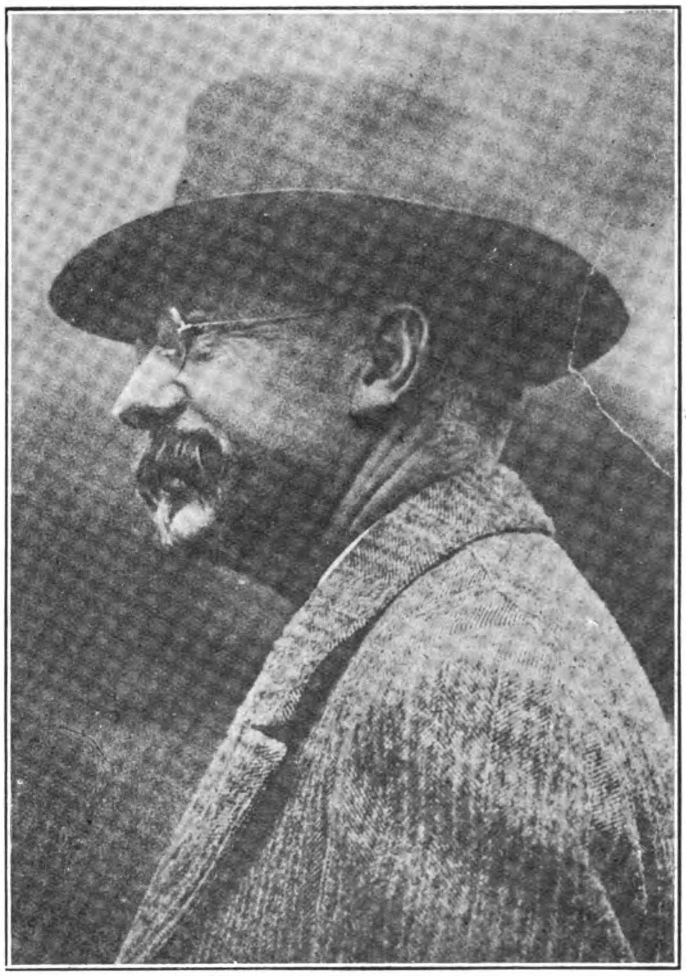
In discussing this matter with a well-known Japanese financier recently, he invited attention to the fact that the electrical field in Japan was of more value to Americans than the prospective railway business of China for the next quarter century, adding, in parenthesis, that the capital of the Daido Electric Power Company and its associated enterprises alone was greater than the total capitalization of the Chinese government railways. The electrical market in Japan for the next two decades offers not only a most attractive field for the investment of American capital, but carries with it a market whose importance to our manufacturers is far more certain and profitable than any other on the continent of Asia.

# Harriman's Far Eastern Plans

## The Inside History of the American Attempt to Gain Control of the South Manchuria Railway as a Link in the Harriman Round-the-World Transportation System

*(Extracted from "E. H. Harriman," a Biography by George Kennan, Published by Houghton Mifflin Company, Boston and New York)*

WRITTEN in memory of the great American " whose services to the science of railroading will hardly be reckoned by those who know what his work was, as less than those rendered by George Stephenson himself," the biography of E. H. Harriman by George Kennan throws a light on the inside history of American railway finance that goes far to wipe out the misconceptions which surrounded some of his operations. Harriman is shown in his proper light, one who had no time for quarrelling with others or rushing into print to defend his actions when subjected to criticism. "The people always find out what's what, in the end, and I can wait. I need all my time and energy to do things" was his characteristic answer to a friend who said he would be misjudged if he failed to defend himself. Harriman started things when he moved and in most cases carried out what he started. The most important chapter of the biography to Far Eastern readers is the one devoted to his plans to acquire control of the South Manchuria Railway. Here he certainly started something, and laid the basis of an American policy that considerably complicated the international political situation in this part of the world, Harriman's plans were undoubtedly sound from the financial and railway point of view, but he apparently gave no thought to the tremendous racial and political problems involved in American control of transportation lines traversing a disputed territory where all indications pointed to the outbreak of another great war. The chapter giving the inside history of his plans follows :



The Late E. H. Harriman

Mr. Harriman's direct business relations with the Far East began in the year 1905. The aid given by Kuhu, Loeb & Co. to the Japanese government in floating its war bonds, as well as Mr. Harriman's own interest in China and Japan, based on his connection with the Pacific Mail Steamship Company, early attracted his attention to that part of the world, and when in the spring of 1905, he received an urgent invitation to visit Japan, from the American minister in Tokyo, Mr. Lloyd C. Griscom, he determined to suspend for a time his financial and railroad activities in the United States and look over personally the Oriental field, with a view to ascertaining what could be done for the extension of American commerce in Far Eastern countries.

" It is important," he said in a letter to Mr. Griscom, " to save the commercial interests of the United States from being entirely wiped from the Pacific Ocean in the future," and " the way to find out what is best to be done is to start something." This proposal to " start something " was characteristic of Mr. Harriman's methods. He did not think it necessary to perfect all the details of a plan before going to work. When he had clearly defined the object to be attained, his policy was to " start something," and then work out the scheme in accordance with circumstances and conditions as they might arise. The clearly defined object that he had in view in this case was the extension of American influence and the promotion of American commerce in the Far East ; but beyond this, with the details not yet worked out, was a plan for a round-the-world transportation line, under unified American control, by way of Japan, Manchuria, Siberia, European Russia, and the Atlantic Ocean. Such a railroad and steamship line, if successfully established, would unite for commercial purposes four of the most populous countries on the globe ; and would enable the United States not only to take a commanding position in the Orient, but to supply the wants and direct in some measure the commercial activities of hundreds of millions of people in the least developed parts of Europe and Asia.

To most observers at that time a round-the-world transportation line under American management, would have seemed an unreliable dream, but Mr. Harriman had made many of his visions come true, and he believed that he could give objective reality to this one. His plan was, first, to secure control of the South Manchuria Railway, which Japan, through the fortunes of war, had just acquired from Russia. This road was then in a very unsatisfactory physical condition; but Mr. Harriman proposed to re-construct and re-equip it with American capital, and make it the eastern part of his proposed trans-Asiatic line. Having secured this essential link, he intended to buy the Chinese Eastern, which he thought the Russians, having lost Port Arthur, would gladly sell, and then acquire transportation or trackage rights over the trans-Siberian and the Russian government roads from North Manchuria to the coast of the Baltic Sea. These acquisitions, in connection with the Pacific Mail Steamship Company and the American railroad systems that he already controlled, wholly or in part, would give him a continuous line more than three-quarters of the way around the globe, and it would be a comparatively easy matter, thereafter, to connect up the termini by establishing a line of steamers across the Atlantic from the United States to Russia. He anticipated most difficulty in persuading the Japanese to surrender or share the control of the South Manchuria road, which, with the Fushun coal-fields adjacent thereto and the southern part of the island of Saghalin, were all that they had been able to get from

Russia, by way of indemnity to cover their colossal war expenditures. However, he had strong hope of success, for the reason that the Japanese were heavily in debt and urgently in need of capital for the improvement of their transportation facilities and the development of their recently acquired territory on the Asiatic mainland. The purchase of the Chinese Eastern and the acquirement of the necessary rights over the trans-Siberian he regarded as comparatively easy. Russia had allowed a Baltimore capitalist to build and manage her first railroad, from St. Petersburg to Moscow, and had even asked an American engineer to finance and construct the great road from the Urals to the Pacific. It seemed probable, therefore, that the Czar would gladly make concessions to American capitalists if, with their aid, he could have the trans-Siberian line double-tracked, properly equipped, and efficiently managed.*

Preparations for the trip to the Orient were begun. The party sailed from San Francisco on the steamship *Siberia* August 16 and, after short stops at Honolulu and Midway Island, arrived in Yokohama on the evening of August 31.

The reception given to Mr. Harriman by Japanese officials, financiers, and business men was extremely cordial. Representatives of the Bank of Japan and the famous Mitsui Company boarded the steamer as soon as the anchor was down, and when the party had landed and taken quarters at the Grand Hotel, calls and assurances of welcome were received from the president and vice-president of the Industrial Bank of Japan; the manager of the Japan Steamship Company; Count K. Inouye, one of the "Elder Statesmen;" Baron Iwasaki, Senator Watenabe, and Mr. K. Mori, a personal representative of the minister of finance.

As Mr. Harriman could spend only a limited time in the Far East, and as he desired, before his return, to visit China and Korea, he was obliged to promote his round-the-world-line enterprise, as far as it could be promoted in Tokyo, by a "whirlwind campaign" of visits and interviews. Between September 1 and 13, he made the acquaintance of all the prominent statesmen in Japan, including Marquis Ito, Count Okuma, the premier, and most of the ministers; and succeeded in awakening the interest and enlisting the support of several eminent financiers, including especially Mr. J. Soyeda, president of the Japanese Industrial Bank. Having accomplished this in a few days, he and his party started on September 13 for Kyoto and Kobe, leaving further negotiations for the acquirement of the South Manchuria Railway in the capable hands of Minister Griscom and President Soyeda.

During Mr. Harriman's absence, Minister Griscom did all that could be done to promote what seemed to him the best interests of the United States in the Orient by persuading the higher Japanese authorities to consider favorably Mr. Harriman's plans. In his interviews with Premier Katsura, Count Inouye, and the minister of finance, he took the ground that co-operation with America would be in every way profitable to Japan, by strengthening her credit, furnishing her with capital for the improvement of her transportation system, facilitating her trade, and enabling her to develop quickly and fully the material resources of her recently acquired territory on the Asiatic mainland. The South Manchuria Railway was urgently in need of reconstruction and re-equipment, and there was no man in America, perhaps in the world, better qualified by experience and ability to direct such work than the rebuilder of the Union Pacific. Mr. Harriman's relations, moreover, with American bankers and financiers were such that he could secure at once the pecuniary support which Japan needed, but which she alone might not be able to get quickly enough to meet the emergencies of the situation. The suggested project would bring Japan and the United States into much closer relations, both commercially and politically, and if successful it would furnish a large revenue to the Japanese government and thus compensate the Japanese people for their failure to get a pecuniary indemnity from Russia.

In his negotiations with the higher authorities, Mr. Griscom was ably assisted by Mr. Durham W. Stevens,† who had been in the service of the Japanese government for more than twenty years, and who had earned the respect and trust of all the emperor's statesmen and officials.

The result of their joint efforts was in every way encouraging. Premier Katsura said that he would give the matter immediate and serious consideration, and Count Inouye, one of the most influential of the elder statesmen, promised that he would call a meeting of the minister of finance, the minister of communications, and other high officials directly interested, and would try to reach a decision at once. Count Inouye himself was very favorably impressed and said to Mr. Griscom: "We would be very foolish to let such a great chance slip."

When Mr. Harriman returned to Tokyo, on October 8, negotiations were so far advanced that the imperial authorities were ready to consider promptly, if not to accept, a definite proposition; and in three or four days of strenuous activity he succeeded in getting the details settled and reduced to writing in the following memorandum of agreement:—

Memorandum of a preliminary understanding, dated October 12, 1905, between His Excellency Count Katsura Taro, representing the Japanese government, and Mr. E. H. Harriman, representing himself and associates.

"A syndicate to be formed to provide capital for the purchase of the South Manchuria Railway, acquired by the Japanese government, and its appurtenances; the rehabilitation, equipment, reconstruction and extension of the same, and the completion and improvement of the terminals at Tairen (Dalny); and it is understood that the two parties are to have joint and equal ownership in the properties acquired. Permission to work coal mines (in connection with the railroad) to be given to a corporation by special agreement, in which there shall be joint interest and representation.

The principle of development of all industrial enterprises in Manchuria shall be such that each party shall have the right to an equal interest with the other. The Manchurian railroad, with its appurtenances rails, cross-ties, bridges, superstructure of all character, stations, buildings, platforms, warehouses, docks, wharves, etc., to be taken at their true value, to be determined by joint representation of each party.

The organization to be made on basis that will meet exigencies and conditions as they may exist at the time. As it is deemed advisable to meet the conditions in Japan, the corporation is to be operated with Japanese control. Changes are, however, to be made therein from time to time, as far as circumstances will permit, looking toward a final equalization of representation and control. The corporation is to be organized under Japanese law. Mr. Harriman, having agreed for himself to operation through a Japanese company, the only open question is as to his associates agreeing thereto, which he believes they will.

To provide for an arbitrator, it is agreed that Mr. Henry W. Dension shall be appointed to fill that place.

* The proposal to finance and build the trans-Siberian railway was made by the Russian government to a well-known railroad engineer in the United States. The terms offered were liberal, but the amount of capitalr equired was so great that it could not be obtained without the aid, or at least the good-will, of the Jewish bankers and financiers in Europe. They, incensed by the treatment of their people in Russia, declined to co-operate, and the American engineer found it impossible to organize a syndicate that would be strong enough to finance the enterprise in July and were soon completed.

† Mr. Stevens entered the Service of the Japanese government in 1883, as counsellor of its legation in Washington. He was soon afterwards transferred to Tokyo, where he became a member of the bureau du protocol of the conference for the revision of treaties between Japan and foreign powers. Between 1887 and 1904 he was engaged in various diplomatic negotiations, and in the latter year he was appointed adviser to the Korean government at Seoul. He was assassinated in San Francisco in 1908 by a misguided Korean fanatic who regarded him as an enemy of the Korean people, although, in reality, he had always been their sincere friend.

In case of war between Japan and China, or Japan and Russia, the railroad shall at all times obey the instructions of the Japanese government in the matter of the conveyance of troops and war materials, and the Japanese government is to compensate the railroad for services rendered and protect it against aggressions at all times.

It is agreed that Mr. J. Soyeda, president of the Industrial Bank of Japan, shall be the medium of communication between the parties hereto.

The including of any outside interests (other) than the parties hereto shall be done only after conference and mutual agreement."

With this memorandum of agreement in his possession, Mr. Harriman sailed from Yokohama in the steamship *Siberia* on the afternoon of Friday, October 12. He had not accomplished all that he desired to accomplish, but he had at least "started something," and there seemed to be a fair prospect that the concession thus obtained would ultimately lead to the consolidation of Japanese and American transportation interests on the Asiatic mainland, and greatly extend and promote the commerce of the United States in that part of the Orient.

Unfortunately, while Mr. Harriman was at sea, on his way to San Francisco, all his Far Eastern plans were suddenly blocked by an obstacle that he had neither foreseen nor considered. Three days after he sailed from Yokohama, Baron Komura, the Japanese minister of foreign affairs, returned to Tokyo from the United States, bringing the treaty that he and Minister Takahira had just negotiated with the Russian plenipotentiaries at Portsmouth. As soon as the Harriman-Katsura agreement for joint control of the South Manchuria Railway was shown him, he said "It cannot possibly be carried out, because it is inconsistent with Article VI of the treaty that we have just made with Russia." The article in question provided that the transfer of the South Manchurian road from Russia to Japan should be made only with the consent of the Chinese government. Until, therefore, such consent should be obtained, Japan had no legal rights that could be shared with Mr. Harriman. Aside from this, Baron Komura was opposed to the Harriman-Katsura agreement on its merits. The Japanese people were already so dissatisfied with the Portsmouth Treaty that they had resorted to mob violence as a protest against it, and their discontent would be greatly increased if they should learn that their government had sold to a Japanese-American syndicate nearly all that they had gained in two years of successful war. To have made peace without securing a pecuniary indemnity was bad enough; but to sell more than half the fruits of their victory to the Americans, and thus throw open to foreign competition the commercial field which they had bought with their treasure and blood would seem to them intolerable.

Baron Komura's arguments and influence were too strong for the supporters of the Japanese-American agreement, and in less than a week a change of policy was decided upon. When Mr. Harriman, with his mind full of plans for the future, arrived in San Francisco, he received from the Japanese consul there the following note:—

I beg to inform you that I have been instructed by Count Katsura, of my government, to deliver the following message to you immediately upon your arrival in San Francisco:—

"The Japanese government have found it necessary to institute a more thorough investigation and examination of the questions which are the subject of memorandum of October 12, 1905, and they consequently request you to regard the memorandum as in abeyance until they are able to communicate with you more fully regarding the matter."

Ten days later, when Mr. Harriman had reached New York, he received the following cable message from Mr. J. Soyeda, president of the Industrial Bank of Japan:—

Tokyo, October 30, 1905.

E. H. Harriman, New York.

Prime minister requests to forward following confidential message to you explanatory message handed you by Japanese consul San Francisco.

"Having considered detailed report made by minister of foreign affairs on his return home, and having in view pacific attitude Chinese government on railroad question, Japanese government has come to conclusion that question embodied in memorandum, October 12, requires more thorough and complete examination than possible at present time. As you are aware, Portsmouth Treaty provides for consent of China regarding transfer to Japan of railroad property, and for agreement with Russia regulating connecting railroad service. Until agreements with China and Russia are concluded, impossible to determine precisely what rights and properties are included in the transfer, or what earning capacity of railroad is likely to be. Without full knowledge on these points impossible to make definite arrangements for working railroad and property which would prove satisfactory to either Japanese government or E. H. Harriman. Consequently Japanese government deem wise request E. H. Harriman to regard said memorandum as in abeyance for the time being. Japanese government will proceed, as soon as possible, to conclude necessary international agreement. Such agreement will probably necessitate some essential change in proposed arrangement with Mr. Harriman. But in any event, Japanese government will consult him before making arrangement with private capital."

Soyeda.

This cable message was the result of a compromise between Baron Komura and the supporters of the Harriman-Katsura memorandum. The former advocated immediate cancellation of the agreement, for the reason that it was inconsistent with Article VI of the Portsmouth Treaty. In view, however, of all the circumstances, and especially of Katsura's ignorance of the stipulation regarding Chinese consent, Baron Komura agreed to regard the memorandum as "in abeyance," and to leave open the possibility of confirmation at a later time, provided no objection should be raised by the government of China.

If the Japanese minister of foreign affairs had been previously consulted, and had favored the agreement on its merits, he might possibly have found some means of dealing with the Chinese complication; but he had never met Mr. Harriman and had not been impressed, as had his colleagues, by the latter's forceful personality; he doubted the expediency of sharing control of the South Manchurian road with a syndicate about which he knew little or nothing; and he believed that the agreement, if allowed to go into effect at that time, would increase his own unpopularity in Japan, and would render extremely difficult, if not wholly impossible, the negotiation of the treaty with China that he then had in contemplation. He, therefore, insisted upon postponement, at least, and the other members of the ministry yielded.

In this thwarting of Mr. Harriman's plans there seems to have been no intentional breach of faith on the part of the Tokyo authorities. It was simply a case in which one branch of the government, acting independently, concluded a treaty that nullified action taken almost simultaneously by another branch. Count Katsura did not know that Baron Komura had agreed in Portsmouth to make the transfer of the railroad conditional upon Chinese consent, while Komura, in concluding such agreement with Russia, was ignorant of the Tokyo memorandum. One compact or the other had to be set aside, and in holding the Harriman agreement "in abeyance" while he negotiated with China, Baron Komura thought, perhaps, that he was making the best of an accidental and unfortunate situation. But be that as it may, he started for Peking with Mr. Denison, on November 6, leaving the railroad matter in this unsettled state.

Negotiations with the government of China for a new treaty occupied more than a month, and Mr. Harriman was not informed

of the result until January 15, 1906, when he received from Mr. Soyeda the following cable message :—

Tokyo, January 15, 1906.

E. H. Harriman, New York.

Baron Komura returned on January 1 and the new cabinet was formed on the 7th. I have been urging the necessity of informing you what to be done, and am now asked to wire you. Count Katsura requests me to let you know that obtaining from China consent contemplated by Article VI Portsmouth, N.H., Treaty it was necessary to provide that Manchurian railway should be worked by company composed exclusively of Japanese and Chinese shareholders, following in that respect terms of original concession to Russia. Count desires me to convey expression of regret that, in view of above circumstance, he is compelled to ask you regarding memorandum of October 12, 1905, as of no effect, as it is manifestly impossible to make any arrangement based on it. He adds, however, that the Japanese government entertain a doubt as to possibility of Japanese and Chinese capital alone being sufficient to meet requirements of necessary improvements and extension of Manchurian Railway, and that therefore should an occasion arise in future enabling them to open negotiations with foreign capitalists, on a different basis, a fresh consultation may be held with you. I desire to add Count has been relieved of his position as prime minister, and send this telegram after consulting with Marquis Saionji, his successor.

Soyeda.

In a letter written to Minister Griscom in January, 1906, Mr. H. W. Denison, legal adviser of the Japanese foreign office, gave the following explanation of Baron Komura's failure to get the consent of China to the Harriman-Katsura agreement :—

"The Japanese government have secured the consent of China to the assignment of the railroad (the South Manchurian) between Port Arthur and Chang-chun, subject to the same terms and conditions that attached to the original grant to Russia ; that is to say, the railroad is to be worked by a company composed exclusively of Japanese and Chinese shareholders. You will find the original concession to Russia in Rockhill's book " Treaties and Conventions with and Concerning China and Korea," pp. 207-224, and I enclose a newspaper copy of the official version of Baron Komura's agreements with China . . . If the Chinese avail themselves of the opportunity of taking half a share in the Manchurian enterprises, a definite understanding on the basis of the memorandum of October 12 is impracticable. There is at the present time a very strong anti-concession wave sweeping over China. The government are endeavoring, by hook or by crook, to get back the grants already made. They cancel the concessions in case of default in any direction, and they buy back the grants if no grounds for cancellation exist. In this frame of mind, and being unable to cancel or repurchase the Manchurian concessions, it is more than likely that China will gladly take the one-half interest in the enterprise. In that case I believe some arrangement on new lines will be possible, but only if the negotiations are undertaken by a man of force and prestige like Mr. Harriman."

In the spring of 1906, Mr. Jacob H. Schiff, of the firm of Kuhu, Loeb & Co., happened to visit the Far East, and, at the request of his old friend and associate, Mr. Harriman, made an attempt to revive the 1905 agreement ; but Baron Komura was as much opposed to it as ever, and after a number of conferences the negotiations were again dropped.

Thus ended Mr. Harriman's attempt to get control, or partial control, of the South Manchuria Railway, as an essential link in his projected round-the-world transportation line. His ill success, however, did not shake his faith in the practicability of the enterprise, but merely led him to consider other means of bridging the gap between the Gulf of Pechili and the trans-Siberian road. The difficulties in the way were very great. A new and independent line through Manchuria or Mongolia could not be built without Chinese consent, and the Chinese, at that time, were strongly opposed to the granting of any more railroad concessions to foreign syndicates. So far, moreover, as a line through Manchuria was concerned, they themselves were almost powerless, for the reason that, in the treaty of December, 1906, with Japan, they had agreed " not to construct any main line in the neighborhood of and parallel to the South Manchuria Railway." Even, therefore, if they had been willing to let Mr. Harriman build a road from the Gulf of Pechili to the terminus of the Chinese Eastern, they could not do so, because it would necessarily be a " main line in the neighborhood of and parallel to the South Manchurian."

Mr. Harriman thought, at one time, of building a road across the Gobi Desert by the old caravan route, passing through Kalgan and Urga and connecting with the trans-Siberian near Irkutsk ; but as the distance would be great—twelve hundred miles or more—and as most of the country to be traversed was so barren as to promise little in the way of agricultural development, this scheme was soon dismissed as impracticable.* The only alternative was a new line, about four hundred and fifty miles in length, from the Gulf of Pechili to the trans-Siberian Railway at Tsitsihar. This road, although nearly parallel with the South Manchurian, would be separated from it by an average distance of one hundred and seventy miles, and consequently would not be in the prohibited " neighborhood."

In the early part of 1906, Mr. Harriman received full reports on the trade, industry, and resources of northeastern China from Colonel Holabird and Mr. Wallace, two experts whom he had sent to make investigations in the Far East ; and in that and the following year he was kept fully informed with regard to railroad affairs in Siberia and Manchuria by Willard D. Straight, consul-general of the United States at Mukden.†

For a year or more, no opportunity to promote the Far Eastern enterprise presented itself, but in September, 1907, Lord French, representing Pauling & Co., of London, and Mr. J. O. P. Bland, representing the " British and Chinese Corporation," secured from the Chinese government the right to extend the Chinese Imperial Railway from Hsin-min-tun to Fakumen, with the privilege of building, ultimately, to the trans-Siberian at Tsitsihar. As this seemed to open the way for such a Russian connection as Mr. Harriman had in view, Mr. Straight wrote him, in September, 1907, suggesting an alliance with the British syndicate, as a means of securing the essential link in the projected round-the-world line without the co-operation of the Japanese. Mr. Harriman replied by cable, however, in October, 1907, that, owing to the panic of that year, financial conditions were such as to prevent the raising of the necessary funds.

In the summer of 1908, when the financial situation in the United States had somewhat improved, Mr. Harriman decided to make another move in the Far East, and requested Secretary Root to recall Consul-General Straight, in order that American capitalists might discuss with him the expediency of making a loan to China for agricultural development and railroad construction in Manchuria.

*It is not certain, however, that even this line would have been unprofitable. The Chinese themselves afterward began the construction of four hundred miles of railway along this route, and on the Peking-Kalgan section, which was completed in 1912, the net profits of operation in 1913 were twenty per cent. on the investment.

†Mr. Straight was a young graduate of Cornell University whose acquaintance Mr. Harriman made in October, 1905, at the house of Edward Vernon Morgan, American minister to Korea. Mr. Straight was then vice-consul-general in Seoul, but he had previously been correspondent of Reuter's Agency and the Associated Press in Korea and Manchuria and had spent two years in the service of the Chinese imperial maritime customs at Nanking and Peking. He impressed Mr. Harriman as a young man of character and force, and one whose ability and experience might make him a valuable assistant in such an enterprise as that which was then in contemplation. When the American legation in Seoul was closed, in the fall of 1905, Mr. Straight went with Minister Morgan as private secretary, and when Mr. Morgan was appointed minister to Cuba in 1906, he accompanied him to Havana. A few months later the state department transferred him to China and made him consul-general at Mukden. On his way back to the Far East, in the summer of 1906, he spent a week-end at Arden, where Mr. Harriman discussed with him the railroad situation in Manchuria and arranged to keed in touch with him by means of correspondence.

Meanwhile Mr Straight had secured from Tang Shao-yi, the Chinese governor at Mukden, a signed memorandum of agreement which was to form the basis of negotiations for a loan of $20,000,000. With this sum it was proposed to establish a Manchurian Bank, which should co-operate with American and Chinese interests in the construction of a railway from Tsitsihar to Aigun. Then, if the bank and the American capitalists could come to an agreement with Pauling & Co., who had the right to build a road southward from Tsitsihar to Hsin-min-tun, it would be possible to construct a trunk-line from the Gulf of Pechili to the Amur, and thus bridge the gap between the Pacific Ocean and the trans-Siberian road.

In September, 1908, Consul-General Straight returned to the United States, bringing with him the memorandum of agreement with Tang Shao-yi for the $20,000,000 loan. Through the influence of Mr. Harriman, and with the cognizance and approval of the secretary of state, Kuhu, Loeb & Co., agreed to undertake this loan, provided all the details thereof could be satisfactorily arranged. Late in November, Tang Shao-yi came to Washington, ostensibly to thank President Roosevelt for the remission of part of the Boxer indemnity, but really, in great part, to negotiate the proposed loan for the establishment of the Manchurian Bank.

Here again, however, Mr. Harriman's plans were blocked by events that could not possibly have been foreseen. Tang Shao-yi's appointment had been made through the influence of his friend Yuan Shih-kai, who was then grand councillor and head of the Chinese foreign office, and who was greatly interested in securing American capital for the development of Manchurian resources. About the middle of November, 1908, both the emperor and the empress-dowager of China died, and Prince Chun, an enemy of Yuan Shih-kai, became regent. This undermined Yuan's power, and led, a few weeks later, to his dismissal from office. Tang Shao-yi, thus left without support at home, became discouraged, and the matter of the loan was allowed to drop.

Mr. Harriman, however, continued his negotiations for the acquirement of a Manchurian line, both with Russia and again with Japan. In the summer of 1909, after he was stricken with mortal illness, he secured a promise from the Russian minister of foreign affairs, Mr. Kokovtsef, that upon the latter's return from a trip that he was about to make to the Far East, he would recommend the sale of the Chinese Eastern Railway to American interests. But even this partial success came too late. On September 9, Mr. Harriman died, and there was no one left in America capable of undertaking, much less of carrying through, such a colossal enterprise as the establishment of a round-the-world American transportation line. Whether the " Master Builder " himself could have accomplished it, if he had lived, it is impossible to say; but the results of successful accomplishment might have influenced profoundly the world's history. No one who has studied Mr. Harriman's constructive and administrative methods can doubt that if he had ever acquired even partial control of the trans-Siberian railway, he would have doubled or trebled its carrying capacity. Then when the great war of 1914 came, Russia would have been able to draw heavy artillery and ammunition from Japan and America over an efficient through line of great capacity, and would not have been reduced to such straits as she was when her troops, largely without proper weapons and almost wholly without reserves of ammunition were forced out of Poland and driven halfway to Petrograd. Her defeats in the war with Japan in 1904-05 were mainly due to the inadequacy of the trans-Siberian road as a means of speedy transportation, and her reverses on the German frontier, ten years later, were due, in part at least, to the same cause. During the winter and spring of every year, the railroad to the Pacific was her only open line of communication with the outside world, and it never was in physical condition to meet the demands made upon it. If, reconstructed and re-equipped by Mr. Harriman and the American syndicate, it had been made part of a great international transportation system, it might have become the decisive factor in the struggle with Germany in 1914-15, and might thus have changed the earlier stages, if not the whole course, of the great world war.

# The Kwantung Lease

## Throw On The Limelight

IT is not often we agree with the conclusions of " Putnam Weale " on Chinese political questions. However, we confess that the most enlightening contribution from the Chinese official side to the controversy with Japan over the legality of the Kwantung lease, comes from his pen in an article entitled " The Story of the Twenty One Demands." Mr. Simpson bears out our contention that the truth about the demands remains to be told. We have invited attention to the conflicting stories emanating from Tokyo and Peking which disclose that the ultimatum was invited by Yuan Shih-kai to save his face before the nation; that there was some sort of secret understanding between Yuan and Okuma in which the former contributed funds to the latter's political campaign in Japan in exchange for a promise to support his restoration of the monarchy.

We have since learned from the highest authorities in Tokyo that it was Tsao Ju-lin, the vice-minister of foreign affairs in the Yuan government, who personally visited the Japanese legation and requested Minister Hioki on behalf of Yuan to present the ultimatum. We have also learned on equally good authority of the existence of a signed statement of Marquis Okuma which corroborates the above story and throws further light on the negotiations of 1915. This was in the form of an interview for the American press, a copy of which was submitted to a foreign newspaper in Japan and rejected. The signed statement, however, is still in existence in the original Japanese bearing Okuma's well-known signature.

In presenting his version of the demands, Mr. Simpson says:

" The Japanese had quite accurate information regarding the monarchy plan almost before Yuan Shih-kai himself was thoroughly aware that his inner circle had determined to make him emperor or wreck the country in the attempt. His opposition to Japan was expressed in such a form that it was easy to take advantage of a moral vulnerability which could only arise through treachery. Treachery to the republic had been settled upon in Peking; that is why in the preamble to the Twenty-One Demands (which has never been published in its complete form and probably never will be) the Japanese told him plainly that as he was virtually emperor it rested with him either to enlist the decisive factor—Japan—on his side or take the consequences.

" Had he been really a bold man and politically honest, he would have taken the consequences, and circulated as fast at printing presses could print millions of copies of the Twenty-One Demands until the heavens and earth were filled with them. That was his one last chance. He missed it. The secrecy enjoined upon him which he officially preserved was the silken cord which finally strangled him. Imagine any man allowing himself to be murdered in a room, with the windows open and 400 million people outside unless he is in some way an accessory!

"Thus the position at the very start was not what the Chinese people have been taught to believe. The treachery (if it is necessary to employ such strong word) was not on the side of Japan. The Japanese having been rudely challenged, as they considered, after having more or less unwillingly captured Tsingtao were determined to see who was master in the region of the Far East. And they proceeded to work on lines which were not exceptional since they had done the same thing in Korea . . . That in addition to the formal negotiations, Yuan Shih-kai was carrying on private soundings in Tokyo need not be doubted."

Mr Simpson admits that the real treachery was on the part of China, that Yuan and his intimates had determined to betray the republic. With this truth established, it is natural than they should seek recognition when the coup was ready to spring. It also seems natural that they would have to pay the price for such recognition. This would explain the secret preamble mentioned by Mr. Simpson in which the Japanese told Yuan plainly that he was the emperor, and as such weilded the power to accede to the demands. Mr. Simpson's admission incidentally fully bears out and vindicates the attitude of Dr. Sun Yat-sen towards the Peking traitors to the republic and lends substance to Sun's own version of how the demands originated.

In concluding his story, Mr. Simpson says :

"I, however, am one of those who do not think it necessary for China and Japan to be enemies. It is bad for business and bad for human progress. I would like to see a Sino-Japanese commission nominated to sit in Tokyo to study the question of Manchuria in particular and railway building generally in the Chinese domain,—since that is what the remnant of the Twenty-One Demands amount to. It would be easy to transfer the territorial lease of Port Arthur into a Dairen municipality, just as it would be easy to make the Hanyehping enterprises into a proper railway-building centre with every nation interested. A little more imagination should be shown on both sides. Sending communications about non-validity (or cancellation) of documents does not modify the actual position which has nothing to do with paper or parchment."

This appears to be the only sensible statement that has come from the Chinese official camp, revealing as it does a disposition to effect a friendly compromise to an issue that until clarified, will remain a bar to harmonious relations. It must be admitted that Japan's answer to China's note announcing the cancellation of the 1915 treaty, is as unconvincing as the Chinese argument. The demands and treaties arising therefrom are difficult to justify even if it be proven that Yuan Shih-kai was willing to pay the price for Japan's recognition to a restoration of the empire. As far as the Kwantung lease was concerned—and this was the crux of the demands—it is well known that its extension to 99 years was agreed to by Yuan without serious discussion or opposition. As Mr. Simpson says in his version :

"The actual negotiations conducted in Peking by the Foreign Minister, Lu Cheng-hsiang, assisted by Tsao Yu-lin, vice-minister, are easily summed up. Yuan Shih-kai had not only made up his mind to give way on Shantung and Manchuria long before the ultimatum but all the details had been settled by the beginning of April. This wrote off Group I (Shantung) and Group II (Manchuria) which were placed on an uniform 99-year leasing system. Group III, which was the Hanyehping iron and steel enterprises on the Yangtze, and Group IV, which was merely a declaration about non-aliention of Chinese territory, were unimportant in themselves. Group V, the sketch of the proposed Japanese protectrate, was, of course, the hard nut. From first to last the real struggle was round this question. How little real importance was attached to Manchurian issues can be proved by the fact that when years later I was called upon to write a memorandum defining the geographical limits of South Manchuria based as far as possible on treaties and documents, I found it necessary to visit the senior delegate, Lu Cheng-hsiang, to ask him whether there was any map of the mining-areas conceded in the exchange of notes of 1915 as I was unable to find a certain area mentioned therein. He answered that the place I named existed because he had telegraphed an inquiry to Mukden at the time and they had replied that they know of the locality. That it is the way the Manchurian issue was dealt with."

This relieves the Japanese from the charge that their position in Kwantung was obtained by the application of the ultimatum, and as this is all that remains of the demands, it weakens China's case on this point.

In responding to the Chinese note, the Japanese diplomatically understated their position by adhering closely to the advice of the late Mr. Henry W. Denison given during the negotiations which preceded the war of 1905. The Japanese answer to one of Russia's notes was couched in terms which revealed a determination to support their position by arms. When the note was brought to Dension for perusal and comment, he asked : " are you ready to go to war " ? " Yes, if necessary," was the reply. " Then rewrite your note and make it mild," was Denison's comment. Japan, therefore, intentionally worded her reply to China in the mildest possible terms. The difference between the two cases, being that Japan has no intention of going to war with China over Kwantung unless China herself should precipitate a situation that would force Japan to act. Japan has fought two wars for the possession of this territory, one against China alone and the other against China and Russia acting as allies. She is willing to fight a third, if needs be, but in this case, she is in possession of the territory and the war will have to be forced upon her.

From all appearance, Japan rejects any overtures for further discussion as to the right of her permanency in Kwantung by any Sino-Japanese commission or international convention. China cannot submit her case either to the league of nations or the Hague tribunal unless Japan consents. This she refuses to consider. She stands squarely upon the validity of the 1915 treaty and says in effect, that her right to Kwantung was definitely settled as a result of the war with Russia, in which China was allied with her enemy and provoked the conflict by her double-dealing. If Japan's position under the 1915 treaties is weak and her arguments unconvincing, she is correspondingly invulnerable and unassailable when she goes behind the twenty-one demands and rests her case on China's alliance with Russia which precipitated the catastrophe of 1905, and from which, by reason of the most profound secrecy surrounding the alliance, China escaped paying her share of the indemnity.

China had her revenge for the humiliation of 1895. Her secret alliance with Russia, the text of which has been officially revealed after many years, brought the latter into Manchuria for the express purpose of destroying Japan. She escaped paying the penalty in 1905 at Portsmouth. The facts are now known and Japan is in possession of Kwantung ; bought at a price which staggered humanity at the time. Japan paid the price exacted as the result of China's treachery, and if China now wishes to attack her from the hard won position, she will have to pay a greater price that mere denunciations of treaties, commercial boycotts or student street parades.

A remarkable fact connected with the agitation surrounding the cancellation of the 1915 treaty, is that no Chinese newspaper has seen fit to aquaint its readers with the truth concerning China's secret treaty of alliance with Russia signed in 1896, which brought Russia into Manchuria and handed over the railway concessions and territorial lease so that Russia could be in a position to attack Japan. This is not an alleged treaty as the leading anti-Japanese newspaper of Japan would have us believe ; it preceded the signing of the Chinese Eastern Railway concession and other agreements which gave Russia dominant rights in Manchuria. Its authenticity has been officially acknowledged by China and the text filed at Washington during the disarmament conference. It is the key to the puzzle, the starting point of modern Far Eastern history, the instrument that set the ball rolling and automatically made the Anglo-Japanese alliance a vital necessity to the security of Asia. Starting from this date, and with this treaty as the basis, all subsequent moves on the Far Eastern political chessboard are intelligible to even the most superficial reader. China's own duplicity, weakness and disorganization, are solely responsible for her international troubles.

It is time to stop beating around the bush. The world and China demands the facts ; all the facts. Although standing upon the validity of the treaty signed as the outcome of the twenty-one demands, Japan, as a matter of form, and to avoid further humiliation of her weaker neighbor, is prepared if pushed to extremes, to call China to account for her crime of 1896 which made possible the war of 1905, and to demand tardy reparation for the sacrifices imposed on her by the alliance with Russia. Is China prepared to face this issue ? Is she prepared to square her accounts with Japan and admit her culpability for the war of 1905 ? If so, there is only one compensation that Japan will exact—the recognition of the leasehold over Kwantung for 99 years. Unless China recognizes this just position of Japan, or insists upon constantly raising the question of the legitimacy of her right to the Kwantung lease without any attempt to atone for her own treachery, a situation may well be created that would compel China to pay even heavier damages than those she is now called upon to face by Japan's occupation of the strategic key to

Manchuria. Japan has answered China very meekly. There is a meaning to this meekness which China should not misinterpret.

Perhaps Japan would be willing to enter into some compromise with China over this matter, but it is a foregone conclusion that such compromise will have to based upon China's frank and open acknowledgement of the part she took in bringing about the Russo-Japanese war and a recognition of Japan's sacrifices which terminated Russian imperialism in the Far East and restored the Three Eastern provinces to Chinese sovereignty. Once the present generation of Chinese are educated to the part played by Li Hung-chang and the old Manchu mandarinate in forcing the war with Russia upon Japan through the medium of a secret alliance, the way will be cleared for a permanent peace in the Far East. Count Witte confesses in his memoirs that he bribed Li Hung-chang by the payment of 500,000 roubles for the lease to Kwantung, which provided Russia with the strategic base from which to conduct her war plans upon Japan. The Chinese should be told these facts by their publicists, and as the full truth becomes known, the way will be cleared for a better understanding of Japan's real position. Constant harping on the twenty-one demands, which reflect no credit on either Japan or China, cannot help towards a solution to this problem. The roots of the question go down deeper, and until the Chinese are permitted to see that these roots are embedded in the mud and filth of the old Manchu double-faced diplomacy of the last century, and which gives to Japan a legitimate grievance against their rulers, there can be no hope of a proper solution to the Kwantung question.

* * *

# Proposed Chinese Cotton Mill Loan

IT has been known for some time that many new Chinese cotton mills erected during the boom period on long term credits for machinery and plant have been having a hard time, but it comes as a distinct shock to learn that these conditions have reached a point where a loan guaranteed by the government is deemed necessary to save them from going under. It is furthermore regrettable at this crisis in the financial affairs of the country that the promotors of the loan look forward to placing the bonds on the foreign market secured by a special surtax of one tael on each bale of yarn and guaranteed by the government from the proceeds of the increased customs revenues agreed to by the Washington conference. The disbursement of the loan, should it be issued, is to be supervised by the inspector-general of customs and the representatives of the Chinese and foreign banks interested, in other words, a further charge on the customs surtax, which, to all appearances, is to bear the burden of redemption for all of China's unsecured obligations. The depression in the cotton goods trade is so marked that the cotton mill association at Shanghai has requested its member mills to reduce their spindles in operation to half the present number or suspend night work in order to limit production, a marked contrast to the activity in Japan where the leading mills are doubling their equipment in order to eliminate night work.

In presenting the petition to the government, outlining a plan for floating a loan of Taels 30,000,000 the cotton mill association invites attention to the rapid development of the cotton industry in the past few years. In 1917 the total number of spindles in the different cotton mills was about 700,000 and at present the figure has swollen to over 2,000,000, with an increase in assets from Tls. 30,000,000 to Tls. 100,000,000.

The rise in the exchange rate of gold and delay in the delivery of machinery by foreign firms has caused serious losses to the mill owners, civil strife has been responsible for business stagnation and the failure of the cotton crops last year, sent up the price of raw cotton and placed the mills in a more difficult position than ever. If present conditions prevail, the mills, will, in a year or so, be compelled to close and a large number of the half million workers now employed thrown out of employment.

In order to find means to relieve the situation, the petitioners inform the government that a syndicate should be organized to raise funds to finance the mills by issuing debentures, in Europe, America and the home market. Three advantages, they claim, can be derived from the organization of such a syndicate, namely: (1) the syndicate itself needs no current capital; (2) when the banking business of the syndicate is confined to the cotton mills alone, it is easy for the syndicate to watch and study the financial standing of its debtors and (3) that the syndicate will form a medium between the cotton mills which have surplus wealth to invest, and the mills which need capital.

The petitioners state that their plan has been endorsed by foreign financiers but in order to put it into execution the government is asked to exempt raw cotton from likin, and levy a special surtax of one tael on each bale of yarn, such surtax to be used as security for the redemption of the debentures. The management of the mills which make use of the loan proceeds for their capital will be subject to the supervision of the syndicate. Loans made to the mills by the syndicate will be redeemable by yearly instalments. The syndicate on receipt of such repayments from the debtor mills will use the proceeds to redeem debentures. According to the plan, the entire amortization of the Tls. 30,000,000 loan covered by the debentures will be completed in eighteen years. The government is requested to guarantee the redemption of the loan, because when it is secured on government revenue, its credit will be enhanced in the eyes of the public and the issue of the debentures will be facilitated.

In describing the conditions which brought about the present depression, the cotton mill association makes no mention of the distressing consequences attendant upon the operations of the many wild cat exchanges which sprang into existence last year, inducing unprecedented speculation in all commodities and materially contributing to bringing the price of yarn to its present low level. In the actual condition of Peking finances it is hardly probable that such a loan will receive official sanction without some "gratuity" to the ministries who must authorize its issuance. We hear rumors (denied by the cotton mill association) to the effect that a sum of Taels 150,000 will be paid to the minister of agriculture and commerce as commission, and that $8,000,000 will be allocated from the proposed loan to the same ministry for "industrial development," etc.

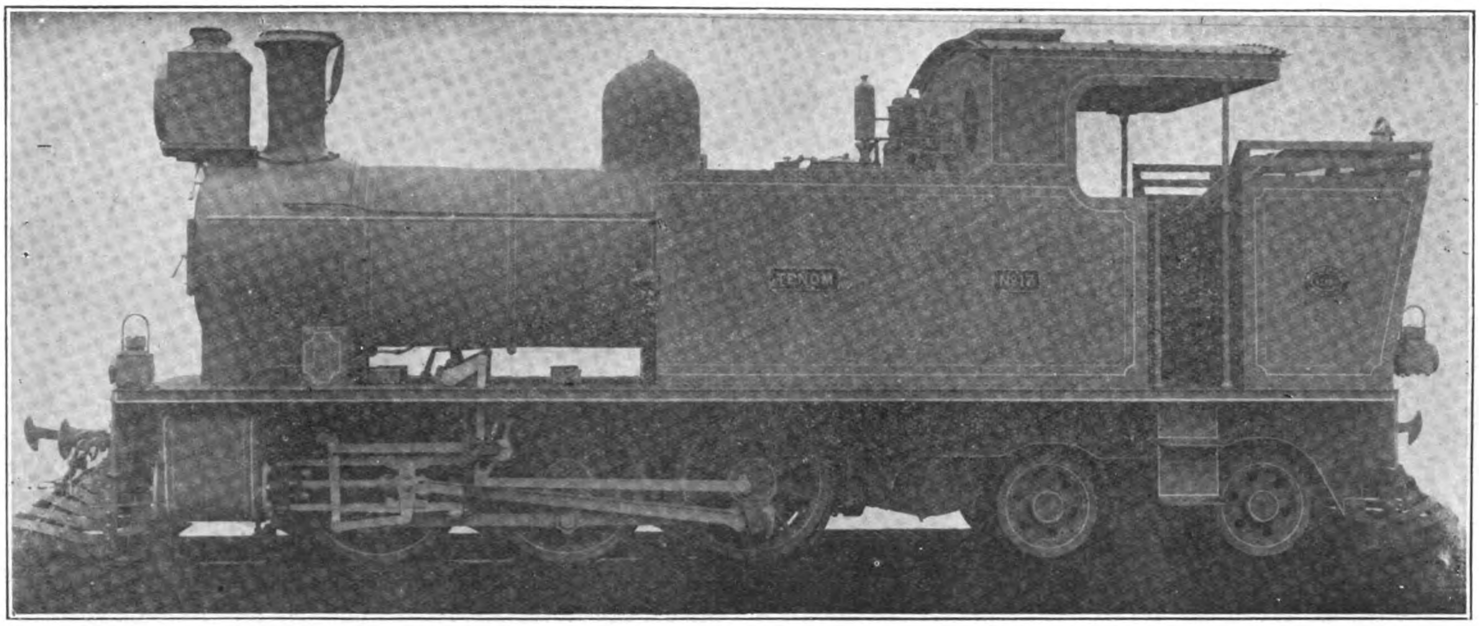
* * *

# Electrical Course in St. John's University

A PRACTICAL course in the problems of operating electrical machinery in factories has been started in the science hall of St. John's University. The course is conducted through the industrial department of the Y.M.C.A. and will be open to all Chinese assistants in manufacturing and industrial establishments in the Shanghai district. E. L. Clark, E.E., and M. H. Pai, E.E., both graduates of the Massachusetts Institute of Technology, will have charge of the instruction which will take the form of weekly lectures and practical demonstrations. The fee for the entire course will be $5 payable in advance at the Chinese Y.M.C.A.

The real purpose of the course is to provide needed instruction in practical electricity for shop men and foremen who have the actual handling of motors in factories. Technical schools have provided and are providing instruction for the engineers and superintendents at the top, but there has always been a need for practical instruction in the actual handling of electrical appliances for the considerable number of assistants in manufacturing institutions. Practical instruction along the lines indicated will constitute an excellent investment for the owners and managers of manufacturing enterprises, for it often happens that ignorance on the part of some employee can cause great losses.

Mr. Clark who will have charge of the actual demonstrations is connected with the International General Electrical Company of Shanghai.



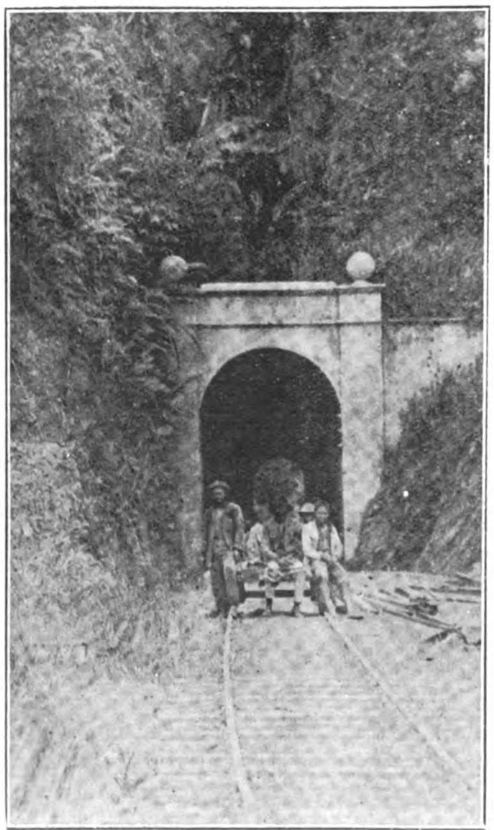
Type of Engine Used on the North Borneo State Railways. Made by the Hunslet Engine Co., Ltd., of Leeds

# Railways and Roads in North Borneo

*By G. C. Irving*

A CRITICISM that casual visitors never fail to include in their impressions of Borneo is the absence of roads, and the criticism is not confined to visitors for our own people lose no chance of taking the government to task for its neglect of development in this respect. A study of the history of development in Borneo will answer critics, though possibly it may fail to satisfy them, and will show how one thing has led to another until to-day the construction of roads has been given a prominent place in the program of future development.

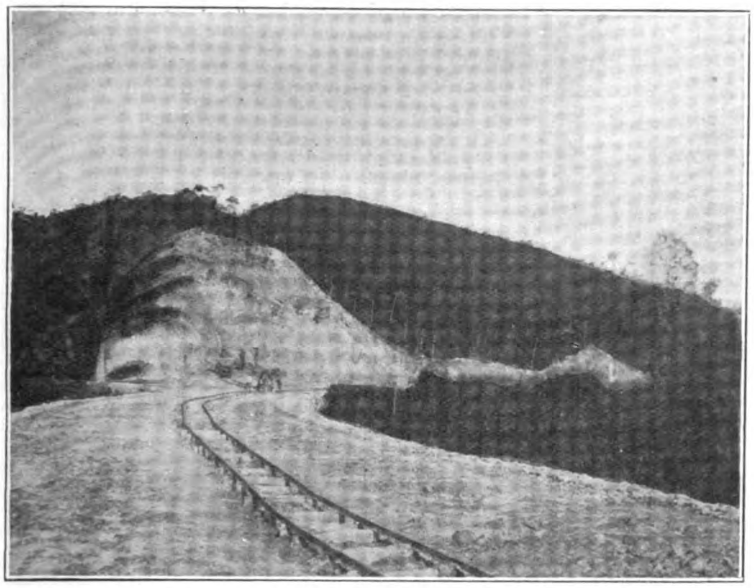
When North Borneo came into British hands there was nothing in the form of overland communications beyond the mountain trails used by war parties. Owing to the head hunting propensities of the interior tribes, travel was too dangerous to be popular and any such thing as inter-village trade was unknown. The pioneers of civilized government made their headquarters on the principal harbors around the coast and pushed their influence towards the interior by means of the numerous rivers which flow from the central ranges. The early years of the British settlement were occupied in the pacification of native tribes to reach whom the government officers were content to use the native trails. The plantations that came into existence were all situated upon the banks of rivers which provided adequate and inexpensive transport. In these circumstances, added to the fact that the chartered company was not over blessed with cash resources there was no incentive to open roads. Matters remained in this state until late in the nineties when attention was turned to the advisability of opening communication through the well populated villages of the west coast with the promising country that had been discovered in the interior. In the discussions that took place before the policy of building a railroad was adopted there is no doubt that the advocates of roads hotly opposed the railway scheme. It is understood that Mr., now Sir Hugh, Clifford, who was governor of Borneo at the time, was a strong supporter of roads but the decision of the court of directors went against him. Thus there came into existence in about the year 1899 the British North Borneo State Railway which, built in two sections meeting at the little township of Beaufort, penetrates the interior as far as Melalap in the valley of the river Padas. This railway which is a single line, metre gauge system connects Beaufort and the interior with the port of Jesselton whilst the branch section extends from the same junction to the diminutive port of Weston at the mouth of the River Padas. The total length of line is about 120 miles of which 56 miles between Beaufort and Jesselton follows the coast line. As an experiment, for such the State Railway must be considered, the policy must be judged by results. Before it came into existence the government revenues from the residencies of the west coast and interior were a negligible quantity; to-day they represent a total of $500,000.00. This revenue has grown from, among many sources, a land settlement scheme for native lands, the immigration of Chinese and the opening of rubber estates during the rubber boom of 1910. It is only just to say that the increase in revenue has been a direct result of railway development. Against this it has to be admitted that the railway has been a constant drain upon the revenue for it has so far failed to make a profit or even to pay its way.



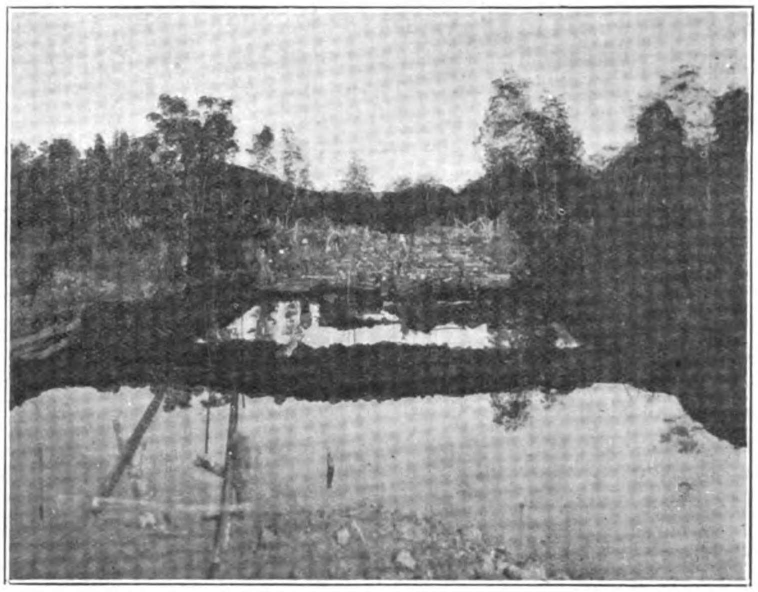
Pengalat Tunnel, 600-ft. long on the North Borneo State Railways

Disappointment has been experienced in the two principal types of produce that were calculated to provide freights; these were lumber and jungle produce. The

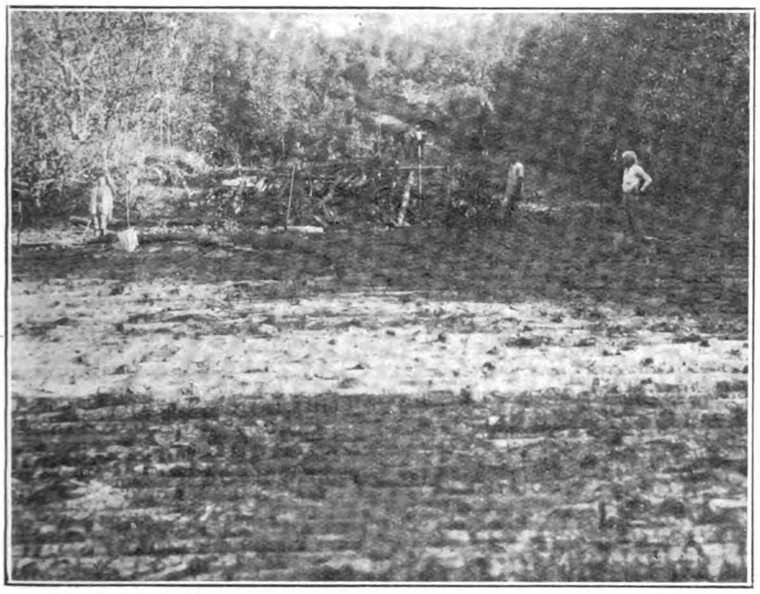
# THE JESSELTON TUARAN ROAD IN NORTH BORNEO



Through the Likas swamp showing portion of corduroy road. Timber logs; bed of stone or coral on topside retaining walls and earth filling completed except for metalling



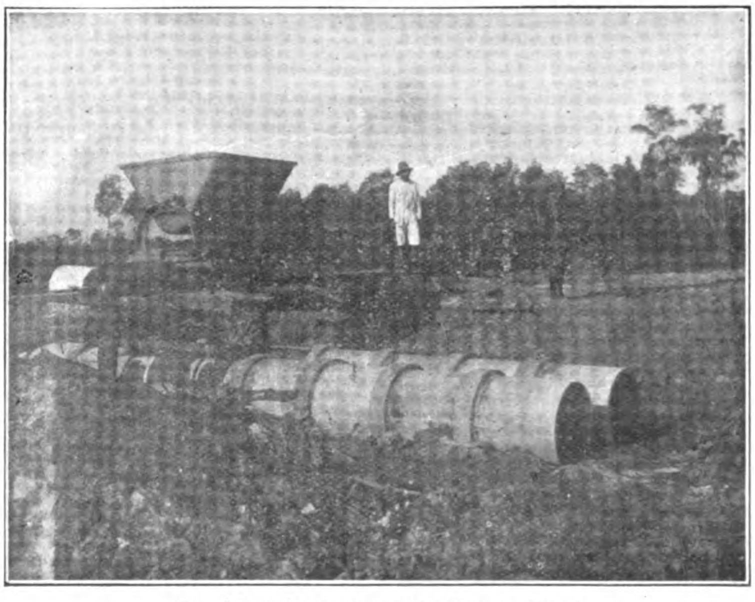
Likas Swamp. View from Tuaran end up to finish of corduroy: excavation of 3-ft. to 4-ft. of swamp material and refilling with spoil



Corduroy foundation of greeling timber over deep swamps

Likas Swamp. View from Likas River to commencement of corduroy: stone retaining walls on each side, built on corduroy

reasons given for the failure of the timber trade are the heavy cost of production in comparison with the east coast, where lumber is carried by river and sea to the mill, and the fact that the railroad was of too light a construction and the rolling stock inadequate for hauling of heavy freights. The loss of freights in jungle produce, principally rattans and 'damar' was due to a miscalculation of the productivity of the forests of the interior and to the ignorance of the fact, in those days, that much of this produce found its way across the border into Dutch Borneo. Another and serious loss of freights was the failure to produce wrapper leaf



Double culvert: Jesselton-Tuaran Road

tobacco in the interior at a profit. Two large estates were opened in 1902 and 1903 which, if successful, would have exported annually large crops of tobacco, a paying and bulky freight. This tobacco proved a failure on the Amsterdam market and the estates were only saved from extinction by the boom in rubber which they both now produce in considerable quantities. There are sixteen rubber estates on or near the railway line; these estates provide the majority of freights which up to now have failed to fill the capacity of the railway. As the track runs through a portion of the sago-producing country, known as the Klias

peninsular, it was confidently anticipated that sago flour of which about 3,000 tons are exported annually, would form one of the principal freights. The railway, however, failed to induce more than two or three firms to move their factories inland and the bulk of the trade adheres to the rivers at the mouths of which the sago factories are situated. To sum up, the railway, after a test of twenty years, has not succeeded in paying its way. Without it, however, it is doubtful if the western part of north would be enjoying anything like the revenue that it does. We are not going to argue from the point of view of roads as to whether roads would have produced better results, for the good reason that our arguments could not be founded on any known data. At the beginning of the century mechanical road transport was in its infancy and the creation of colonial railways was a policy which was being pursued in almost every wild country. Borneo was merely following the fashion. At the time of writing this article the complete re-organization of the State Railway has been accomplished on the advice of Mr. F. W. Barrow, a railway expert of wide experience and special knowledge. It has resulted in a considerable decrease in service of trains, economy in the use of rolling stock and drastic reduction in personnel. As there are clear signs of improvement in trade the prospects for the railway under strictly economical conditions are distinctly promising.

## Roads

Up to the year 1920 North Borneo had no roads at all with the exception of town and suburban roads in Sandakan (the capital) and Jesselton. During and after the rubber boom the question of extending the railway beyond Jesselton to the north was under discussion. It was during Sir West Ridgeway's first visit to the territory that the suggestion of a road to cross the country from Jesselton to Sandakan was first mooted. This was jumping with a vengeance from a policy of no roads to a very ambitious scheme in the opposite direction. We need not recapitulate the long discussions that followed, suffice it to say that as a policy the trunk road has received approval and has been in operation for the past two years. Road construction was started in 1920, a year which produced the most promising results in trade and revenue, so that everyone looked forward to a real hustle in development.

Hopes were raised even higher by the granting of a rubber concession of 100,000 acres near Sandakan which was located on the line of the new road. Alas for human hopes, the slump of 1921 brought such schemes tumbling to the ground. The expansion of rubber planting vanished into their air, retrenchment fell upon development schemes of every description and amongst them the first to feel the result of the slump were the new roads. In 1922 little was done beyond the completion of earth works in hand and a modest program of metalling. The present year has opened with a promise of some further advance which is calculated to complete altogether about forty miles of road of lighter construction and a narrower surface than was originally intended. Even this is a step in the right direction for it will open up several thousands of acres of good land and bring more motor transport into the country. In the latter respect there has been, for such small towns as Sandakan and Jesselton, a very big increase in the use of mechanical transport. Without giving exact figures there must be about forty cars of various makes of which the Ford and Dodge are the favorite and are certainly the most suitable. As the roads extend, the demand for cars will have a proportionate increase which will justify the road policy at once from a traffic point of view.

In matters of construction the road from Sandakan has presented no serious difficulties beyond a scarcity of good stone for metalling. The Jesselton-Tuaran road on the contrary passes through sections of swamp which have required expensive foundation work, whilst numerous small rivers have called for a heavy program in bridge building.

For road surface a hard sandstone was used where quarries could be found within easy distance of the road but latterly on the more remote sections of the road experiments are being made with coral. With a view to protecting the road surface as far as possible from damage by traffic a prohibitive tax has been placed upon vehicles with solid tyres and those exceeding four tons in weight. This policy is dictated by the necessity for economy in construction and upkeep whilst there is no reason to anticipate any heavy volume of traffic for some years. To encourage settlers and to open up new lands, feeder roads are to be made as circumstances and expansion dictate until the present roads are carrying their maximum load when the question of improving or widening the surface will be reconsidered. Our road policy must go hand in hand with immigration without which there will be a lack of settlers to take up land. It has already been proved that the roads are causing a rise in land values which in some cases have changed hands at 100 per cent. over prices that ruled a year or so ago.

## Bridle Paths

This article would be incomplete without a reference to the work that has been done during the last twenty years in linking up districts by a system of bridle paths. In the old days travel across country could only be accomplished by following native trails or the beds of rivers. If the native tribes were ever to be brought into closer touch with the government means had to be found for making travel quicker and safer. For years district officers have pushed the construction of these six-foot bridle paths into the most remote parts of the interior until to-day there are no less than 800 miles of good track along which a pony can be taken at a canter.

Without them our native tribes would in many cases still be comparative strangers to us and we should not be able to boast that head hunting raids are a thing of the past. The maintenance of our bridle path system is a heavy item of expenditure, especially in districts where little or no revenue is to be got in return; as they are well graded it will be a simple matter should circumstances call for it to widen them sufficiently to carry light traffic; as it is they are not suited to anything but pony and pack transport.

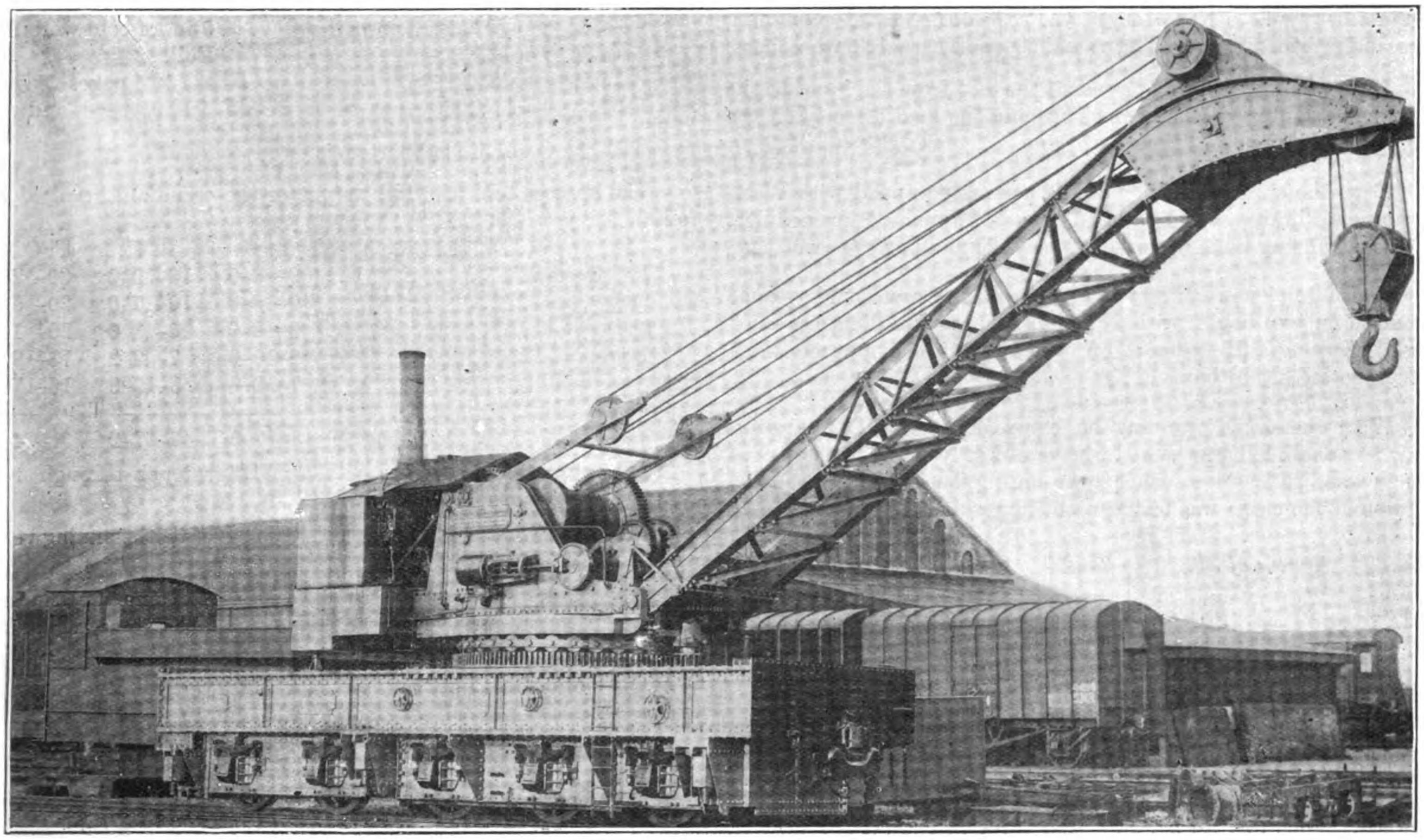
# Powerful Grab Hopper Dredger for Bombay

Messrs. Wm. Simons & Co., Ltd., launched complete ready for work from their yard at Renfrew on March 19 the twin-screw 1,500-ton hopper dredger *Chelura*, fitted with four Priestman grab cranes for dredging to a depth of 60 feet below water level.

The vessel is propelled by two sets of triple-expansion direct-acting surface condensing engines supplied with steam from two cylindrical multitubular boilers constructed to Lloyd's requirements for a working pressure of 185-lbs. per sq. inch and of sufficient power to obtain a speed of nine knots per hour in loaded condition.

The dredger is fitted with a novel arrangement of mooring jets for controlling and regulating the position of the dredger when at work. The engine room outfit includes all the most modern fittings and independent steam mooring winches are fitted at bow and stern. The hopper doors are controlled by hydraulic appliances for raising and lowering. Suitable accommodation is provided below deck forward for crew and on upper deck aft for officers.

The vessel with its machinery has been constructed to the highest class at Lloyd's and has been designed and constructed under the direction of Messrs. A. J. Barry & Partners, Consulting Engineers and Agents to the Bombay Port Trust, 2 Queen Anne's Gate, London, S.W. 1.



# 36-Ton Breakdown Crane for the S.N.R.

## Built by Messrs. Joseph Booth & Bros. Ltd.

DESCRIPTION of 36-ton steam breakdown crane built for the Shanghai-Nanking Railway by Messrs. Joseph, Booth & Bros., Ltd., Union Foundry, Rodley, Leeds, to the designs and specifications of the railway consulting engineers, Messrs. Sir John Wolfe Barry and partners of Westminster, London.

The crane is capable of running on a train up to 45 miles per hour.

The normal capacity of the crane is

| | | | |
|---|---|---|---|
| 36 tons at | 20-ft. | radius. | |
| 26 ,, | ,, | 24 ,, | ,, |
| 20 ,, | ,, | 29 ,, | ,, |
| 15 ,, | ,, | 32 ,, | ,, |

With the draw girders out and the screw jacks blocked when the draw girders are out to the maximum distance the screw jacks are 15-ft. from centre to centre.

There are also four rail clips to secure to the rails in case of necessity.

The hoisting rope is 4-in. circumference and 230-ft. long and the derricking rope 3.75-in. circumference and 280-ft. long. The hoisting rope is wound on a cast iron barrel with 25 right-hand grooves, being driven through machine cut cast steel gearing from the engine shaft and arranged for hoisting, slewing, derricking and traveling. The hoisting machinery is mounted on a strong plate frame carried with the jib on a cast steel bottom swivel 9-in. 9-in. diameter.

The bottom swivel is driven by a cast steel pinion coupled through bevel gearing and friction clutches on the main engine shaft and meshing into a circular rack on the periphery of the roller path immediately beneath, the swivel revolving on 36 mild steel rollers 8-in. diameter.

The boiler is mounted on an extension platform carried on two 15-in. by 4-in. channels securely bolted to the engine frame coal bankers and tank being carried on the same platform.

The engine has two $9\frac{1}{2}$ by 12-in. stroke cylinders one mounted on each side of the main frame and directly coupled to the engine main shaft. The boiler is a 4-ft. 6-in. diameter by 6-ft. 3-in. high Spencer Hopwood quick steaming boiler 100-lbs. working pressure with both injector and duplex pump feed and all necessary fittings.

The driver's platform is immediately in front of the boiler and protected by a roof, the operating levers are directly in front of the driver and consist of steam, derrick and travel, slewing, hoisting, and reversing levers and also a foot brake.

A chequer plate platform on either side permits the driver or fireman to attend to any part of the machinery whilst crane is working.

The machinery is all mounted on a steel plate underframe carrying on the underside the propping joists and the whole carried on five pairs of wheels 43-in. diameter the journals being 6-in. by 12-in. all running in cast steel boxes.

The two leading pairs of wheels with a 5-ft. 9-in. wheels base run in a heavy plate frame bogie, the axle boxes of the remaining three pairs being mounted in the main frame with a rigid wheel base.

Heavy elliptical springs transmit the load from the frame to the axle boxes, a steel distance block placing the load directly on the spring buckle when the crane is working.

Both the crane and the match truck are equipped with Westinghouse air brakes as well as hand brakes. Janney Penn couplers with centralizing buffers permit of easy coupling on curves.

The match truck consists of a 15-ft. 4-in. channel under-frame mounted on two bogies with 2-ft. 9-in. wheels in diameter such bogies carrying a jib support on which the jib is lowered when traveling and a tool box.

With the crane standing on curve of about 312-ft. radius drawbars extended and jacked with screws at 15-ft. centres, rail clips not in use, pads all in place over spring buckles. Under this condition, the crane was tested with the result thus :

| *Load.* | *Radius of Jib.* | *Test.* | *Speed.* |
|---|---|---|---|
| 45 tons | 20′-0″ | Slewing clockwise and counter clockwise | Full |
| ,, | ,, | Hoisting | 14-ft. in 53 sec. |
| (B.P. 80-lbs. per sq. in. Stop valve 75-lbs. per sq. in.) | | | |
| 36 tons | 20′-0″ | Slewing clockwise | 2 rev. in 68 sec. |
| ,, | ,, | ,, counter clockwise | ,, ,, 57 ,, |
| (B.P. 85-65-lbs. per sq. in. Stop valve 50-lbs. per sq. in.) | | | |
| 36 tons | 20′-0″ | Hoisting | 14-ft. in 49 sec. |
| (B.P 90-80-lbs. per sq. in. Stop valve 75-lbs. per sq. in.) | | | |
| 26 tons | 24′-0″ | Slewing clockwise and counter clockwise | 1 rev. in 29 sec. |
| (B.P. 40-lbs. per sq. in. Stop valve 40-lbs. per sq. in.) | | | |
| 26 tons | 24′-0″ | Hoisting | 14-ft. in 41 sec. |
| (B.P. 80-lbs. per sq. in. Stop valve 70-lbs. per sq. in.) | | | |
| 20 tons | 29′-0″ | Slewing clockwise | 1 rev. in 33 sec. |
| ,, | ,, | ,, counterclockwise | ,, ,, 31 ,, |
| ,, | ,, | Hoisting (slow gear) | 14-ft. in 38 sec. |
| ,, | ,, | ,, (fast ,, ) | 14-ft. in 22.5 sec. |
| (B.P. 75-lbs. per sq. in. Stop valve 55-lbs. per sq. in.) | | | |
| 15 tons | 32′-0″ | Hoisting | 12′-6″ in 18.5 sec. |

Under all hoisting tests the crane jib was at right angles to the axis of the track.

To test the derricking speed, from max. radius—32-ft. to min. radius—20-ft. timing 46 sec. with no load on the crane.

Crane tested free on rails, screw jacks released free of packings, with a load of 7 tons, 0 cwt. and 2 grs. lifted at 20-ft. radius and gradually derricked out to 35 feet without tipping the crane.

The indicator plate showing the radius of the jib is marked with safe loads as follows :

| | | | | |
|---|---|---|---|---|
| 35 tons at 20′-0″ | Propped, | 10 tons | unpropped. |
| 26 ,, ,, 24′-0″ | ,, | 7 ,, | ,, |
| 20 ,, ,, 29′-0″ | ,, | 4 ,, | ,, |
| 15 ,, ,, 32′-0″ | ,, | 3 | ,, |

The crane traveled freely on a curve about 312-ft. radius at 22-ft. 6-in. in 12 sec.

The bogie centre traversed 2-in. of the 3½-in. side play provided, the full weight is taken on the centre, the side bearers being quite clear.

The bogie control springs are put into place under slight compression, and under the actual test gave an actual compression on the control spring equal to a load of 80 cwts.

The crane was weighed, when lying quite level with

| | |
|---|---|
| Gauge glasses on boiler .. | 5-in. of cold water. |
| Tank .. .. .. .. | Full. |
| Bunker .. .. .. | ,, of coke. |
| Tools .. .. .. .. | All on board, and |

Crane jib supported as on match trucks.

The springs took the full weight of the crane and resulted as follows :

| | L. H. | R. H. | T. C. Q. |
|---|---|---|---|
| 1st fixed axle .. .. .. | 9–13–0 | 10– 9–0 | 20– 2–0 |
| 2nd ,, ,, .. .. .. | 9–18–0 | 10– 7–0 | 20– 5–0 |
| 3rd ,, ,, .. .. .. | 9–18–0 | 10– 3–0 | 20– 1–0 |
| Bogie .. .. .. .. | 6–10–0 | 7– 9–2 | 13–19–2 |
| | 7–18–3 | 8–19–0 | 16–17–3 |
| | T. 43–17–3 | T. 47– 7–2 | T. 91– 4–5 |

The crane was also tried with the match truck through the running gauge and was clear.

All machine cut gears bear the full length of teeth running very quietly.

Boilers, slewing pinion and rack were perfect and the slewing friction clutches worked without heating and all bearings were quite cool.

The boiler, boiler fittings, pump, injector and all other fittings and attachments were all satisfactory and in proper order.

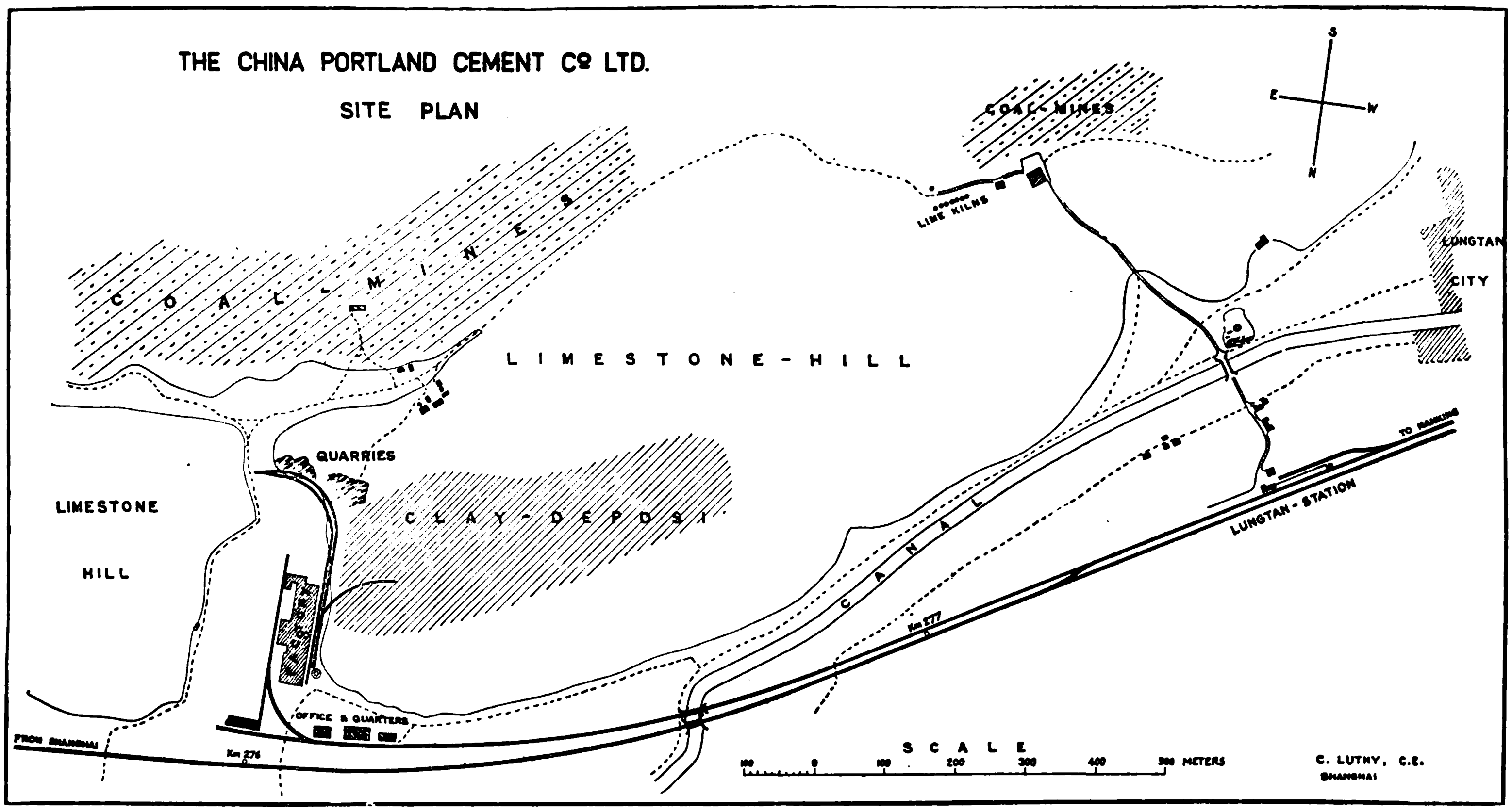
# A Belgian Mission to China

A BIG effort is being made by Belgian manufacturers, aided by the government, to extend their foreign trade. Under the auspices of the comité central industriel, a Belgian organization similar to the federation of British industries, a mission, comprising representatives of the leading firms of the country, has started for the Far East with the avowed object of recapturing prewar markets for Belgian goods in China and Japan, which have been practically lost since the war.

A similar mission was organized by the government about a year ago under the direction of M. Rouma which, during the course of 1922, visited the various South American republics and carried out a program of trade propaganda for Belgian industry. Its effects are becoming apparent. Some months ago Brazil placed considerable orders with Belgian metallurgical firms, and now the Argentine republic has placed an order with the Comptoir des Aciéries belges for 30,000 tons of rails (37 k.g.), as well as for railway accessories. A further order for 54,000 tons of rails is announced, and negotiations have been opened in connection with the supply of 25 locomotives and 2,000 waggons.

The Polish government has just placed an order for 180 locomotives and for railway materials, comprising signals, points, bolts, etc. The total value of foreign orders amounts to hundreds of millions of francs and will have the twofold effect of providing employment and improving the value of the Belgian franc.

The economic mission to China and Japan left Marseilles for Kobe on February 25. The mission is under the leadership of the well-known Mons manufacturer, M. Cannon Legrand, who will be accompanied by several technical experts, representing the following :—The Société John Cockerill, the Société Anonyme Ougrée-Marihaye, the Société La Brugeoise et Nicaise et Delcuve, the Maison Peltzer, of Verviers, the Forge de la Providence, the Société Anonyme d'Espérance Longdoz, the Nouvelles Usines Bollinckx, the Cableries du Hainaut, the rolling material manufacturers, the machine tool makers, etc. The mission also includes a delegate of the Banque Belge pour l'Etranger.




# Cement Industry in the Orient

*(Continued from March Number.)*

*By M. H. Chou, M.S., University of Wisconsin*

## The Shanghai Portland Cement Company

This company was organized by the well-known Shanghai merchant, Mr. Liu Hong-son, quite a number of years ago. Mr. Pao Li-liu, the general manager of the company, traveled extensively throughout America and Europe and finally placed the order for the machinery with the Perruseus Engineering Works of Germany, at a cost of over one half million dollars. The total capacity of the plant is 1,200 barrels per day. The works are situated one mile from Lunghua covering an area of about one hundred *mow*, facing the Soochow Creek on one side and the Whangpoo River on the other.

The plan for main mill and power plant was designed by E. J. Muller, consulting civil engineer, of Shanghai. The payment of the machinery was handled through the China Siemens Company. Construction work was started last spring and it is expected that it will be completed in the spring of 1923, and in operation by next autumn. The buildings of the plant are as follows: Main mill, power plant, godown, office building, engineer's residence, houses for working men, Chinese staff's office, machine shops, barrel-making factory. The raw materials—limestone—come from Wuchow, about 200 miles away; the coal from the Kailan Mining Administration. The erection work is being carried out by four German engineers under Mr. Molatore as chief engineer.

## The China Portland Cement Co., Ltd.

(Factory at Lung Tan (near Nanking))

This company was founded in the spring of 1921. The promoter is Mr. Yao Sing-kee, now managing director. Several sites were considered but the present location at Lung Tan with an abundance of raw material in the immediate neighborhood was selected as the ideal one. The limestone is of very pure quality. These rocks are covered with thick layers of clay. Chemical tests showed that the combination of these two materials in a certain proportion produce a portland cement of best quality. Some hundred yards away are coal mines which supply very cheap coal for the power station but as it contains too much sulphur and ashes cannot be used in the kilns for manufacturing cement. The transportation of the raw materials is very economical, the deposits being higher than the factory and conveyed by gravity.

The factory is connected with the main line of the Shanghai-Nanking Railway by a two kilometre long siding with a reinforced concrete bridge over the navigable canal which connects the factory with the Yangtze Kiang, thereby having very favorable transportation facilities.

The order for the cement-making machinery was placed with Messrs. Nagel & Kaemp of Hamburg who submitted not only the lowest tender but also gave a guarantee for an up-to-date installation having motor drive throughout. The factory buildings were designed by C. Luthy, consulting engineer; the erection and supervision of the buildings were awarded to Mr. Yao Sing-kee.

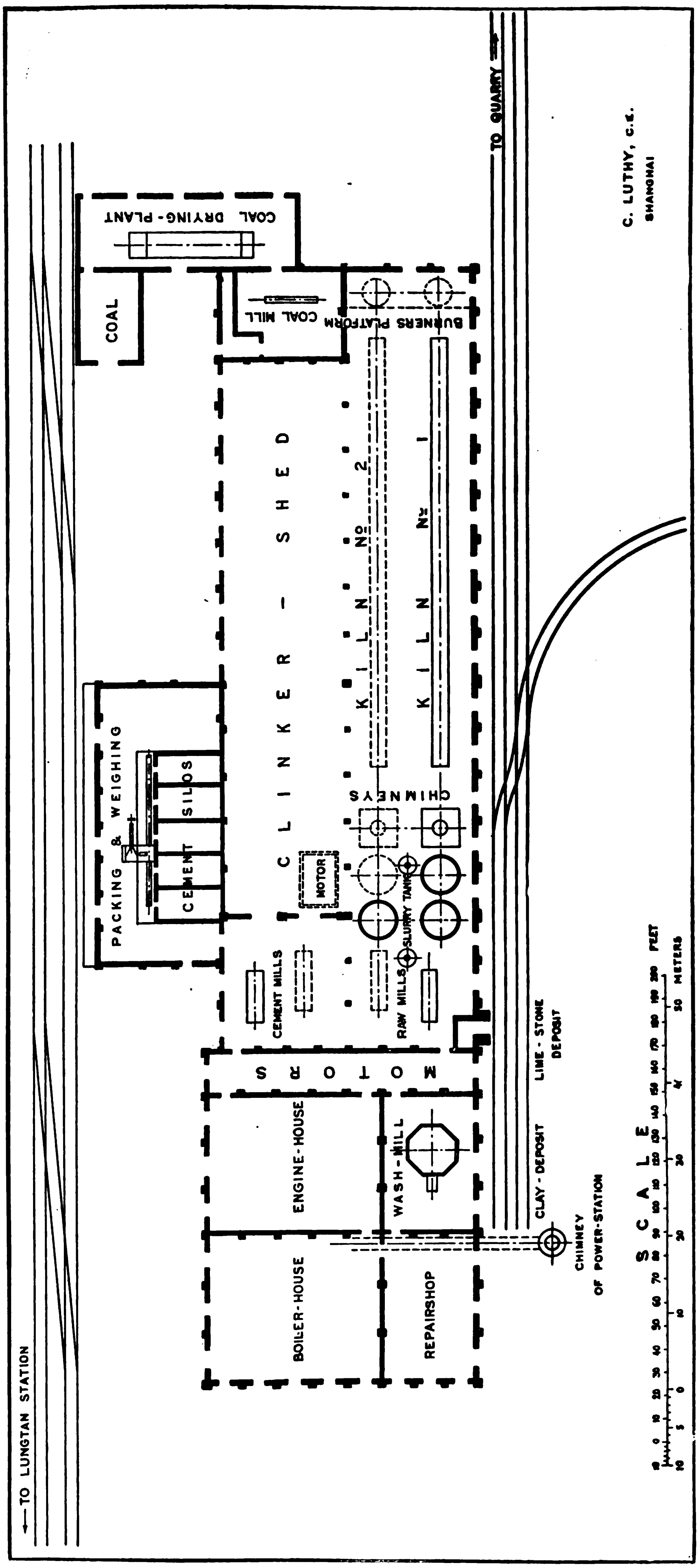
Sound principles guided the designers. In spite of the very favorable conditions they proposed not to start on a too large a scale. As the quality of cement depends very much on reliable supervision it is more economical to train the overseers and workman in a small factory. A large quantity of cement is now being used for the buildings and the heavy machinery foundations, but the extensions may be made with cement manufactured by the company.

The factory is designed for thick slurry wet process of two rotary kilns of 50 metres length and 2,25 m diameter. One such kiln produces per 6,000 hours about 120,000 barrels of highest standard portland cement or about 480 barrels a day. This figure can be increased by expert supervision. The present plant will be equipped with only one kiln, but the building is designed for the installation of another such unit. There is every prospect that this company will be a strong competitor for supply of cement in Nanking, Shanghai and vicinity, owing to its ability to manufacture at low cost and its exceptional shipping facilities.

The power plant will consist of an 800 h.p. steam engine direct-coupled with the generator and two water-tube boilers.

## The Ta Hu Cement Company

The largest new cement company was organized in the summer of 1921. The promotor is Mr. Hsieh Nan-ming, the noted silk and cotton merchant of Wusieh who, with his eldest son, Mr. Hsieh Hsiuh-chin, conceived the idea of establishing a cement works after his trip to the United States and Europe as high industrial commissioner.




**Plan of the China Portland Cement Works**

With a few prominent business men in Wusieh and Shanghai he raised a capital of one million and five hundred thousand dollars and purchased a piece of land of 300 *mow* about two miles from the Wusieh station of the Shanghai-Nanking Railway. It faces the water in three directions, so that the raw and finished materials can be shipped both by water or by railway.

Over thirty import and export companies in Shanghai competed for the order of the cement and the power machinery. Because of the favorable exchange in marks the order for the complete plant was placed with the Han Yuen Co., a German concern, 50 Kiangse Road, Shanghai, at the total sum of 650,000 taels C.I.F. Shanghai. The capacity of the machinery is 2,000 barrels of cement (each barrel, 375-lbs. of cement net) per day.

The cement machinery is from the Humboldts Engineering Works, Cologne, Germany, one of the largest machinery manufacturers of Germany. The arrangement of the machinery is shown in the figure (No. ). The limestone shipped from the hills a few miles from the factory is to be carried by coolies to the jaw crusher. The clay, from the vicinity of the factory site, is to be washed in a big sludge tank. The slurry, properly prepared, is pumped by a sludge pump to a wet compound mill which consists of rotary steel kiln lined with silex stone. The balls used in the compound mill are of flint stone pebbles of very hard quality. After preliminary grinding in the jaw crusher the limestone is elevated to a wet compound mill by an inclined bucket elevator, and further ground in wet to very finely divided paste. Then both the limestone and the clay slurry are pumped by means of an air compressor into mixing silos and properly mixed according to the proportion of their respective chemical constitutents. Samples for chemical analysis are to be taken and analyzed. After the mixed slurry is properly adjusted in its chemical composition, it is again pumped to a sludge tank where it is fed in to the rotary kiln by gravity. The amount of the slurry fed in can be adjusted by the arrangement provided in the tank.

The rotary kiln consists of steel drum lined with fire bricks which must be able to stand the temperature of 1,750°C. It is 220-ft. long. On the other end of the kiln coal dust with compressed air is fed in to burn the clinker. The waste gases pass along the kiln and dry the slurry and then pass through the chimney which is 190-ft. high. Near the chimney there is provided the dust chamber to collect the cement dust carried by the waste gases.

The burned clinker is carried by a conveyor through the steel cooling drum. Then it is elevated up by a bucket elevator and dumped into the clinker hall which is made of reinforced concrete. After being stored there for a month, the clinker is carried by a car and a certain amount of gypsum added. Both are elevated into a storage bin where they are fed into the compound mill. After being ground to 200 mesh, the cement silo consists of eight tanks each of which has the capacity of storing 400 tons of cement. Then samples of the finished cement are taken and tested for their physical properties. After fulfilling all the specified requirements of a sound cement, it will be packed by the pneumatic arrangement into jute bags or barrels or steel drums.

The powdered coal is prepared in the coal drying and milling department. It is first dried in a rotary kiln and then powdered to 100 mesh. The coal powder is elevated to a storage bin where it is fed in to the rotary kiln together with pre-heated compressed air.

The power for operating the cement mill is generated from two turbo-generators each of 1,000 k.w. which consists of two steam turbines, two surface condensers and two air filters. The whole turbine equipment is from the Bergman Electric Works, Berlin, Germany. The boiler equipment consisting of four water-tube boilers, four steam superheaters, four grate stokers, one economiser of 374 sq. metres heating surface, and other necessary pipe lines and other accessories was bought from the German Babcock & Wilcox Co., Oberhausen, Germany.

The barrels are made by special barrel making machinery which has the capacity of turning out 1,000 casks per 10 hours. The grinding machinery such as jaw crusher, compound mill, etc., can turn out sufficient quantities of raw materials for burning 24 hours in 10 hours time. The burning will be continuous throughout day and night.

*Designing and Construction.*—The designing of the cement mill, water tank, power house was done by Mr. E. J. Muller, of a Danish engineer of repute in Shanghai. The construction work was awarded to Mr. Chao Mow-kee, and is supervised by the construction engineer of the Company Mr. T. S. Sih, a M. I. T. graduate, who was construction engineer for the Great China Cotton Mfg. Co. in Woosung, before he joined the Ta Hu Cement Company. The other buildings such as main office, godown, engineer's residence, hospital, watchman station, staff residence, chemical laboratory, and working men house, etc. will all be designed by Mr. Sih. The construction work will be finished sometime in the June of 1923.

*Erection.*—At the time this article is written, the whole boiler equipment and over half of the cement machinery have already arrived at the factory site. The electric parts will be probably erected by the Chinese National Engineering Co., 6A Hongkong Road, Shanghai. The cement machinery will be put up by an engineer sent by the Humboldt Enginereing Works. A German cement expert of over ten years experience will probably be engaged to take care of the production. The chemist engaged by the company to do analysis work is Mr. C. H. Zee, instructor in chemistry in the Soochow University.

As regards the raw materials, the company has leased quite a number of limestone hills in Wusieh. Their chemical composition is as follows :—

ANALYTICAL DATA OF LIMESTONE IN WUSIEH.

| | $SiO_2$ | $Fe_2O_3$ $Al_2O_3$ | CaO | MgO | Ignition loss |
|---|---|---|---|---|---|
| Sample 1 .. .. | 2.95% | 1.18% | 52.30% | .51% | 42.43% |
| „ 2 .. .. | 4.08% | 2.25% | 50.47% | .99% | 41.31% |
| „ 3 .. .. | 4.71% | 1.07% | 49.57% | 2.41% | 40.94% |
| „ 4 .. .. | 1.84% | .71% | 52.05% | 1.43% | 42.44% |

In Wusieh there is an inexhaustible white clay which is excellent material for cement making. Its composition has been analyzed as follows :—

ANALYTICAL DATA OF CLAYSTONE IN WUSIEH.

| | $SiO_2$ | $Fe_2O_3$ | $Al_2O_3$ | CaO | MgO | Ignition loss |
|---|---|---|---|---|---|---|
| Sample 1 .. | 62.92% | | 27.51% | trace | .69% | 5.28% |
| „ 2 .. | 65.43% | | 25.93% | .80% | .55% | 4.70% |
| „ 3 .. | 68.41% | 65% | 22.12% | .12% | .31% | 5.04% |

With good raw materials available in Wusieh we are again particularly favored to turn out cement at very low production cost.

As regards coal, we have also analyzed many kinds produced in China.

ANALYTICAL DATA OF COAL.

| | Moisture | Volatile matter | Fixed carbon | Ash | Sulphur |
|---|---|---|---|---|---|
| Chiang Waung .. | 2.76% | 29.88% | 48.94% | 18.42% | 0.92% |
| Chung Shing .. | 9.97% | 28.97% | 61.58% | 8.48% | 0.96% |

The small amount of gypsum used may be obtained from Hankow, China. The price of gypsum sold in Wusieh is about two taels for 133$\frac{3}{1}$-lbs.

At present the market price of cement varies from 4-4.5 taels per barrel. The Ta Hu Cement Company may be able to turn out cement at considerable lower price. The low price of cement will greatly stimulate the amount of its consumption. Futher the people have been gradually awakened to the importance of highway construction in order to promote trade and commerce. A step further, the necessity for repairing harbors, canals, rivers, which are in a very deplorable condition to-day will demand the supply of Chinese cement many hundred fold. Next to the cotton industry cement will promise to be one of the greatest industries in the near future.

From cement industry the Ta Hu Cement Company expects to branch out in cement brick industry, pottery and tile industry, etc.

CAPACITY OF NEW CEMENT PLANTS.

The capacity of the new cement plants is as follows :

| | Barrels | |
|---|---|---|
| The China Portland Cement Co. .. .. .. | 500 | per day |
| „ Shanghai „ „ „ .. .. .. | 1,200 | „ „ |
| „ Ta Hu „ „ „ .. .. .. | 2,000 | „ „ |
| Total .. | 3,700 | |

The total capacity of three factories will be 1,058,500 barrels annually.

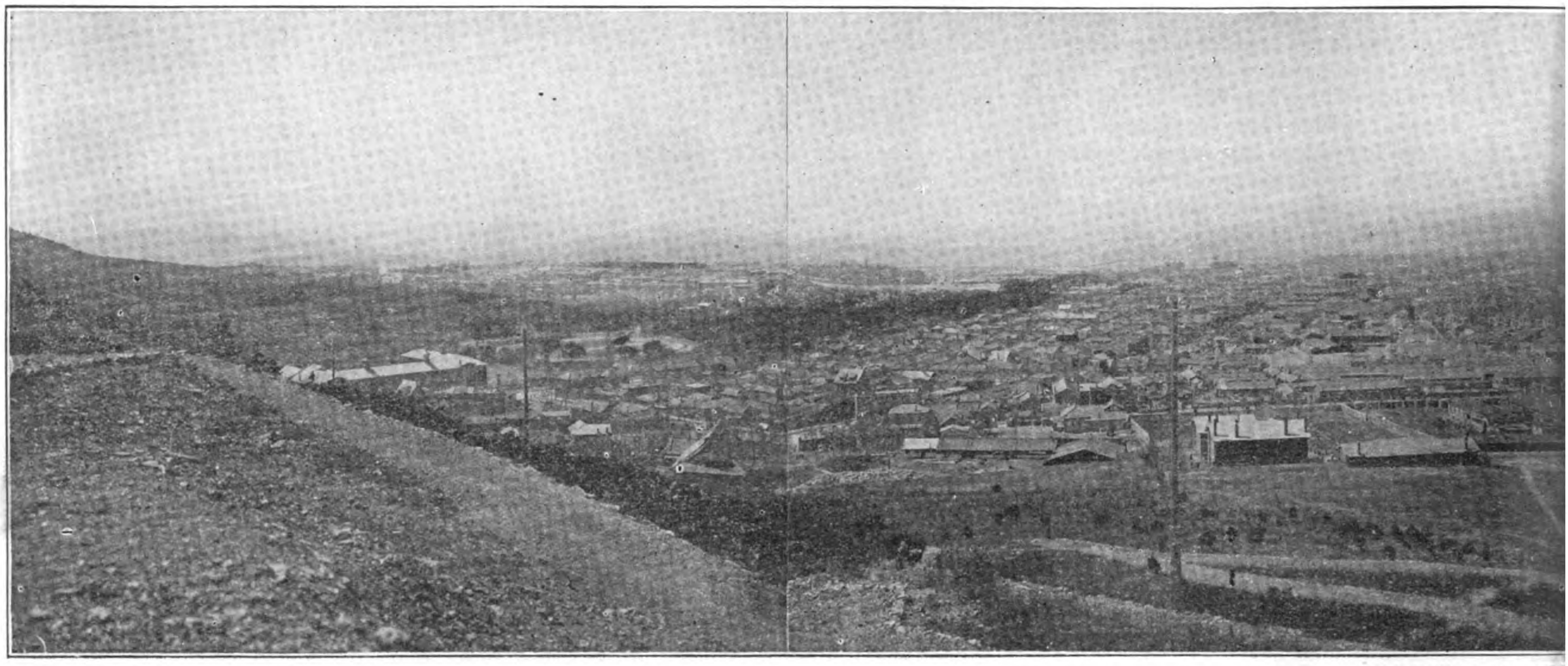
# Electrical Enterprise in China

AMID the political turmoil and resulting trade depression in China, it is pleasant news to hear that, after mature consideration, another well-known firm of British electrical manufacturers is opening a branch in Shanghai.

During the past twelve months Mr. A. R. Kibblewhite, of the old established firm of Callender's Cable & Construction Co., Ltd., has been making a very careful investigation, on the spot, of the future possibilities of the electrical industry in this country. As the result of his carefully weighed recommendations, the firm is opening its own office at 26 Peking Road, Shanghai, and has appointed as manager Mr. A. H. Gordon, A.M.I.E.E., recently manager and chief engineer of the British Electrical and Engineering Company of China, Ltd.

Callender's were the pioneer manufacturers of vulcanised bitumen cable for the transmission of electrical power and, since the seventies, have kept pace with the rapid progress made by the electrical industry. The Company has very extensive works on the south bank of the Thames at Erith, Kent, where heavy cable, electrical accessories and Kalanite insulating material are manufactured, while all rubber wire and cable are manufactured at their Anchor Works, at Liegh, Lanchashire. The head office of the firm is at Hamilton House, Victoria Embankment, London, E.C. 4.

The issued capital of the Company totals £1,300,000 and the average dividend on the ordinary capital for the past eighteen years has been fifteen per cent. per annum.



PANORAMIC VIE

# The Foreign Trade of Manchuria

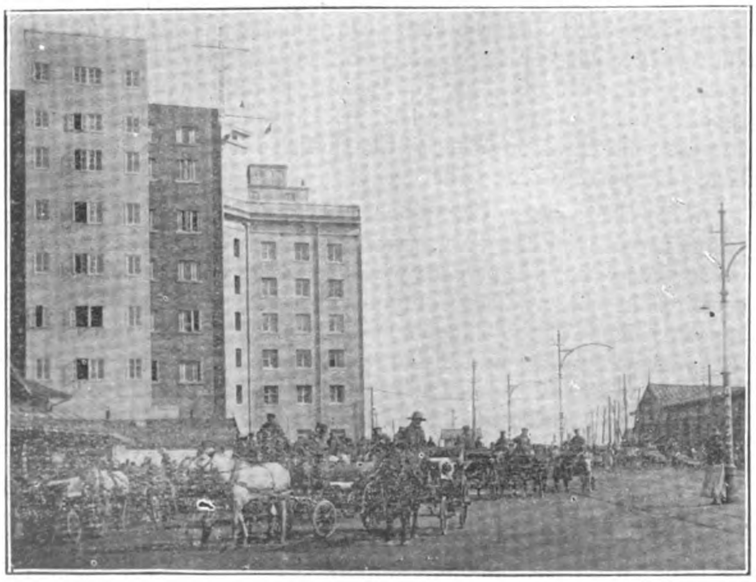
THE American traveler in Manchuria to-day, who rides in comfort in a Pullman sleeping car behind a Baldwin locomotive, over 100-pound Pittsburgh rails; from the modern port of Dairen, with its beautiful plaza, and its great modern banks, business houses and public buildings; and then northward through cities lighted by electricity, with modern railway stations, paved streets, modern hotels, schools, hospitals and scientific laboratories; past American-equipped steel works, coal mines and factory buildings—with such a magic transformation before his eyes the traveler finds it difficult to believe that only a few years ago this country was the home of the Manchu rulers of China and a forbidden land to world commerce.

Trade was a business of the lowest caste of Chinese, and particularly in Manchuria, as the Manchu dynasty forbade the desecration of this sacred ground even by the Southern Chinese. Manchuria for the first time was connected with Shanghai, the economic centre of China, when the port of Newchwang (now Yingkou) was opened to trade by the Tientsin treaty (1858) between England and China. But it was half a century later before Dairen, Antung and the other ports of Manchuria were opened to the trade of the world.

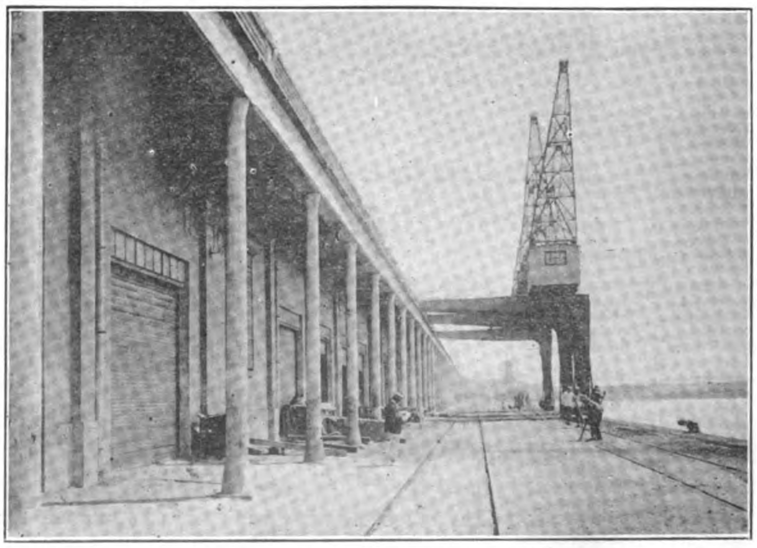
A very slow development of Manchurian trade followed the opening of the port of Newchwang. It was not until 1900 that the Russians began the construction of the Chinese Eastern Railway, which was to give them, in connection with their Trans-Siberian line, an outlet on the Yellow Sea at Port Arthur. But the real awakening of Manchuria came with the Russo-Japanese war of 1904, and the taking over of the southern portion of the railway line by the Japanese in 1907 under the terms of the treaty of Portsmouth. Since then Manchurian commerce has grown tremendously.

The gateways of Manchurian trade are Dairen, Yingkou, Antung and Vladivostok. Of these four the port of Dairen has made the most conspicuous progress. It has now outstripped Tientsin, and leads all other Chinese ports, except Shanghai.

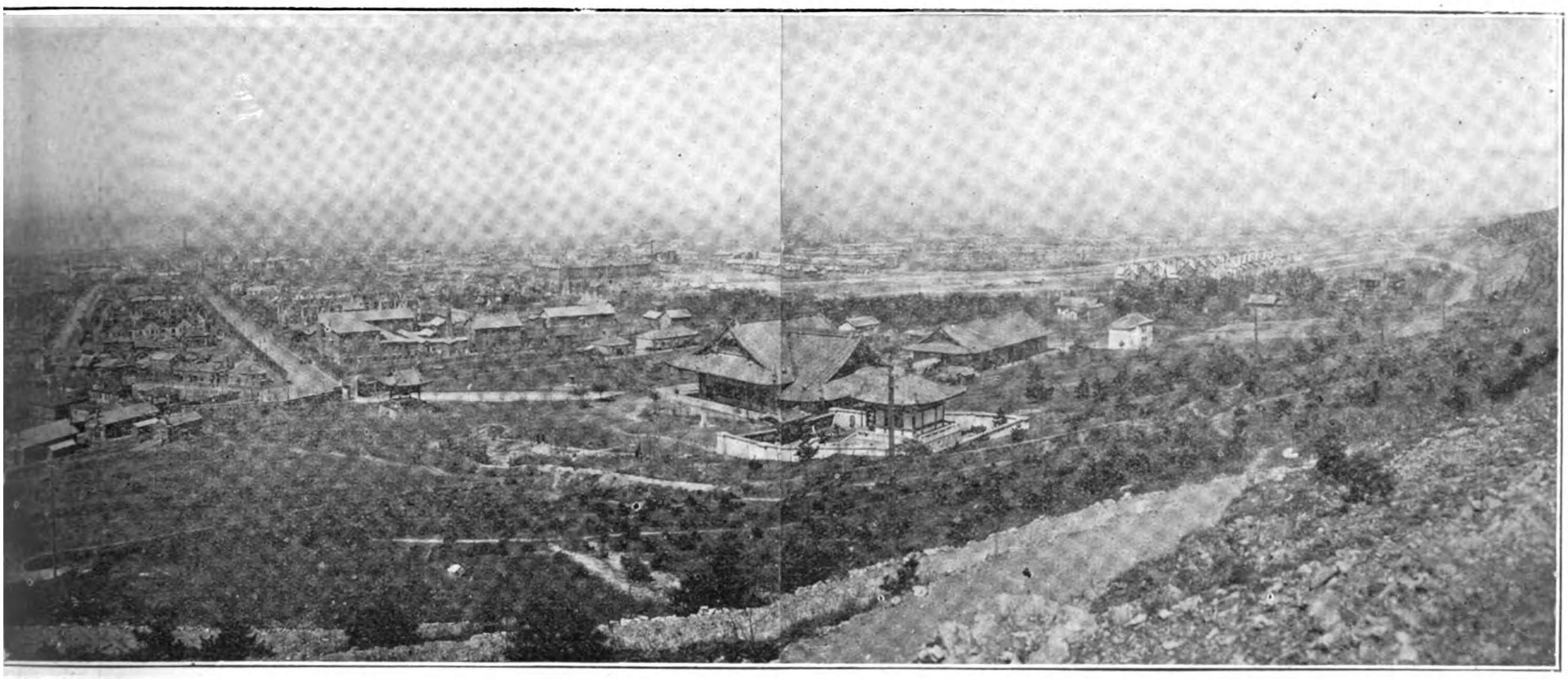
*Growth of the Port of Dairen.*—The growth of Dairen as a shipping port is indicated in the number and tonnage of vessels arriving at the Dairen wharves in 1908 and 1920, being 1,357 vessels with



Wharf Office, Dairen



Concrete Wharves and Warehouses, Dairen



OF DAIREN

a tonnage of 1,829,921 in 1908, and 2,942 vessels with a tonnage of 4,864,904 in 1920.

Before the European war the American flag was rarely seen in the port of Dairen, but since the war there has been a very large increase in American tonnage. The following table shows the tonnage of vessels of he principal maritime nations arriving at Dairen every third year since 1908 :

*Shipping Tonnage Arriving at Dairen : By Countries*

| | Japanese | Chinese | British | American | Others |
|---|---|---|---|---|---|
| 1908 .. | 1,407,778 | 31,041 | 310,756 | .... | 80,346 |
| 1911 .. | 1,872,294 | 55,818 | 398,141 | .... | 336,690 |
| 1914 .. | 3,034,075 | 98,476 | 433,909 | 3,302 | 268,316 |
| 1917 .. | 2,628,570 | 176,853 | 183,596 | 8,198 | 121,498 |
| 1920 .. | 3,408,369 | 483,073 | 421,028 | 381,729 | 170,705 |

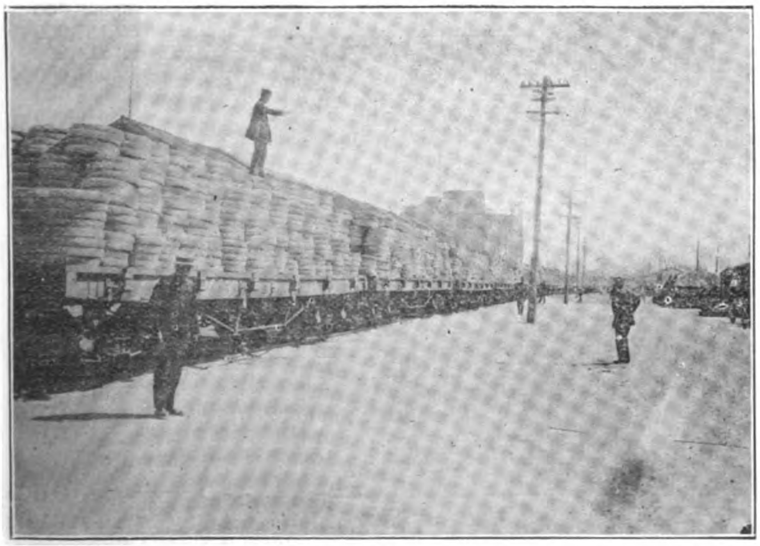
The other leading nations represented in the 1920 arrivals were : Russian, 34,146 tons ; French, 18,277 tons ; Norwegian, 11,618 tons. Before the war the German tonnage ranked next to the Japanese and British, reaching 307,000 tons in 1913.

A large part of the imports unloaded at the Dairen wharves naturally comes from the neighboring countries of the Far East, but, since the South Manchuria Railway began making heavy purchases in the United States, there has been a very considerable overseas trade. The tonnage of imports from the different countries for 1908 and for the period 1914-1920 is shown herewith :

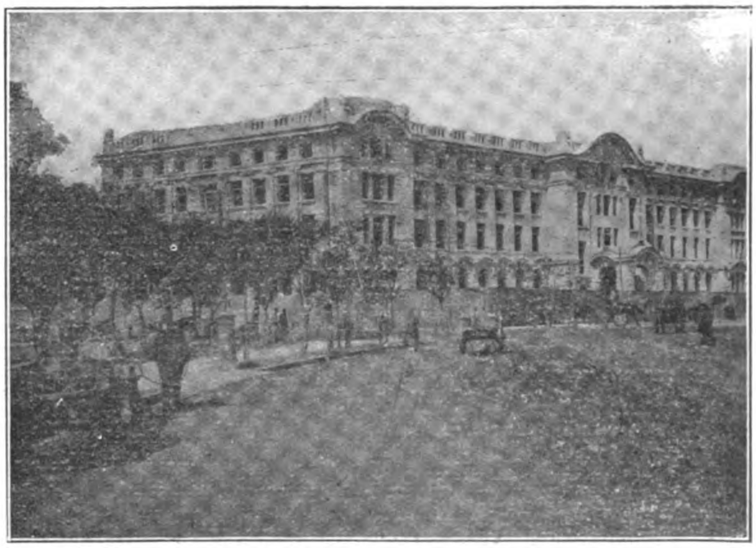
*Tonnage of Imports into Dairen : By Countries*

| | Japan | China | Chosen | U.S., Europe and Others | Total Tons Imported |
|---|---|---|---|---|---|
| 1908 .. | 214,551 | 14,442 | 15,584 | 92,350 | 336,927 |
| 1914 .. | 258,865 | 121,367 | 17,009 | 108,533 | 505,774 |
| 1915 .. | 240,685 | 164,062 | 20,948 | 111,535 | 537,230 |
| 1916 .. | 313,131 | 194,316 | 26,689 | 65,786 | 599,922 |
| 1917 .. | 424,065 | 278,130 | 35,893 | 95,180 | 833,268 |
| 1918 .. | 466,144 | 392,952 | 27,930 | 69,519 | 956,545 |
| 1919 .. | 730,004 | 528,153 | 16,887 | 135,575 | 1,410,619 |
| 1920 .. | 588,519 | 274,730 | 22,938 | 88,028 | 974,215 |

The value of Dairen's foreign trade has greatly increased, the total exports and imports being now about seven times as large as in 1908. The record of the maritime customs trade of Dairen, in Haikwan taels, in 1908 and 1920, is shown in the three tables following :—



**Hills of Bean Cake on a Freight Train entering the Dairen Wharf Compound for Ocean Shipment**



**Magnificent new Building of the Dairen Paper, Produce and Stock Exchange**

*Value of Imports at the Port of Dairen*

| | From Foreign Ports (taels)* | From Chinese Ports (taels)* | Total Imports (taels)* |
|---|---|---|---|
| 1908 .. | 17,215,936 | 3,060,713 | 20,276,649 |
| 1920 .. | 71,040,883 | 22,028,602 | 93,069,485 |

*Value of Exports at the Port of Dairen*

| | To Chinese Ports (taels)* | To Foreign Ports (taels)* | Total Exports (taels)* |
|---|---|---|---|
| 1908 .. | 5,069,133 | 7,342,402 | 12,411,535 |
| 1920 .. | 16,842,406 | 108,223,857 | 125,066,263 |

*Exports and Imports : Port of Dairen*

| | Imports (taels)* | Exports (taels)* | Total (taels)* |
|---|---|---|---|
| 1908 .. | 20,276,649 | 12,411,536 | 32,688,184 |
| 1920 .. | 93,069,485 | 125,066,263 | 218,135,748 |

Just Beans and Bean Cake: Nearly Two Million Tons of these Products pass annually through the Port of Dairen

Dairen's exports trade is largely made up of agricultural products and coal. In tonnage, soya bean products are more than sixty per cent. of the exports. The growth of the export trade in the principal items since 1908 is shown in the following table :—

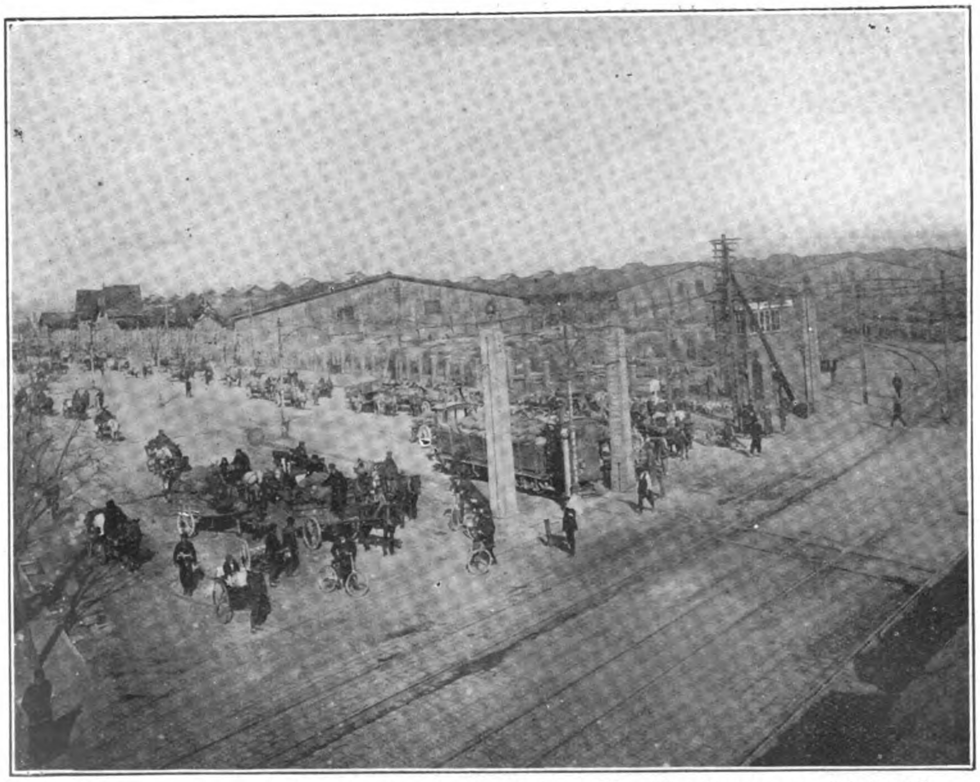
*Commodities Exported from Dairen (in Tons)*

| | 1908 | 1911 | 1914 | 1917 | 1920 |
|---|---|---|---|---|---|
| Beans .. .. | 182,629 | 272,457 | 255,112 | 191,780 | 567,129 |
| Bean cake .. | 204,627 | 446,801 | 512,823 | 852,867 | 1,131,208 |
| Cereals.. .. | 13,781 | 97,004 | 118,259 | 198,684 | 707,237 |
| Coal .. .. | 7,703 | 91,115 | 559,761 | 494,645 | 212,589 |
| Sundries .. | 28,646 | 39,285 | 98,518 | 258,332 | 278,935 |
| Total .. | 437,386 | 946,662 | 1,544,473 | 1,996,308 | 2,897,098 |
| Bunker coal .. | 15,276 | 55,322 | 247,193 | 206,131 | 195,428 |

*Foreign Trade of Manchuria.*—With the development of the port of Dairen, the gateway to Manchuria, the foreign trade of the country has grown apace. Three years after the Russo-Japanese war, when Dairen and Antung were opened to commerce, the total trade reached $40,000,000. In the first year after the close of the European war it had risen to nearly $500,000,000. The foreign trade returns for the years, 1911 and 1920, are as follows :

*Foreign Trade of Manchuria (in U. S. Dollars)*

| | Imports from Foreign Ports | Imports from Chinese Ports | Total Imports | Exports | Total Trade |
|---|---|---|---|---|---|
| 1911 .. | $ 44,534,998 | $17,937,313 | $ 63,472,311 | $ 64,924,367 | $128,396,678 |
| 1920 .. | 156,990,557 | 50,923,282 | 207,913,839 | 221,517,637 | 429,431,476 |



A Traffic Hold up at a Railway Crossing in Dairen: The Warehouses are filled with beans, the yards are piled high with bean cake under tarpaulins; the carts are transporting beans to the Mills, while the Tramways are employed to help out the enormous movement

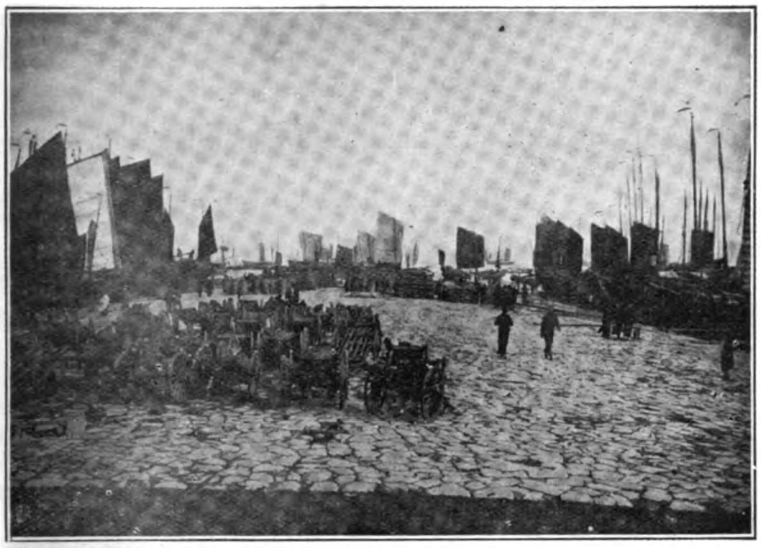
*Principal Exports and Imports.*—Manchuria exchanges her raw materials for the manufactures of other countries. She imports little raw material, and exports few manufactures. The country is still primarily agricultural, although manufacturing is rapidly developing. The soya bean is the foundation of her trade, comprising about half the value of all exports. The values of the principal exports in 1920 were as follows :

| | |
|---|---|
| Bean cakes... ... ... ... | $60,236,000 |
| Beans ... ... ... ... | 35,098,000 |
| Bean oil ... ... ... ... | 22,131,000 |
| Wheat ... ... ... ... | 28,214,000 |
| Other cereals ... ... ... | 19,651,000 |
| Coal and coke ... ... ... | 8,688,000 |
| Wild silk yarn ... ... ... | 7,680,000 |
| Wild silk cocoons ... ... ... | 2,627,000 |
| Kaoliang ... ... ... ... | 7,122,000 |
| Lumber ... ... ... ... | 3,935,000 |
| Corn ... ... ... ... | 2,672,000 |
| Metals ... ... ... ... | 2,488,000 |

Values of some of the principal imports in 1920 were :

| | |
|---|---|
| Cotton goods ... ... ... | $62,099,000 |
| Cotton yarns ... ... ... | 17,009,000 |
| Metals ... ... ... ... | 14,477,000 |
| Machinery ... ... ... ... | 8,531,000 |
| Tobacco ... ... ... ... | 9,090,000 |
| Fabrics (other than cotton) ... | 8,084,000 |
| Bags ... ... ... ... | 7,347,000 |
| Kerosene ... ... ... ... | 6,087,000 |

*Chinese customs returns are reported in Haikwan silver taels. The exchange value of the tael varies with the price of silver. From 1908 to 1915 the average value of the tael in United States currency was 67 cents. In 1916 it was 79 cents ; 1917, $1.30 ; 1918, $1.26 ; 1919, $1.39 ; 1920, $1.24.



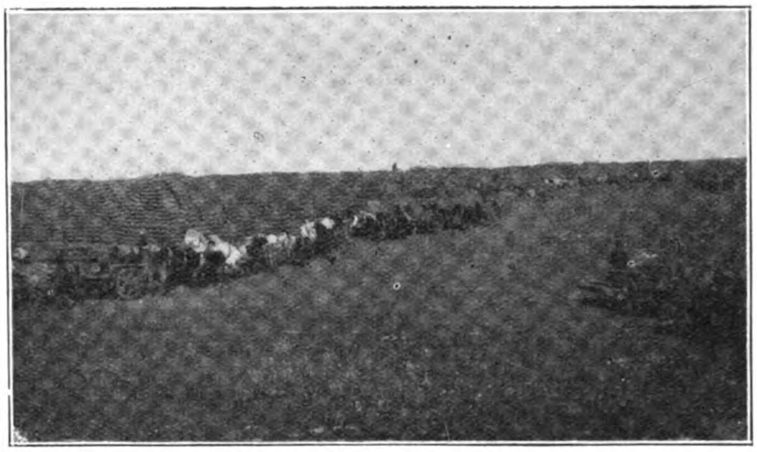
Chinese Junks Aid the Railway to Transport Beans to Dairen

Even on the Banks of the Yalu at Antung the foreshore is covered with Piles of Beans and Bean Cake

*Trade with the United States.*—A very considerable part of the overseas trade of this rapidly developing country is with the United States, because it is to America that the builders of Manchurian industries have turned for modern machinery and railway materials.

American manufacturers have found an open door in Manchuria for their products, and the return tide of Pacific traffic has brought to the United States an increasing flow of the products of the rich soil of Manchuria.

The South Manchuria Railway has purchased in the United States $50,000,000 worth of locomotives, cars, rails and other materials, and the industries developed by it in the railway zone have imported $25,000,000 worth of machinery and materials. In contrast to this open door for American products in Manchuria THE FAR EASTERN REVIEW stated that railways in neighboring provinces of China had purchased $67,500,000 of materials in Europe, but none in America.



A Typical View of the S.M.R. Station Yard at Changchun where Piles of Beans in Bags Stretch for Miles Awaiting Shipment

Manchuria, as its latent resources continue to be developed by modern engineering and agriculture, will offer greater and greater opportunities to American trade.

The record of Manchuria's trade with the United States for the past few years is as follows:

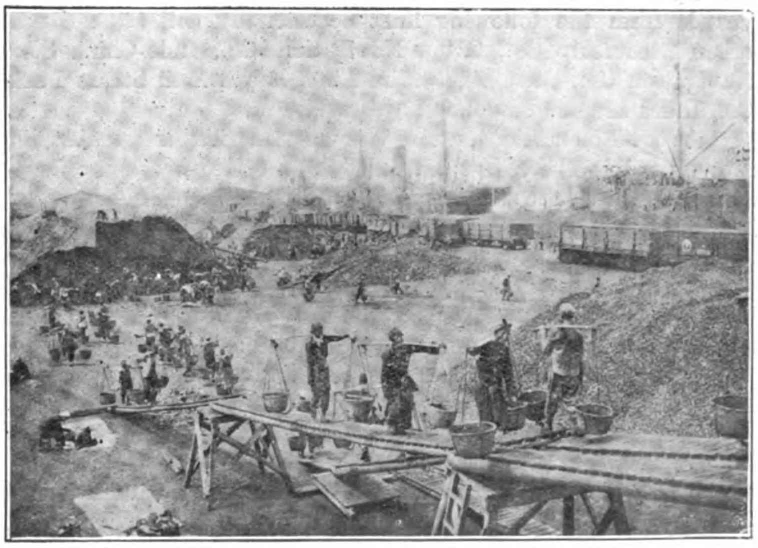
| | Imports from United States | Exports to United States |
|---|---|---|
| 1910.. | $1,212,582 | $8,671 |
| 1911.. | 1,300,169 | 20,400 |
| 1912.. | 1,444,318 | 4,493 |
| 1913.. | 1,689,215 | 88,629 |
| 1914.. | 3,401,336 | 479,972 |
| 1915.. | 1,784,305 | 280,492 |
| 1916.. | 1,673,092 | 1,724,091 |
| 1917.. | 6,293,941 | 16,399,301 |
| 1918.. | 15,323,807 | 35,766,620 |
| 1919.. | 27,678,116 | 14,474,853 |
| 1920.. | 15,871,554 | 16,514,377 |

## (2) Facilities for Commerce

*Railways.*—More than 2,200 miles of railway are now in operation in Manchuria. These lines are as follows:

| *South Manchuria Railway—686 Miles* | Mileage |
|---|---|
| South Manchuria Railway, Main Line, Dairen-Changchun.. | 439 |
| Mukden-Antung Line, Suchiatun-Antung .. .. . .. | 162 |

Another View of Activity on the Dairen Wharves



Loading Bunker Coal at Dairen Wharves

| | | Mileage |
|---|---|---|
| Ryojun (Port Arthur Branch, Chouchuitzu-Ryojun) | .. | 29 |
| Fushun Branch, Hunho-Fushun | .. .. .. .. | 33 |
| Yingkou Branch, Tashihchiao-Yingkou | .. .. .. | 14 |
| Yentai Colliery Branch, Yentai-Yentai Colliery | .. .. | 9 |
| *Chinese Government Railways*—522 *Miles* | | Mileage |
| Kirin-Changchun Line, Changchun-Kirin | .. .. .. | 79 |
| Ssupingkai-Taonan Line, Ssupingkai-Paiyintailai | .. .. | 125 |
| Part of Peking-Mukden Line, Mukden-Shanhaikwan | .. | 261 |
| Yingkou Branch Line, Yingkou-Koupantzu .. | .. .. | 57 |
| *Railways Under Russo-Chinese Management*—1,078 *Miles* | | |
| Chinese Eastern Railway— | | Mileage |
| (Western Section) Manchouli-Harbin | .. .. .. | 584 |
| (Eastern Section) Harbin-Pogranishnaya | .. .. | 341 |
| (Southern Section) Harbin-Kwanchengtzu | .. .. | 148 |
| Jalainor Colliery Branch Line .. | .. .. .. .. .. | 5 |

When the Kirin-Huining Railway, together with five proposed railways in South Manchuria and Inner Mongolia are completed and opened for operation, 1,500 additional miles of line will be added to Manchuria's transportation facilities.

*Waterways.*—The navigable rivers in Manchuria and Mongolia are the Liao in the south, the Yalu in the east, and the Sungari and the Amur in the north. The Sungari and the Amur admit of the greatest exploitalon. Before the railway was built, the Liao served as the only highway of trade in South Manchuria, but now its old glory has vanished. Some 1,500 junks are in operation on the Liao and the river is still a trade channel of importance to interior Mongolia. The Yalu and Liao Rivers remain ice-bound from December to March, while the ice-bound period on the Sungari and the Amur extends from November to April.

*Ocean Steamship Services.*—With the rise of the port of Dairen to second place among all the ports on the China coast, and the development of the harbor facilities for berthing ocean steamships and handling freight, shipping offices of all the shipping companies with Pacific routes have been established at Dairen. The "Commercial Handbook of China," published by the bureau of foreign and domestic commerce, Washington, gives the following summary of the steamship services at Dairen :

The steamship lines with ocean-going vessels calling regularly at Dairen are as follows :

Osaka Shosen Kaisha : Dairen-Kobe (via Moji) ; twice a week ; four vessels. Dairen-Nagasaki (via Korean ports) ; monthly ; one vessel. Tientsin-Takao, Formosa (via Dairen and Chinese ports) ; thrice a month ; three vessels.

Nippon Yusen Kaisha : Yingkou-Yokohama (via Dairen, Tientsin, Chemulpo, Kobe) ; thrice a month ; three vessels.

South Manchuria Railway Company : Dairen-Shanghai (via Tsingtau) ; twice a week ; two vessels.

In addition to the services listed above, passenger and freight vessels from the following lines occasionally call at the port : ocean Steamship Co., China Navigation Co., Indo-China Steam Navigation Co., Glen Line, Shire Line, Royal Mail Steam Packet Co., Indra Line and Bucknail Steamship Co.

As will be noticed, there are no American steamship lines represented in the above lists. It is therefore necessary for the American shipper to send his cargo to Yokohama or Kobe and have it transhipped there to one of the Japanese lines to be forwarded to Dairen, unless, of course, a full cargo can be made up and sent directly to Dairen by a tramp steamer.

*Steamship Lines Now Operating to Dairen.*—The following steamship lines are now operating to Dairen :—

Toyo Kisen Kaisha : Dairen-San Francisco, via Yokohama, Hongkong and Honolulu ; two sailings per month.

Osaka Shosen Kaisha : Dairen-Osaka, via Moji and Kobe ; two sailings per week. Seattle, Tacoma via Kobe ; three steamers ; stop at Dairen on eastbound voyage. New York via Panama ; three steamers ; stop at Dairen on eastbound voyage. European line via Suez ; two steamers ; stop at Dairen on outward voyage.

Nippon Yusen Kaisha: Osaka-Newchwang via Kobe and Dairen; sailing every nine days. Service suspended during winter months.

Yokohama-North China Line (Dairen-Seattle) ; three steamers. Stops at Dairen on eastbound voyage.

Dairen Kisen Kaisha : Tientsin-Dairen-Tsingtao-Shanghai ; two sailings per month.

Chosen Yusen Kaisha : Dairen-Tsingtao-Chemulpo ; three sailings per month.

To-wa Kisen Kaisha : Dairen-Lungkow ; three sailings per month.

Chingkee Steamship Company : Dairen-Chefoo ; twelve sailings per month.

Awakyodo Kisen Kaisha : Dairen-Tsingtao. Dairen-Chemulpo.

Norton Lilly Company, 26 Beaver Street, N. Y. C. : General agents for companies having steamers leaving Atlantic Coast Ports for Dairen.

Barber Steamship Lines, 17 Battery Place, N. Y. C. : Have steamers leaving Atlantic Coast Ports for Dairen.

*Posts, Telegraphs and Telephones.*—Along the line of the South Manchuria Railway, postal, telegraph and telephone systems are organized and operated by the Japanese authorities. More than 700 miles of telegraph lines and 1,000 miles of telephone lines (the two services using more than 20,000 miles of wires) have been installed. Chinese post-offices are maintained in all towns outside Kwantung, in which territory the postal service is operated by the Kwantung Government. Communication facilities are constantly being improved and expanded.

*Warehousing.*—A number of warehousing and forwarding companies are in operation in the principal towns along the South Manchuria Railway. The railway maintains warehouses and storage yards at the Dairen wharves and at the principal railway stations.

*Insurance*—Branches of the leading Japanese, English and American insurance companies are maintained at Dairen. At the end of 1919 there were 61 insurance offices in Kwangtung territory, 130 in the South Manchuria Railway zone, and 93 outside of the zone. The total amount of insurance in force was 666,800,000 yen. Freight at the Dairen wharves is insured by the railway company, by arrangement with a number of insurance companies, and this insurance is voluntarily effected by the South Manchuria Railway without charge to the owners of the goods.

*Banking.*—Manchuria has adequate, modern banking facilities, the great Japanese and foreign institutions maintaining branches in Dairen and other cities. In addition there are a number of local institutions. The Japanese banks maintain twenty-six main offices and sixty branch offices, while the Chinese banks have eleven main offices and seventy branch offices.

The Bank of Chosen ($25,000,000 paid-up capital) and the Yokohama Specie Bank ($50,000,000 paid-up capital) are the largest institutions maintaining branches in Manchuria. They have built imposing banking houses in Dairen, which are among the most beautiful structures facing the plaza. The principal banks in Manchuria are as follows :

| *Japanese* | Authorized Capital | |
|---|---|---|
| Bank of Chosen .. .. .. .. | .. yen | 80,000,000 |
| Yokohama Specie Bank .. .. .. | .. yen | 100,000,000 |
| Chenlung Bank .. .. .. .. | .. yen | 20,000,000 |
| Dairen Bank .. .. .. .. | .. yen | 3,000,000 |
| Liaotung Bank .. .. .. .. | .. yen | 3,000,000 |
| Lungkow Bank .. .. .. .. | .. yen | 11,000,000 |
| Dairen Commercial Bank .. .. .. | .. yen | 2,275,000 |
| *Chinese* | | |
| Bank of China .. .. .. .. | .. yuan | 60,000,000 |
| Bank of Communication .. .. .. | .. tael | 15,000,000 |
| Three-Eastern Provincial Bank .. .. | .. yuan | 600,000 |
| Mukden Industrial Bank .. .. | .. yuan | 13,000,000 |
| Kirin Provincial Bank .. .. .. | .. tiaos | 1,500,000 |
| Heilungkiang Provincial Bank .. .. | .. tael | 404,998 |
| Frontier Development or Territorial Bank | silver yen | 2,000,000 |

| *Foreign* | Authorized Capital |
|---|---|
| Russo-Asiatic Bank .. .. .. .. | rubles 55,000,000 |
| Hongkong & Shanghai Banking Corporation | silver yen 20,000,000 |
| International Banking Corporation .. .. | $10,000,000 |
| Chinese-French Commercial Bank .. .. | francs 45,000,000 |

*Currency.*—As in other parts of China, there are many kinds of currency in circulation.

The foreign bank-notes exert a great influence, and it is mainly through them that the foreign trade of the country is actually carried on. These bank-notes circulate in large amount, and within the limits of the Leased Territory and the railway zone are practically the sole currency. It should be noted, however, that, outside these limited places, their circulation is greatly modified, because, though they are used very extensively and freely for all trading purposes, mutual transactions between the natives are carried on in native currency.

The "Economic History of Manchuria" gives the following table of moneys in circulation in Manchuria :—

| | | |
|---|---|---|
| Chinese currency | Coins | Cash (*chuhchien*), Copper coin (*tungyuan*), Silver doallar (*yangchien*), Sycee (*yinting*). |
| | Notes | Government notes (*kuantieh*), Copper coin notes (*tungyuanpiao*), Silver dollar notes (*yangchienpiao*). |
| Foreign currency | Coins | Japanese silver yen, Mexican dollar, Japanese and Russian subsidiary coins. |
| | Notes | Japanese military notes, Bank of Japan notes, Bank of Chosen notes, Yokohama Specie Bank notes, Russian ruble notes. |

*Trade Organizations.*—Chambers of commerce are maintained at Dairen, Mukden, Antung, Changchun, Yingkou and other cities. At every trade centre there is a Chinese guild. The Dairen organization publishes periodical reports on the trade and industry of Manchuria.

The Dairen Produce Exchange was established in 1913 ; in 1915, a produce and currency exchange was opened at Kaiyuan, and another at Changchun in 1916. In 1917, a currency exchange was established in the Dairen Produce Exchange, and now the produce and currency exchanges are known as the Dairen Exchange. In 1919, produce and currency exchanges were opened at Kungchuling, Ssupingkai and Tiehling, and in 1920, at Mukden, Yingkou and Liaoyang. In addition stock and merchandise exchanges have been founded at Dairen, Mukden and Antung under private management.

On these exchanges there is trading in beans, bean cake, kaoliang, bean oil, wheat, Italian millet, etc., gold notes issued by the Bank of Chosen, Russian ruble notes, silver notes issued by the Yokohama Specie Bank, Chinese small silver coins, and Chinese small silver coin notes. In Manchuria, owing to the great variety of currencies in circulation and more particularly because of the constant fluctutations in their exchange rates, the currencies have come to be looked upon as commodities. Because of this peculiar feature in the currency situation in South Manchuria, the exchanges are under government management ; and in order to guarantee delivery and to settle accounts between sellers and buyers, a trust and guaranty company under private management is attached to each exchange.

For the purpose of providing long-term capital to develop the country, there have been organized the Oriental Developing Company, the Eastern Enterprise Company and the Manchurian Enterprise Company. These financial institutions make loans against lands and buildings.

A commercial museum was established in Tiehling in 1906. Similar institutions were opened later in Changchung, Antung and Harbin. The Kwangtung government recently established in Port Arthur the Manchuria-Mongolia production museum.

## THE YOKOHAMA SPECIE BANK NEW BUILDING

*[Continued from page 246]*

and on the south by the former German Club. The building is on the bend of the Whangpoo River and with the lawn and approaches in front obtains a first class outlook.

The design is of a severe, chaste, and broad character, Neo-Grec in style, relying on scale, proportion, and combination of materials for its individuality.

As in the case of the Hongkong & Shanghai Bank and Chartered Bank of India, Australia & China it is of steel framed construction throughout, fabricated by Messrs. Dorman & Long, with fire resisting reinforced floor and roof slabs. The structure is built upon a foundation consisting of a reinforced framed concrete raft superimposed on piling.

The Bank is to be a stone fronted building of Japanese granite with metal windows and facings, and its details are a departure from precedent. The ground floor entrance is a bold feature, and all the stone details are vigorous owing to its position and foreground, the heavy mass and simple detail carrying across these open spaces.

The principal consideration in the formation of the interior is to provide a large well lit banking hall with rooms and offices planned for the effective administration and to simplify the complex work of a bank. The interior will be dependent for its effect on the simple lines and detail, reinforced with marble and metals, and the coloring of the woodwork and furnishings.

A heating and ventilating system is formulated on modern scientific lines to serve the whole of the building and is planned to be effective during all seasons. Proper ventilation is a great factor to raise the working efficiency of the occupants of the room.

The central area is spacious, and no rooms will look into ill lit areas, but all have abundance of light. Effective doors are arranged for fire protection, and the interior will be hygienically constructed in every part. Materials and details are arranged so that the cost of maintenance will be reduced to a minimum. Practical and model contrivances will be installed to attain the standard of modern buildings. Particular attention will be given to modern hygienic apparatus and material, so that utility and comfort will be correlated and soundly conceived.

The contract for the erection of the structure has been undertaken by Messrs. Trollope & Colls, Ltd., 28 The Bund.

The architects are Messrs. Palmer & Turner of Hongkong, Shanghai and Hankow.

## THE WORLD'S BIGGEST TIN DREDGE

*[Continued from page 251]*

Marshall engine connected to the gearing by a 20-in. Redaway camel hair belt. Water is supplied to the screen and boxes by an 18-in. centrifugal pump and a 12-in. high-pressure pump each direct coupled to a high-speed engine. These pumps and engines being built by Messrs. Thompson & Co., of Castlemain, Victoria, Australia.

The mooring winch is provided with six large independent drums driven by one engine. The ladder winch drum controlled by a separate engine is exceptionally large—being 6-ft. 2-in. in diameter. The object of this being to enable both ladder lines to work on the face of the drum all the time and so save wear on the ropes.

The forehead gantry, cantilever and ladder hoisting gear is all particularly strong and serviceable. The two 4-in. ladder lines run through five sheaves each both top and bottom, and lead on to the same drum. The dredge is designed to dig to 50-ft. below the paddock water level and the theoretical capacity of the plant based on 22 hours run is 7,920 cubic yards per day. An inspection of the dredge gives the impression of strength and serviceability and the general arrangement and construction of the machinery appears all that could be wished for. There is plenty of room on deck and the facilities for handling gear and arrangements for getting about are very satisfactory.

Except for the main engine, the electric lighting plant and the bucket pins, the whole plant was built in Australia.

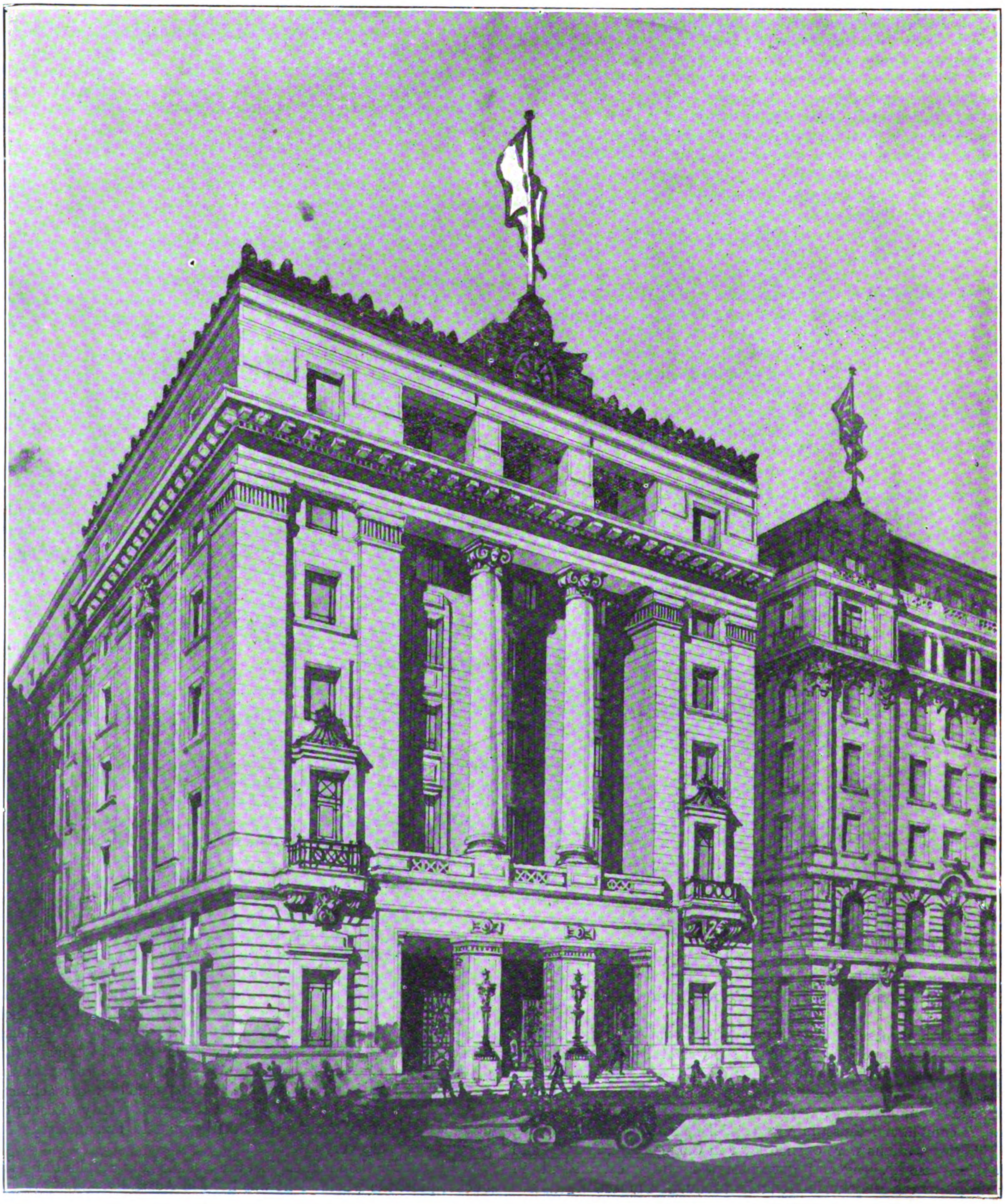
# YOKOHAMA SPECIE BANK NEW BUILDING

## SHANGHAI

THE Yokohama Specie Bank, which is in the course of erection, displays in the design freshness and vigor in the strong masses and lines and in the use of Far Eastern motives.

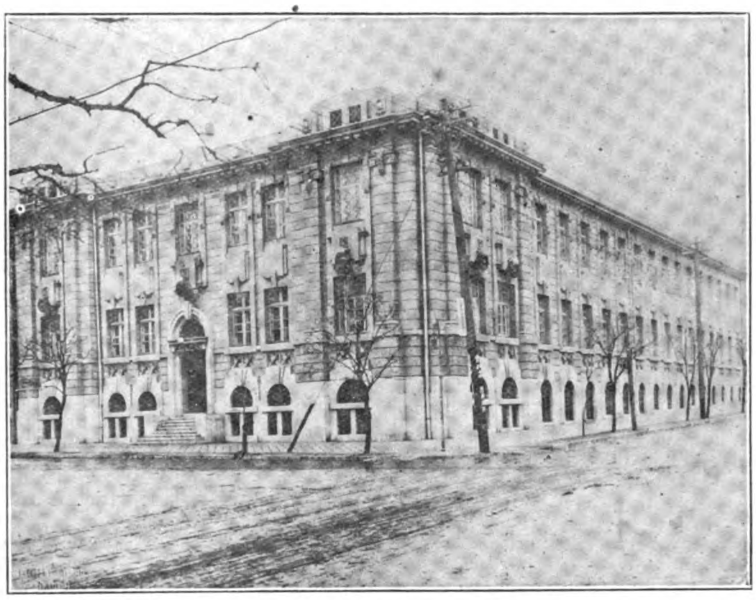
The perimeter of the site is bounded on its north side by the Jardine, Matheson Building and the Yangtze Insurance Offices,

[Continued on previous page]



# Automatic Telephone System at Dairen

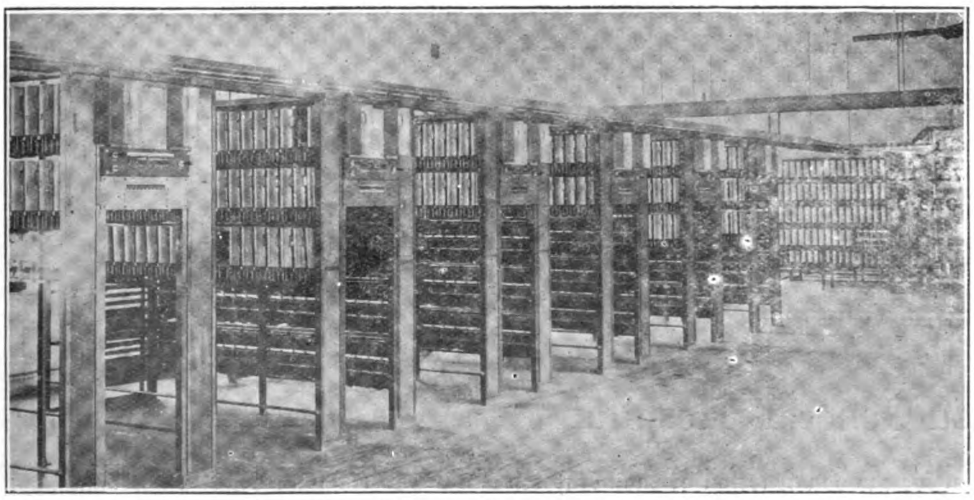
WHAT promises to be initial step towards its gradual adoption in the larger cities of Japan is the new automatic telephone system just placed in operation in Dairen. A 500 line private exchange was completed last Septembeı in Tokyo by the engineer of the Automatic Telephone Manufacturing Company of Liverpool, which is now being thoroughly tested by the experts of the ministry of communications, and to gather further first hand data and experience it was decided to install the same system in Dairen. The first complete automatic telephone system in the Far East was successfully placed in operation last year in Harbin by Mr. L. W. Smeltzer, engineer for the above company, where despite the linguistic difficulties the system has proved a complete success. Completing this contract he came to Dairen in March of last year to superintend the installation of the 5,000 wire system for the Dairen municipal authorities and it is now ready for operation.



Telephone Exchange Building, Dairen

The telephone system at Dairen dates back to the Russo-Japanese war (1904-1905). In a little over fourteen years, the local subscribers will have reached 4,000 the ultimate capacity for the existing equipment. The Exchange soon became pressed for room, for installing more switch boards. The station had to be shifted and rebuilt, and the question of deciding upon the exchange plan was faced. At a new colonial city like Dairen, the telephone girls are constantly changing, the average term of their services being only seven months. In addition to the difficulty to recruit the candidates, their training is made all the moıe laborious because of the necessity to teach them enough Chinese and English to deal with the Chinese and foreign subscribers.

A study of the telephone traffic conditions then prevailing at Dairen showed that, except for the need of a heavy investment at the outset, the automatic telephone, compared with the manual system, requires much lighter expenses for up-keep, while making it possible to save the pay for the telephone operators. In the long run, the automatic system was conclu ded to be more economical. Besides, the local climate, it remains generally dry, except in the rainy season of July and August This makes the use of high-pressure electric current comparatively easy. Save for the actual operation and maintenance, there were left many points awaiting investigation, but it was agreed to experiment upon the automatic system, which is to be the first to be adopted under Japanese management.



View of First and Second Selectors

Of the several systems in existence, the Strowger system, was chosen, and orders for the plant placed with were the Automatic Telephone Manufacturing Co., Liverpool, through a Shanghai firm towards the end of 1920.

The Strowger system is the latest two-wire one of horizontal covered relay type, having the ultimate capacity for 10,000 individual lines, exclusive of party lines. In the initial period, 5,080 lines are being actually installed, and 46-49 volts of the common battery system is used.

The line switch is of the rotary type, possessed of 25 bank terminals, each switchboard being equipped with the necessary connector and 100 lines. The telephone numbers are to consist of four figures uniformly.

The first level of the first selector connects with a special selector, in order to absorb the preliminary impulse, while the second level is provided against the future enlargement (five figures, instead of four, to be used in numbering the telephone apparati to be installed and the third selector will be needed).

From the third to the eighth levels have been appropriated for the subscribers to the apparati under installation at present. The ninth level is set apart for use as the outgoing trunk lines to the Shahokou branch station (equipped with the magnet-series multiple switch board with about 250 lines actually installed and 18 each of outgoing and incoming trunk lines.

The tenth level is for the trunk lines to the toll recording board.

4,600 lines belonging to individual subscribers, none of whom has a representative telephone number, 200 lines belonging to such as have representative telephone numbers and also have each a private exchange, and 280 lines serving as trunk lines to the private exchange totalling 5,080 lines, have been disposed of.

For the subscribers, each having a representative telephone number, and also such as have private exchanges of their own, rotary connectors are used. These lines, compared with the ordinary lines, generally bear heavier traffic load than ordinary lines. When each switchboard accommodates 100 lines, the maximum number of connectors to be fitted thereto will be still found inadequate, and the lines to be installed may have to be restricted in number.

By the prevailing telephone traffic situation at Dairen, each

switchboard requires 31 rotary connectors, even granting that it is fitted with only 70 lines.

In passing, the maximum number of connectors to be installed for a switchboard is 32, with 8 switches and 4 shelves.

Thus, at present, 70 lines per board are regarded as the maximum.

SPECIAL TELEPHONE NUMBERS

The special telephone numbers are as follows:

| | Spec. Tel. No. |
|---|---|
| Toll Recording Board .. | 0 |
| Shahokou Branch Station | 9 |
| Fire and Police .. .. | 19 |
| Test Desk .. .. .. | 101 |
| Information Desk .. .. | 102 |
| Complaint Desk .. .. | 103 |
| Time Service .. .. | 104 |

Remarks: The number for calling the test desk is not published. It is used in direct communications between the repairing gang and the testers concerned.

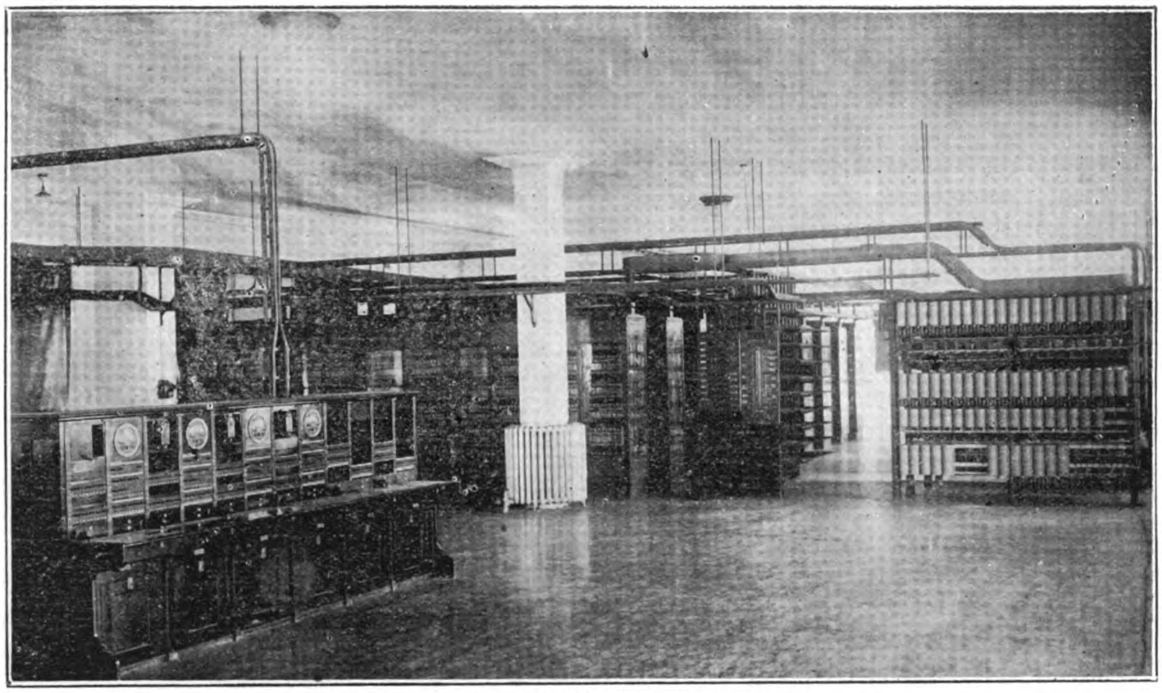
The second selectors are for the general subscribers and are to answer the requirements of the hundreds. How each level of the special second and third selectors (for the exclusive use by the central exchange people) is used as indicated in the trunking diagram (Plan 1).

The numbers of the trunk lines between the line switches and the different desks are as follows:

| | No. of Trunk Lines. | Where Installed. |
|---|---|---|
| Toll Recording Board .. .. .. | 10 | Test Desk. |
| Toll Board .. .. .. .. .. | 33 | Toll Board. |
| Dead Number Service .. .. .. | 10 | Information Desk. |
| Information Desk .. .. .. .. | 10 | ,, |
| Fire and Police .. .. .. .. | 1 | ,, |
| Complaint Desk .. .. .. .. | 5 | Complaint Desk. |
| Hospital .. .. .. .. .. | 1 | ,, |
| Inspectors' Trunks .. .. .. .. | 11 | |
| Test Distributors .. .. .. .. | 6 | Test Desk. |
| Test Trunks to Main Distributor .. .. | 4 | ,, |

As to the disposition of 34 outgoing trunk lines from the toll desk to the automatic telephone service, for each of the four groups of 1,000 lines each, having P.B.X. trunks, 6 lines are assigned, and for each of the two groups containing no P.B.X. trunks, 5 lines are allotted, making the total 34 lines, which are made to connect direct with the second selectors.

The trunks for the dead numbers are to be kept connected with all cases of withdrawal from subscription, changes of the numbers, etc., so that any one calling any of these numbers may be informed to that effect.



**General View of Automatic Telephone Exchange at Dairen**

# The Mantetsu General Hospital

GROUND has been broken for the construction of the Mantetsu General Hospital at Dairen, and building operations have started on such a scale that the completion of the immense group of buildings may reasonably be expected within two years.

The site for the proposed improvement is on a plateau of solid rock in the centre of the city of Dairen, and has every advantage that could be desired for an institution of this kind.

A fireproof building of reinforced concrete, five stories high, and containing some 1,800 *tsubos* of floor space per floor, has been designed, and many special features have been incorporated in the plans to make the service efficient for the patient and convenient for the medical staff. Five electric elevators and seven enclosed stairways will insure comfortable service to all parts of the buildings, which is divided into the customary hospital departments, and includes a large assembly hall and library.

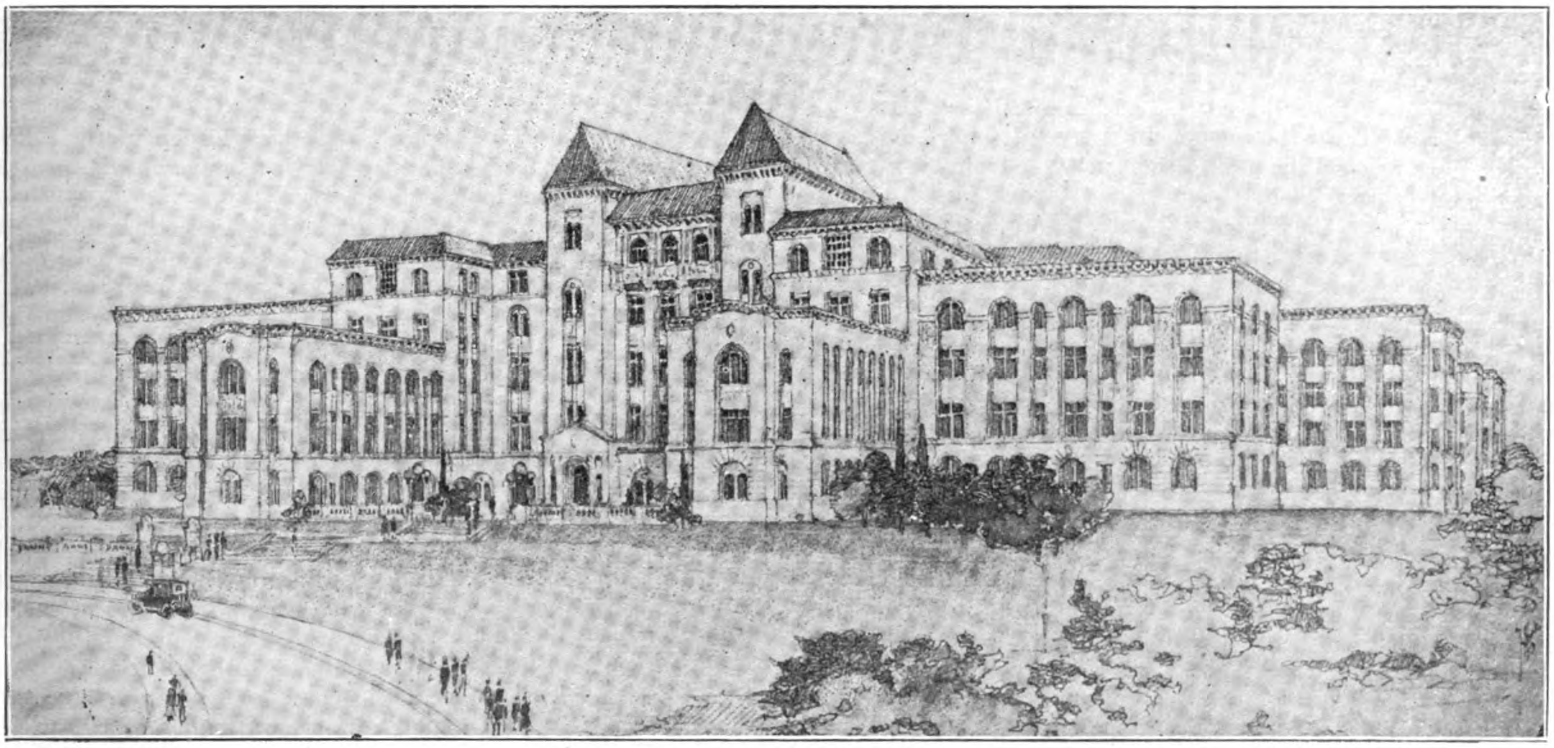
The major operating rooms are on the fifth floor, and arranged in such a manner that several operations may be had at the same time. These, in addition to special operating rooms, located in different departments and making a total of twelve in number, will render ample service for the institution now and in the future.

The building is divided into two parts consisting of suites and departments for the treatment of out-patients, as well as four separate ward units for medical and surgical patients.

Manchurian granite, tapestry brick and terra cotta will be used on the exterior, which will be imposing and of high architectural character. The partitions throughout will be of hollow tile or metal lath and plaster. Marble, tile and other high grade materials are used extensively.

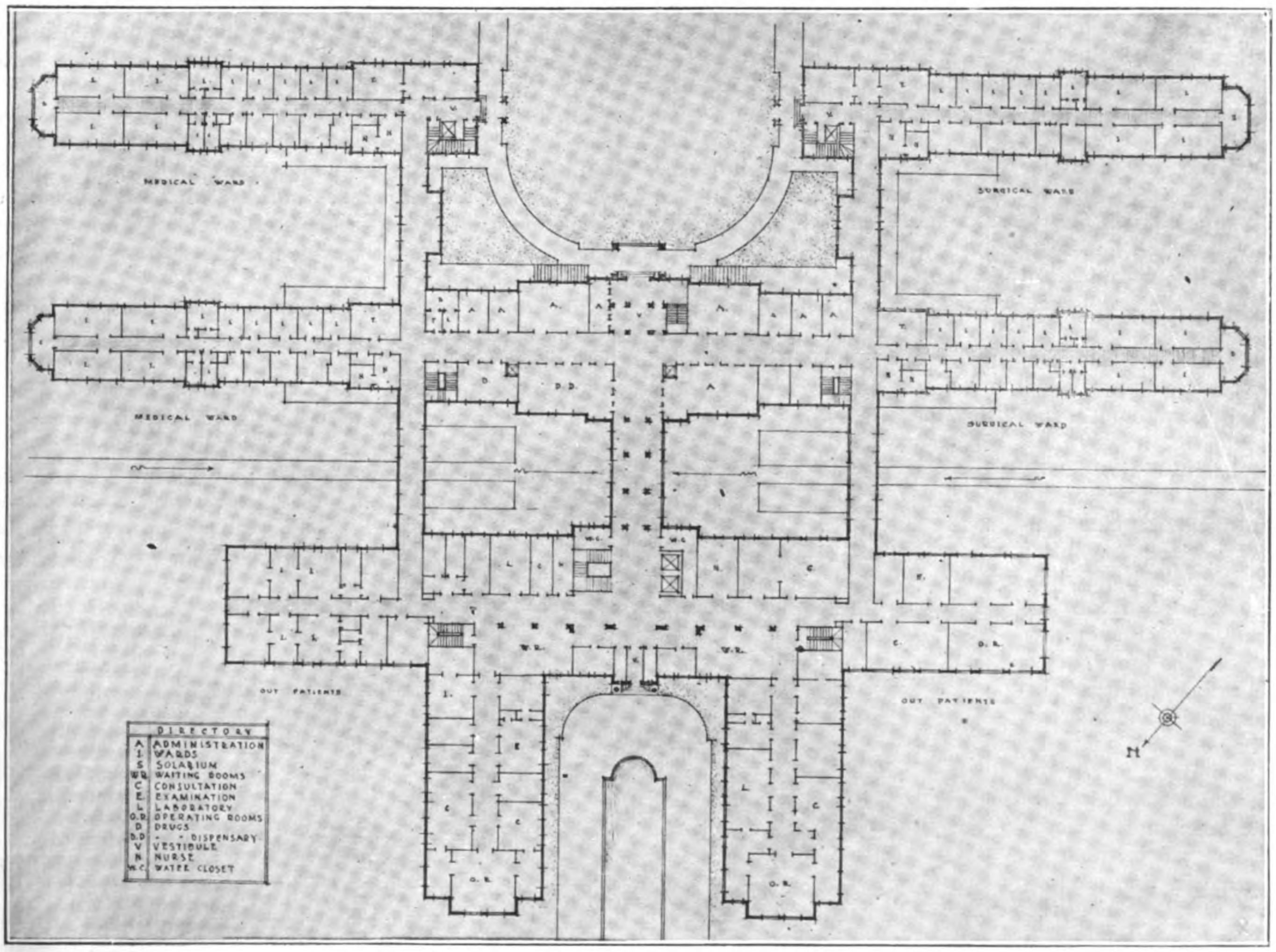
A tunnel will connect the various new buildings to those already in operation on the present site, and a new power house will be built to furnish steam for heating purposes. The heating of certain parts of the buildings will be by means of filtered and washed air conveyed by ducts, motors and fans to the various rooms, insuring a constant change of pure and tempered air irrespective of the season or temperature outside. A large solarium and roof garden is provided on the roof and arranged for use in summer as well as in winter.

The buildings are being erected under the supervision of the George A. Fuller Co. of the Orient, Ltd. for the South Manchuria Railway Company, and when completed, together with the present buildings and those contemplated in the future, will give Manchuria a plant the like of which does not at present exist in the Far East.



**MANTETSU GENERAL HOSPITAL, DAIREN**

**Under Erection by the Geo. A. Fuller Co. of the Orient, Ltd.**



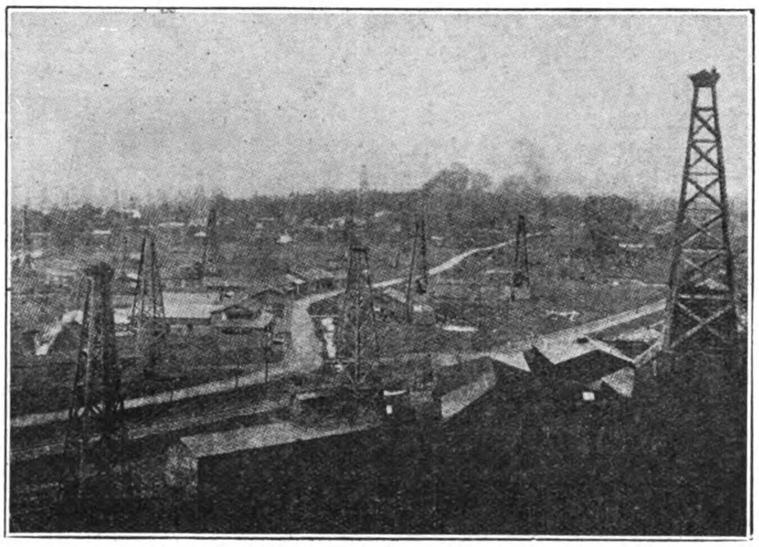

**Ground Floor Plan : Mantetsu General Hospital, Dairen.**

# Japan's Petroleum Industry

THAT the petroleum industry of Japan has about reached the utmost limit of its producing power is foreshadowed by the merger of Japan's largest oil enterprise, the Nihon Sekiyu K. K. (Japan Petroleum Co., Ltd.), with the Hoden Seikyu K. K. The business results shown by the combination, however, have been most unsatisfactory to the shareholders. Dividends have decreased from 42 per cent. in September, 1921, to 15 per cent. in September, 1922, although out of profits there has been a considerable reduction of fixed capital accounts effected.

Decreased profits have been caused by the sharp fall in the market prices of oil during the past year. Comparing prices at the end of September with those in January, there is a decrease of 30 per cent. Compared with the high prices during the war, there is a decrease of more than one-half. Owing to the declining prices this company began to restrict production, thus adding to the loss of profits.

The cause of the fall in market prices is largely to be found in the great accumulation of oil stocks in the United States directly influenced by the decreased demand from Europe, and increased production at the American wells. At one time the stock of petroleum on hand in the United States was more than 250,000,000 barrels. Eventually there was a sharp decline in quotations in the United States and this affected the Japanese market. At the same time the cheap American petroleum was making its way into the Japanese domestic market, materially influenced by the fall in freight rates across the Pacific. Due to a very active manufacture of light oils from the cheap imported crudes, the supply of this grade of oil rapidly swamped the market, and as a matter of course, market prices went lower and lower, and very sharply at that. Oil for lighting was also adversely affected, and all in all, the Japanese petroleum industry has been having a hard time of it.



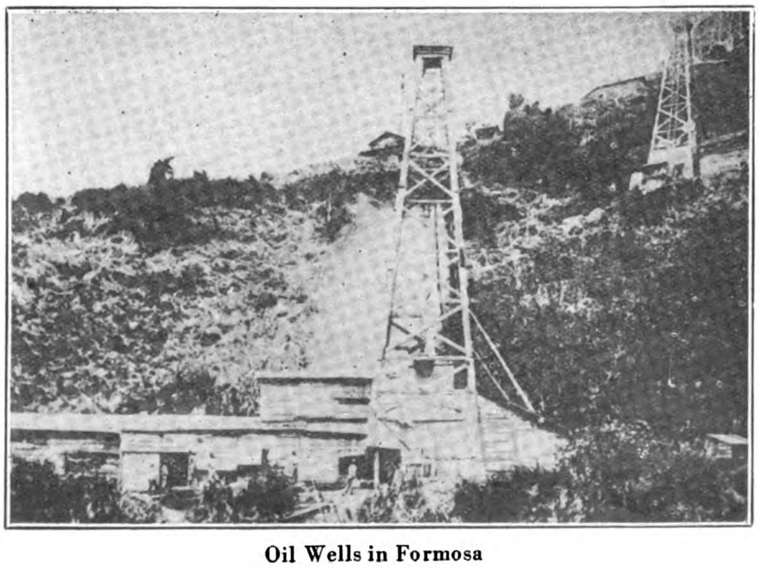
**Nagaoka Oil Fields: Hoden Oil Company**

When the Nihon Sekiyu K. K. was formed in 1921, one of the purposes of the merger was to unify the drilling operations of the two merging companies, and to regulate and unify production in the different refineries. At the same time great stress was placed on the importance of continuing exploitation of the oil fields owned in 25 different localities in Japan, and in Formosa. Despite this intention, one of the most noticeable items in the term statement of account is one which shows a gradual decline in the production of crude oil. Since the merger two new wells have been opened, one in Formosa, and the other in Akita prefecture. But the addition of their flow to the general production has not helped to stave off the general tendency to a decline in production.

If this decline in production continues, the condition of Japanese oil refiners will be more and more adversely affected by the importation of cheap foreign crude oil for refining in Japan. This possibility has evidently alarmed the directors of this company, for one of its most recently announced plans, is for the construction of a huge oil tank depôt near Yokohama, which could only have for its purpose, the storage of imported crude oils. From this it is certain that this great combine which was intended to develop the domestic petroleum resources, has found it essential in order to ensure its continued prosperity to turn its attention to the refining of imported oils for sale on the domestic market. If the present rate of increase in production of crude oil in the United States, especially in California, continues uninterrupted, the effect on the Japanese oil market can only be seriously adverse.

When crude oil in the United States began to decline in price, several companies were at once organized in Japan to import American crudes for refining. Since the price of refined oils has fallen so low in Japan, these companies have been also coming in for their share of unhappiness, as most of them are unable to refine at costs under the prevailing market prices. Should crude oil abroad continue to fall in price, it is doubtful, even, if it will be at all profitable for Japanese refiners to continue in business; imports of refined oil can be sold at prices below their costs of production.

Japan has had a bitter experience in the petroleum business in past years. At the close of the Russo-Japanese war, Mr. Soichiro Asano, who has since become one of the leading business men of the country, entered into contracts with three American oil companies to purchase crude oils for refining in Japan. Mr. Asano organized the Tozai Oil Co., Ltd., to refine these imports, and the construction of oil tanks and refineries had been completed, when these three companies were absorbed by the Standard Oil Company, with the result that the contracts were abandoned. Even if Japanese refiners could make satisfactory contracts with American producers to-day, is there any assurance that there will not be a recurrence of the former experience ?



**Oil Wells in Formosa**

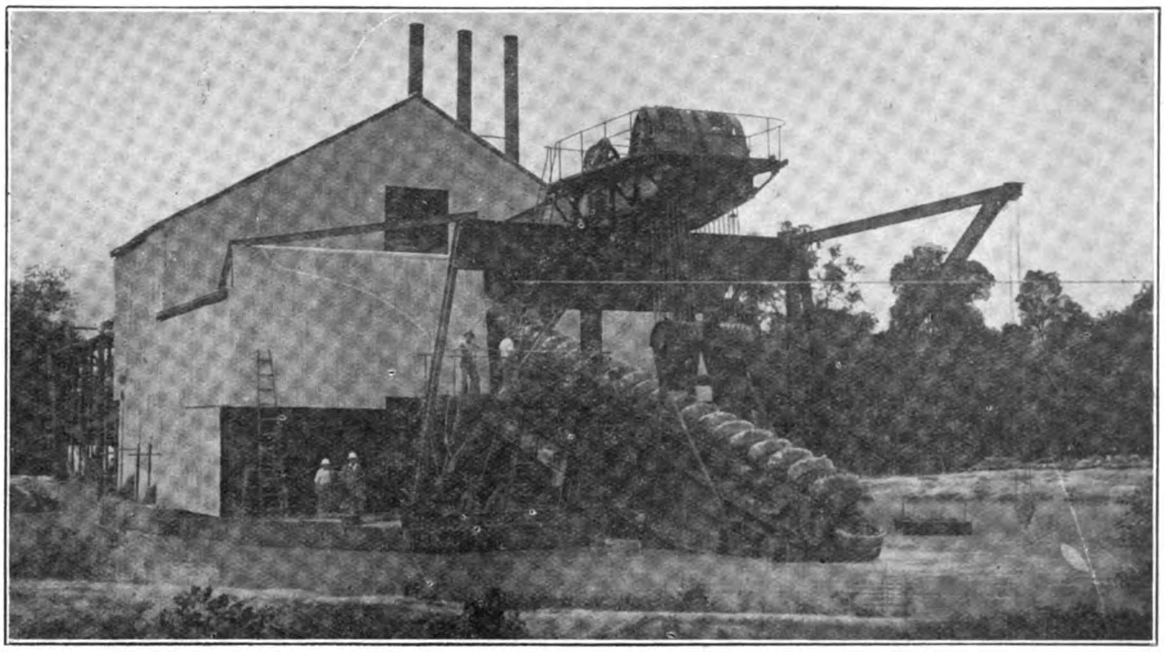
The general impression in Japan to-day is that there is little hope of a prosperous future for the domestic oil refiners.

# World's Biggest Tin Dredge

## At Work in Malaya

*By R. N. Goodwin*

A GIGANTIC tin bucket dredge built in Australia, regarded as the largest, most powerful and most up to-date of its kind in the world, was placed in operation on January 30 last. It belongs to the South Taiping Tin Dredging Co. (1922), Ltd., whose registered head offices are at Penang and it has been erected on the company's property near the town of Taiping in the state of Perak, F. M. S., costing approximately £95,000 to build in Australia, the total amount expended in transport, erection, etc., brought the total sum spent to instal it in working order on the mine, to about $1,000,000. The dredge was christened the "Arthur H. Miles," after the consulting engineer, by his wife in the presence of a laige concourse, which included representatives of the mining munity drawn from all parts of Malaya. An inspection of the dredge when its machinery was set in motion gave a sense of tremendous power, great solidity and enormous capacity. The spacious deck with the cantiliver rising 40-ft. above, the long ladder, endless chain of huge buckets and the big projecting chutes all contributed to create the impression of a terrific concentration of mechanical energy. After the working of the dredge had been explained, the visitors proceeded to the new club, Taiping, where they were the guests at tiffin of Mr. Syd. D. Miles, the general manager, who has furnished the following detailed technical description of the dredge :—

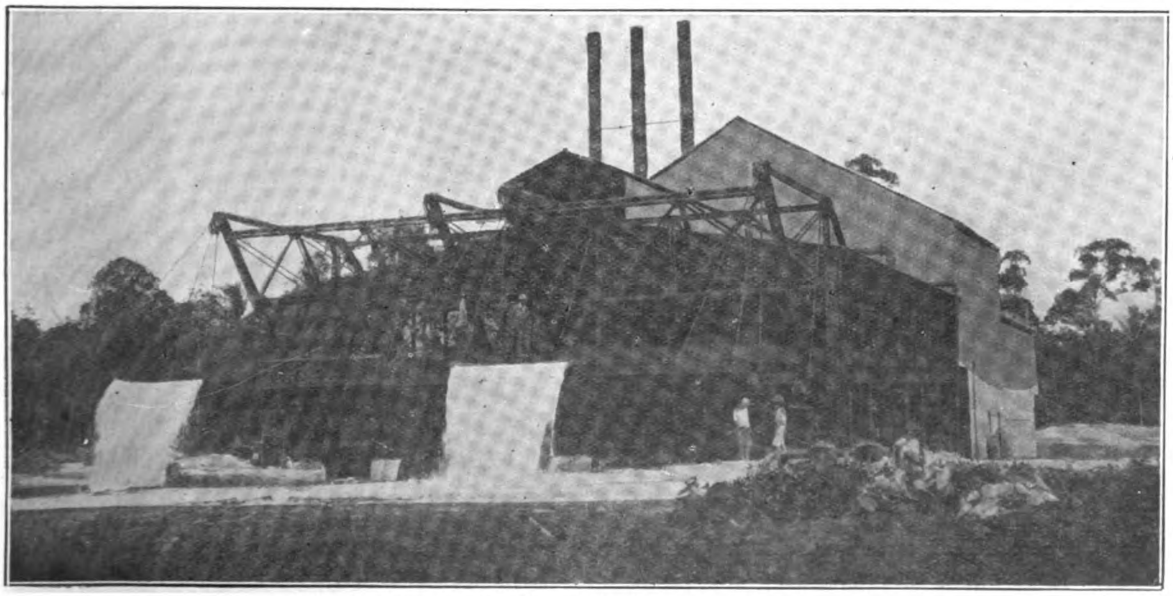


Bow or Bucket End of the South Taiping Tin Dredging Company (1922), Ltd.'s New Dredge.

The dredge—built in Australia by Messrs. Chas Ruwolt Propty Ltd., Melbourne—is the close connected bucket band type designed to dig and treat, what in Malaya is considered abnormal yardage. The hull is of steel 150-ft. long, 58-ft. 7-in. beam and 10-ft. 1-in. deep in the well. The ladder is 96-ft. long, 6-ft. 5-in. wide with a depth of 6-ft. 7-in. in the middle. It weighs, when fitted with ladder rollers, chafing beam rollers, etc., about 60 tons. The bottom end of the ladder is fitted with a round tumbler weighing 9½ tons, the wearing ends of the tumbler shaft are protected and run in grease. The top tumbler is hexagonal and is lined with manganese wearing strips.

The buckets 9 cubic feet capacity are cast steel with manganese steel lip and wearing strips connected with one manganese steel pin, 4-in. diameter at each end. There are 82 buckets in the band, weighing 90 tons. The total weight of the ladder rollers, bottom tumbler, buckets, bushes and pins amounts to 165 tons.

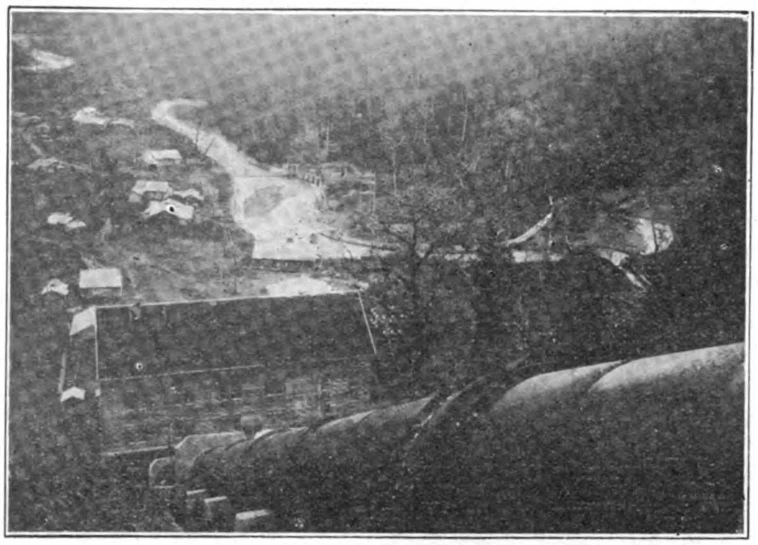
The buckets feed into a suspended drop chute and from there all the *karang* and overburden passes into a revolving screen 48-ft. long and 6-ft. 8-in. in diameter. There are six tin saving tables or "boxes" on each side of the screen with a total area of 4,032 square feet. In addition to these there are three auxiliary boxes on the deck underneath and a "Saveall" box, making a total concentrating area of 5,044 square feet. At the end of the boxes on each side is a chute projecting 20-ft., which in addition to facilitating stacking of tailings is a considerable help in saving tin during the clean up.



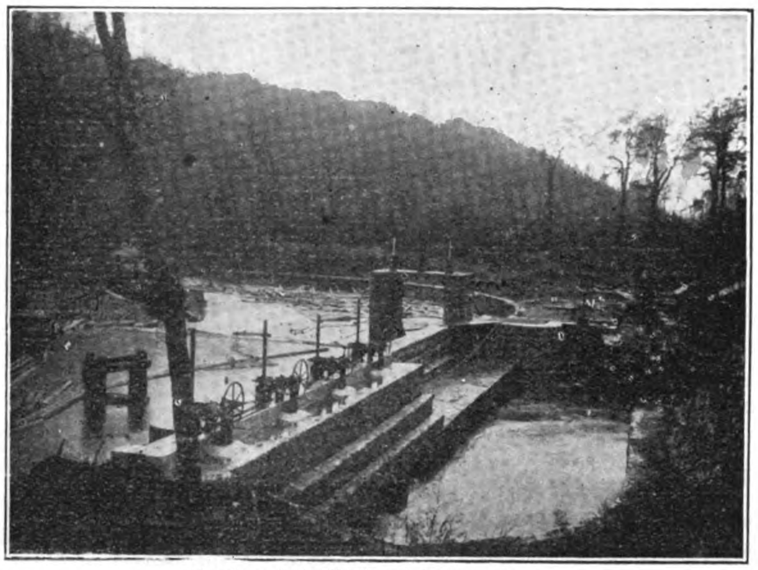
Stern View of the New Dredge for the South Taiping Tin Dredging Co. (1922), Ltd.

Steam is provided by three internally fired dry back marine type boilers, built by Messrs. Chas. Ruwolt which are fitted with super-heaters. The total heating surface of boilers and super-heaters amounts to 2,984 square feet. The buckets and screen are driven by a 35 h.p.

(*Continued on page 245*).



The Hobetsu Power Plant of the Hokkaido Electric Light Company; 3,500 K.V.A.; 4,000 h.p.; 232,5 feet head



Intake of the Hobetsu Power Plant

# A Hydro-Electric Plant in Hokkaido

## A Hidachi Installation

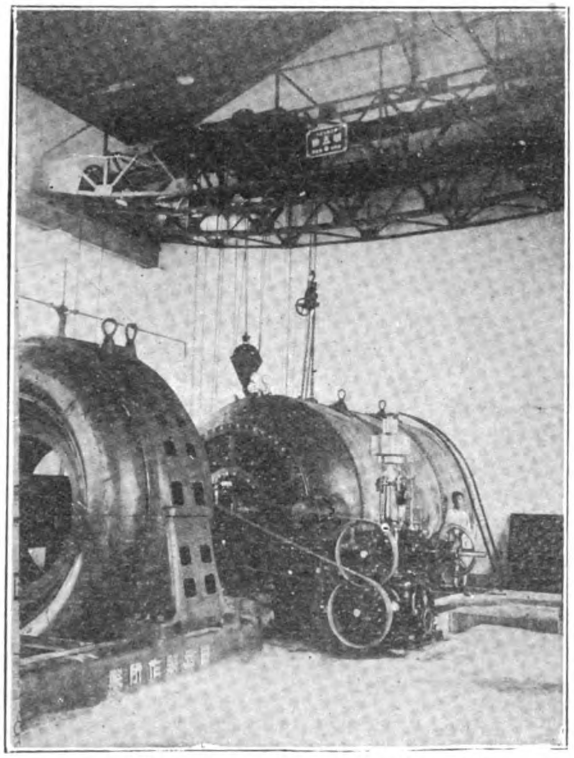
IN the general competition for the equipment of new electrical plants in Japan, the Japanese manufacturers of electrical machinery are making a keen bid for the business and constantly increasing their lead. In our last number we mentioned some of the recent installations of the Hidachi Engineering Works and are now able to give the details of one of their typical smaller hydro-electric plants erected for the Hokkaido Electric Light Co., Ltd.

This company operates steam, gas and hydro-electric plants and supplies light and power to various districts in the Teshio, Kitami, Tokachi and Kushiro provinces. It is capitalized at Y.21,635,000, half paid up. Its last dividends were 12 per cent. The steam plants generate 375 k.w., gas, 529 k.w., and water, 15,870, k.w. Their latest installation, called the Tetsubetsu power plant, is located at Hobetsu in Kushiro province taking its power from the Hobetsu River. This plant was designed to transmit power to the Hobetsu station of the same company, which steps—up the voltage to 55,000 volts. The Hidachi Engineering Works secured the contract for the complete equipment of this plant with a total capacity of 2,200 kilowatts, of which, 1,900 is for general power supply and 300 for special purposes.

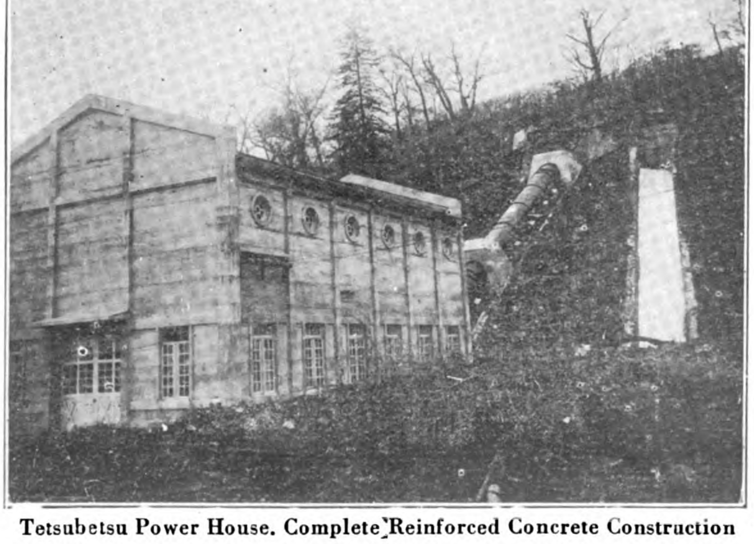
The licensed head of water on the river at this point is 400 cubic feet, each turbine requiring this maximum head. The difference in level between the intake and the water gate is 100 feet with an effective head of 84-ft. The dam itself, of stone and reinforced concrete, is 70-ft. long by 8-ft. high with a top width of 4½-ft. and bottom of 20-ft. At the right side of the dam is an emergency water gate to permit sand and rubbish to be washed away as required. The water gates are constructed in a series of four 8-ft. in width and with side walls 3½-ft. high, corresponding with the depth of the water in front of the gate. The flowing in at the No. 1 intake is directed to the first settling pool equipped with two gates at the left and bottom in order to return to the river the sand and sediment. From this pool the water flows through a tunnel and over a bank 45-ft. wide falling into the second settling tank or pool, four feet lower than the tunnel level. The tunnel from the first pool is built of concrete, horse-shoe shape, 6,996-ft. in length, height 9.75-ft., width 9.5-ft. and 8-ft. at the bottom, with a gradient of 1/1200. The depth of water will be eight feet. The second, third and fourth settling tanks, installed in series, are also equipped with gates to permit the discharge of sediment and sand into the river.

The main water tank is 65-ft. long by 16 to 25-ft. wide in which the water is maintained at a level of 11 to 15-ft. It is equipped with a nine feet diameter iron discharge pipe with a valve to regulate the flow. For 42-ft. from the exit of this pipe there is an overflow bank with a water gate for turning out sediment, and for sudden emergencies to divert the whole head of water into the river again. The

(Continued on page 271)



Generating Room of the Tetsubetsu Power Plant of the Hokkaiko Electric Light Company. "Hidachi" water turbine, 3,320 h.p. head 85 feet, 375 r.p.m. and 2,750 K.V.A. Generator, 6,770 volts



Tetsubetsu Power House. Complete Reinforced Concrete Construction

# Tientsin-Pukow Trains de Luxe

THE Tientsin-Pukow Railway have recently replaced their old wood express trains, operating between Pukow and Peking, with five modern de luxe new semi-steel trains which were supplied by the Pressed Steel Car Co. of New York. Each train consists of one each baggage car, postal car, dining car and drawing room car and two each first-, second- and third-class coupé sleeping cars. Three new semi-steel private cars, supplied by the same builders will shortly be placed in service for operation with the new trains.

These cars of American manufacture represent the last word in modern car construction, and afford the latest facilities for the comfort and safety of the traveling public. They not only excel the best trains in Asia, but will compare favorably with any in Europe or America. The order is the largest and most important for high-class export passenger equipment and was the result of an invitation extended several years ago by the Tientsin-Pukow Railway authorities to several leading car builders to submit designs and send an engineer to China with samples, etc., to recommend, discuss and settle details with them for first-class passenger car service.

The Pressed Steel Car Co. opened an office in China during 1919, under the general management of Mr. H. R. Cooper, with a qualified engineering staff to cope with any problems pertaining to either freight or pasenger trains, and in due time their chief engineers, after many conferences with the various department heads of the railway, worked out preliminary plans and specifications to meet not only the requirements of the railway company, but also conforming to the principal dimensions and fundamental features as decided upon by the commission on railway technics, consisting of a number of foreign railway advisers working under the jurisdiction of the ministry of communications for the purpose of working out standards for the railways of China, after conferences with the mechanical heads of all the railways of China. It might be mentioned that Mr. Shu Shih-chang, former managing director, in line with the other progressive improvements that he had under way on the Tientsin-Pukow Railway, at the time, made it clear that he wanted trains the superior of any in Asia, and the results are due to his initiative.

The proposition of settling details and insuring that the trains came up to the expectation was placed in the hands of Mr. Tsai Kuo-tsao, former chief locomotive and works superintendent, one of the most capable, energetic and conscientious Chinese that has occupied an important motive department position on the Chinese railway. The various features and details were developed after numerous conferences between Mr. J. Alston, Mr. Tsai Kuo-tsao and Mr. W. M. Peach, chief engineer, Far Eastern district, for the Pressed Steel Car Co., as well as interviews with the heads of the traffic and dining car departments. The final decisions, approval and selections of samples were made by Mr. Tsai, through whose efforts and judgment the arrangement, design and appearance of the trains are as the traveling public find them.

Due to the time required in settling the various details, discussions at various standardization conferences and the rapid deterioration of the old equipment, the contract was placed promptly with the only company having a qualified engineer on the ground to communicate to the works the voluminous details that had been discussed. The order was placed through William Forbes & Co., Tientsin, late in July, 1921 and the first twenty-five cars delivered at Pukow during August the following year and delivery completed in October.

The cars were built at Pittsburgh and Wilmington. The cars were erected at the builder's works under the inspection of the well-known British firm of engineers and inspectors, C. P. Sandberg & Co. The cars were lettered, ornamented, painted and varnished, after which they were dissected and shipped in sections; the underframes being shipped in three pieces; each side in four sections with windows, curtains and glass assembled; each body end with door assembled was shipped complete, likewise the vestibule ends. The interior partitions were also shipped assembled with glass, etc., in position.

On arrival in China, the sections and parts were assembled at the Tientsin-Pukow shops at Puchen under the direction of Mr. John Alston, locomotive and works superintendent of the line. The erection was started September 1, 1922, and the trains were ready for service about the middle of January, a record for this volume and type of equipment.

The cars conform to the following principal dimensions :—

| | |
|---|---|
| *Sleeping Cars and Drawing Room Cars.* | |
| Length over body | 65′ 7¾″ |
| Distance between bogie centres | 51′ 10″ |
| Length overall coupled in train | 74′ 1″ |
| *Baggage Cars and Postal Cars.* | |
| Length over body | 65′ 7¾″ |
| Distance between bogie centres | 49′ 2½″ |
| Length over all coupled in trains | 67′ 2½″ |
| *Dining Cars.* | |
| Length over body | 72′ 6¼″ |
| Distance between bogie centres | 54′ 5½″ |
| Length over all coupled in train | 75′ 5″ |
| *Private Cars.* | |
| Length over body | 67′ 7¼″ |
| Distance between bogie centres | 53′ 9½″ |
| Length over all coupled in train | 77′ 3¾″ |
| *All Cars.* | |
| Width over side sheathing | 10′ 0″ |
| Width over eaves | 10′ 1¾″ |
| Top of rail to top of roof | 14′ 2″ |
| Wheel base of bogie | 8′ 0″ |
| Journals | 5½″ × 10″ |

The general design for all the cars is the same, as follows :

## Under Frame

The underframe is of the through four sill type. The centre sills are 12-in. eye beams, 31½-lbs. spaced 16-in apart. The side sills are 10-in. ship channels 28-lbs. The body end sills consist of 5/16-in. web plates with a continuous 18-in. by 5/16-in. top anti-telescoping plate. The platform end sills are of cast steel.

The body bolsters or transoms are the two member forged truss type, each member consisting of a 10-in. by ¾-in. top and a 10-in. by ⅞-in. bottom tie. There are four cross ties or needle beams to each car consisting of a 13-in. by ⅜-in. top tie plate and a 7-in. channel 9¾-lbs. bottom member with two 5/16-in. web plates. The intermediate cross ties or floor supports are 5-in. channels 6½-lbs.

The baggage cars and postal cars are trussed with four and the other cars with two 2-in. truss rods, which were introduced to allow of maximum amount of assembly including painting and varnishing before shipment, and thus reducing the work at destination to a minimum.

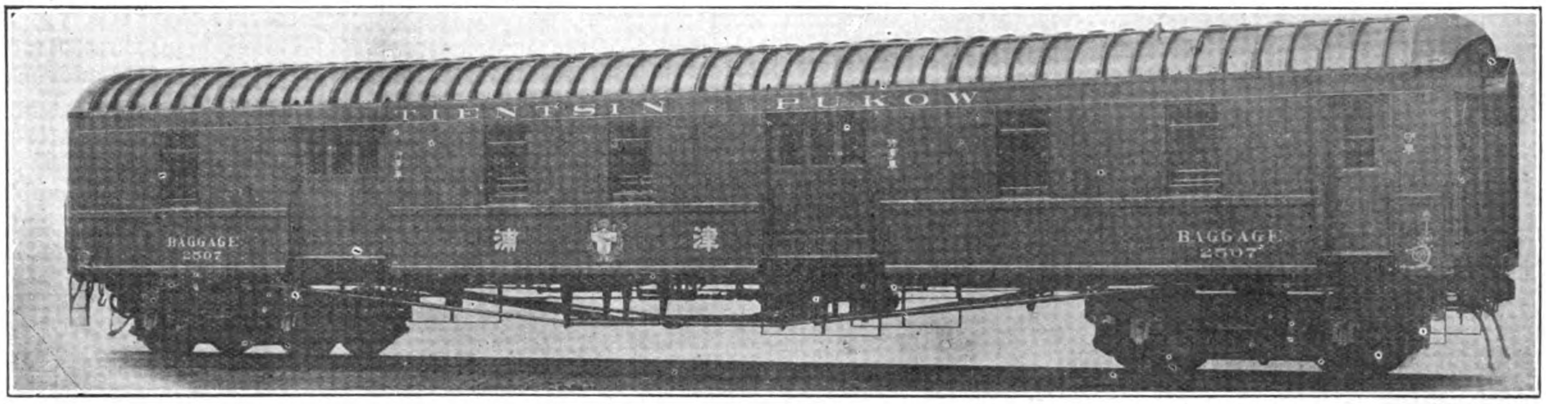
## Body Construction

The vertical members of the side frame are 3-in. by 2-in. by ¼-in. angles extending from side sill to side plate, the spacing being arranged to suit the window and door openings for the

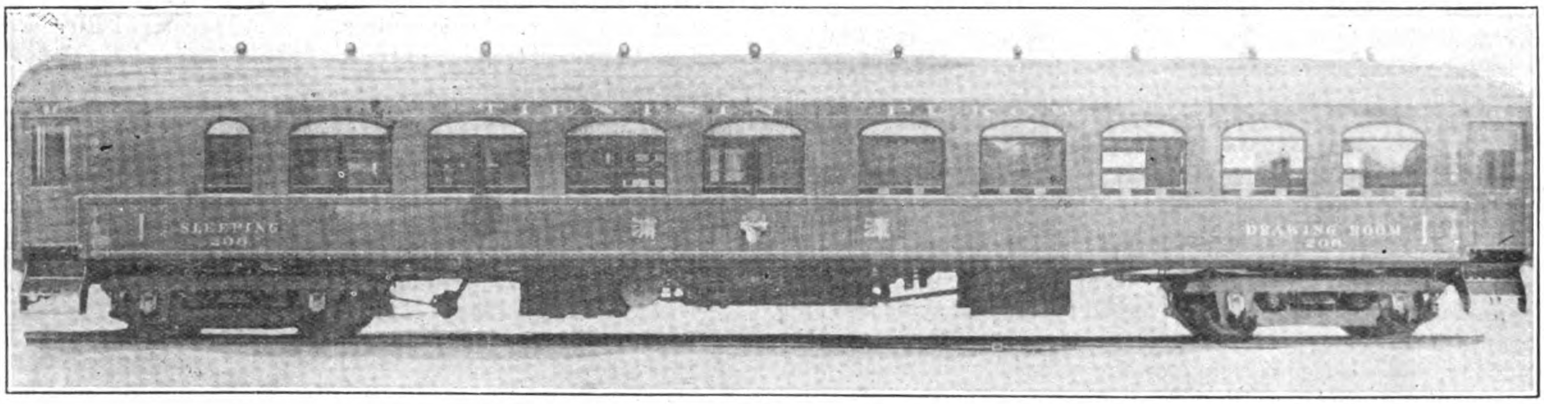
## THE CARS FOR THE FIVE TRAINS DE LUXE FOR

**Supplied by the Pressed Steel Car Company with**

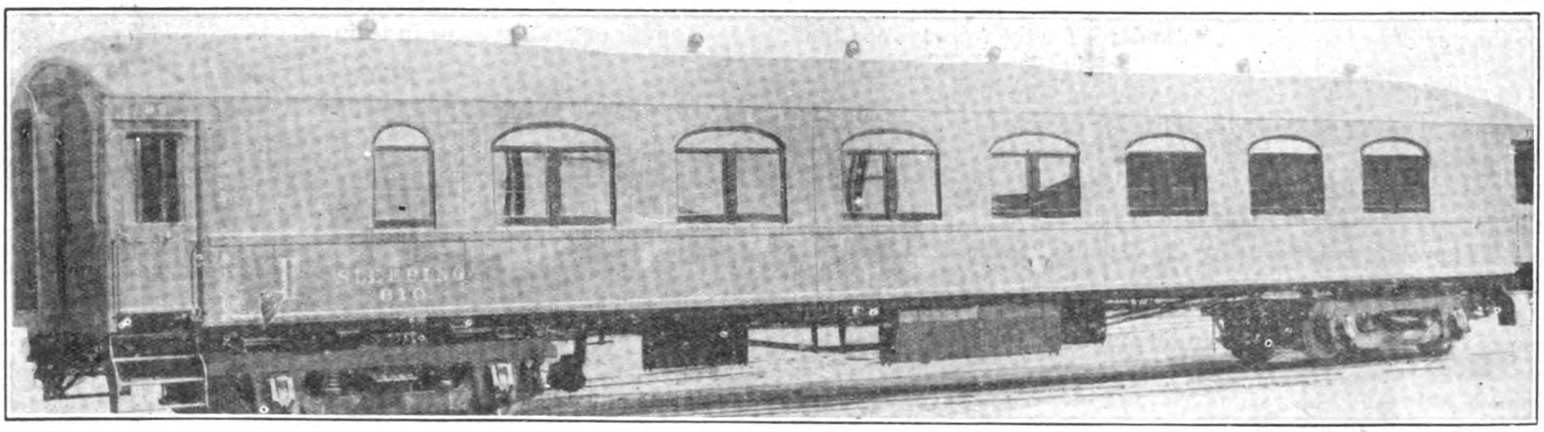
***Erected at the Puchen Shops of the Tientsin-Pukow Railway Under the***



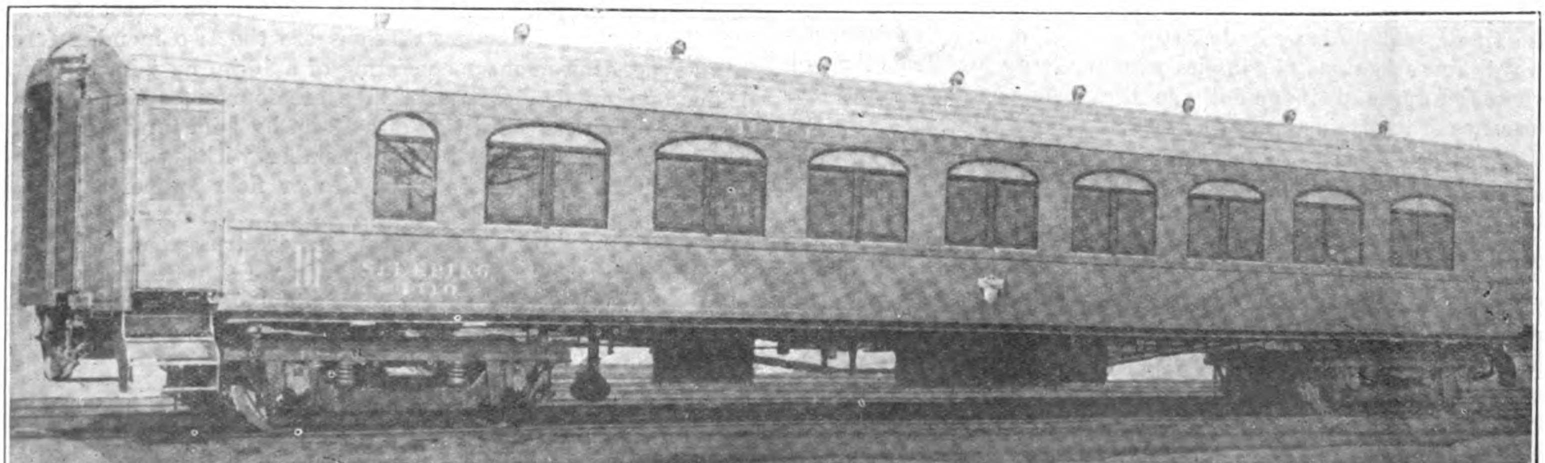

**Baggage Car**




**1st Class Compartment Sleeping and Drawing Room Car**



**Second Class Sleeping Car**

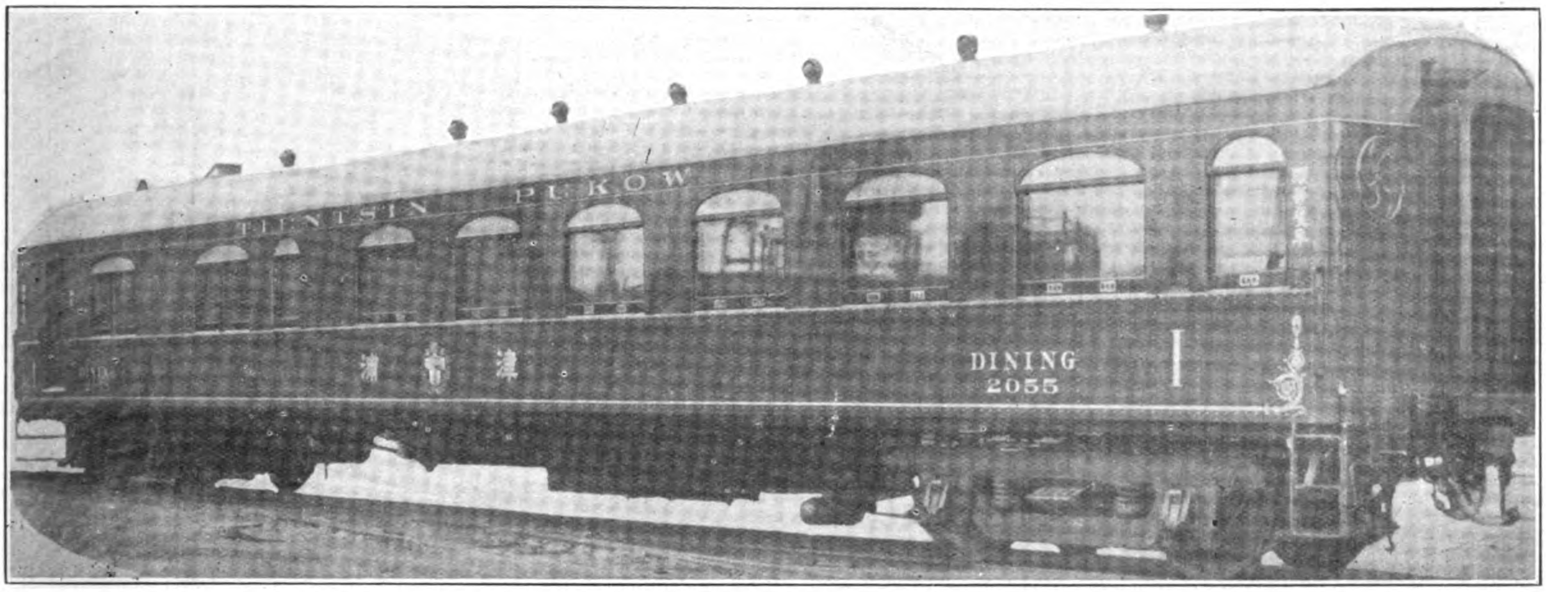


**Third Class Sleeping Car**

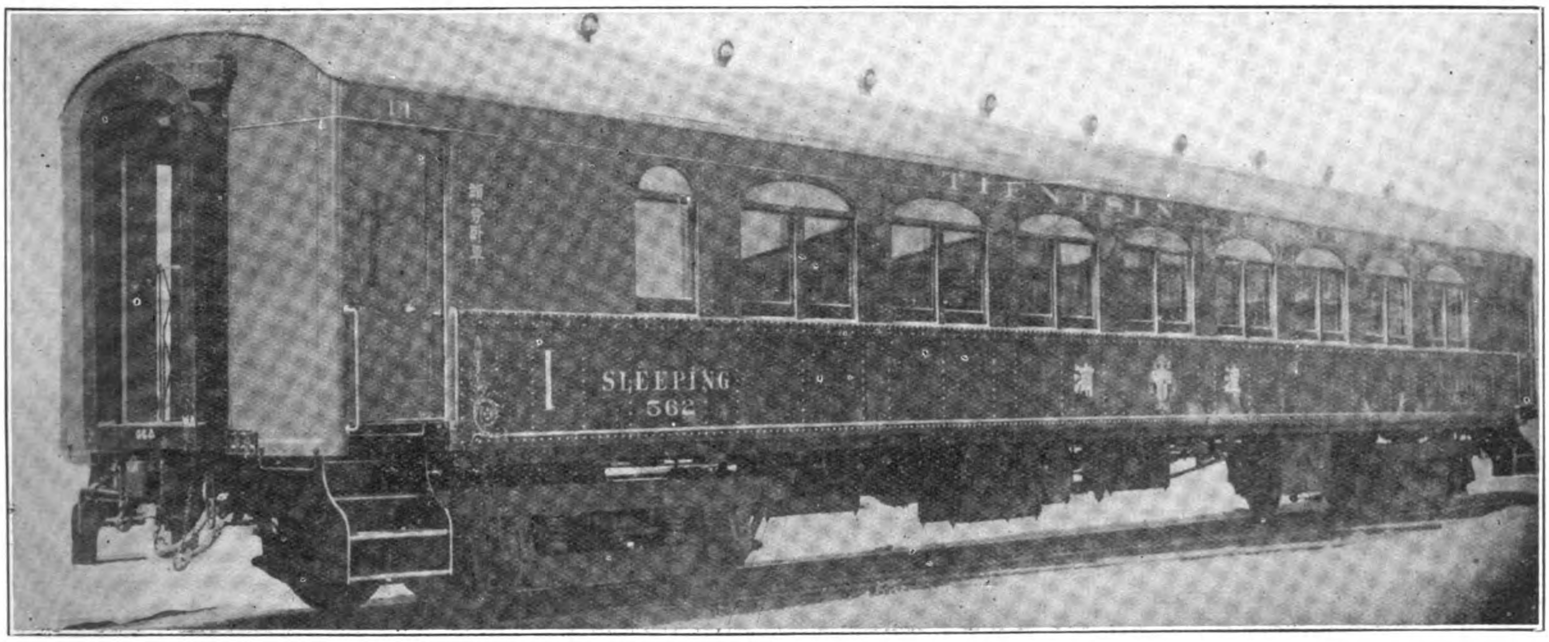
# SERVICE ON THE TIENTSIN-PUKOW RAILWAY

**Materials Supplied by the United States Steel Corporation**

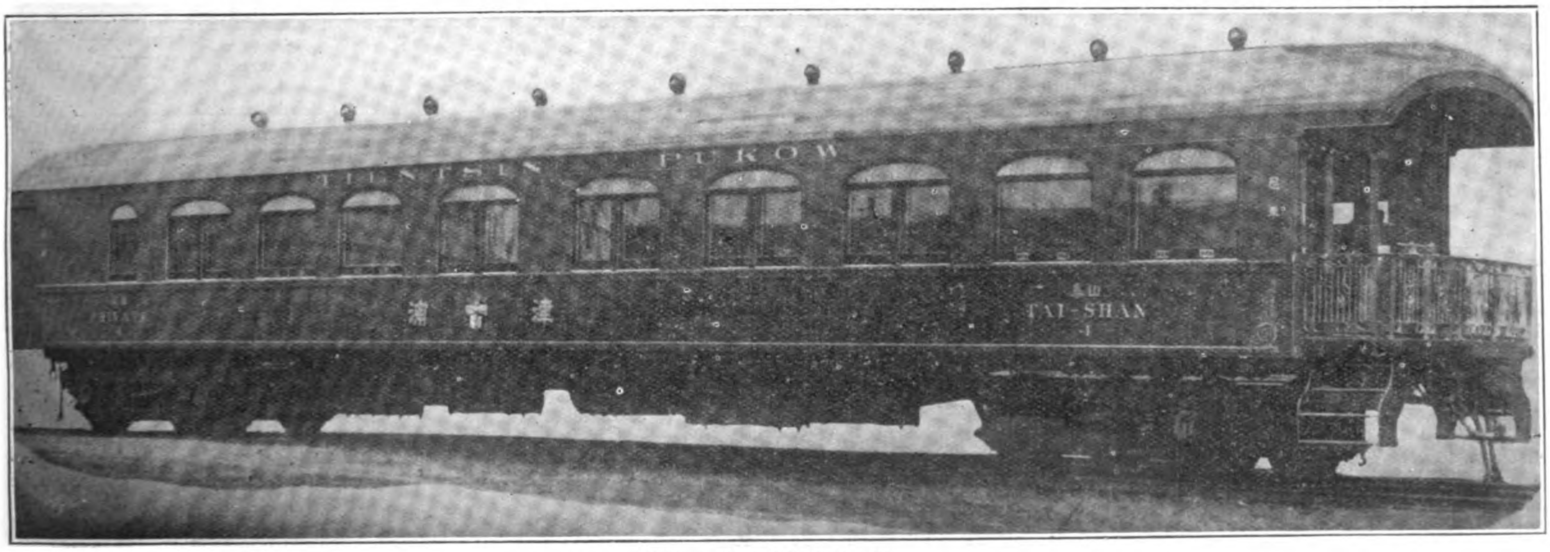
***Direction of John W. Alston, Locomotive and Works Superintendent***



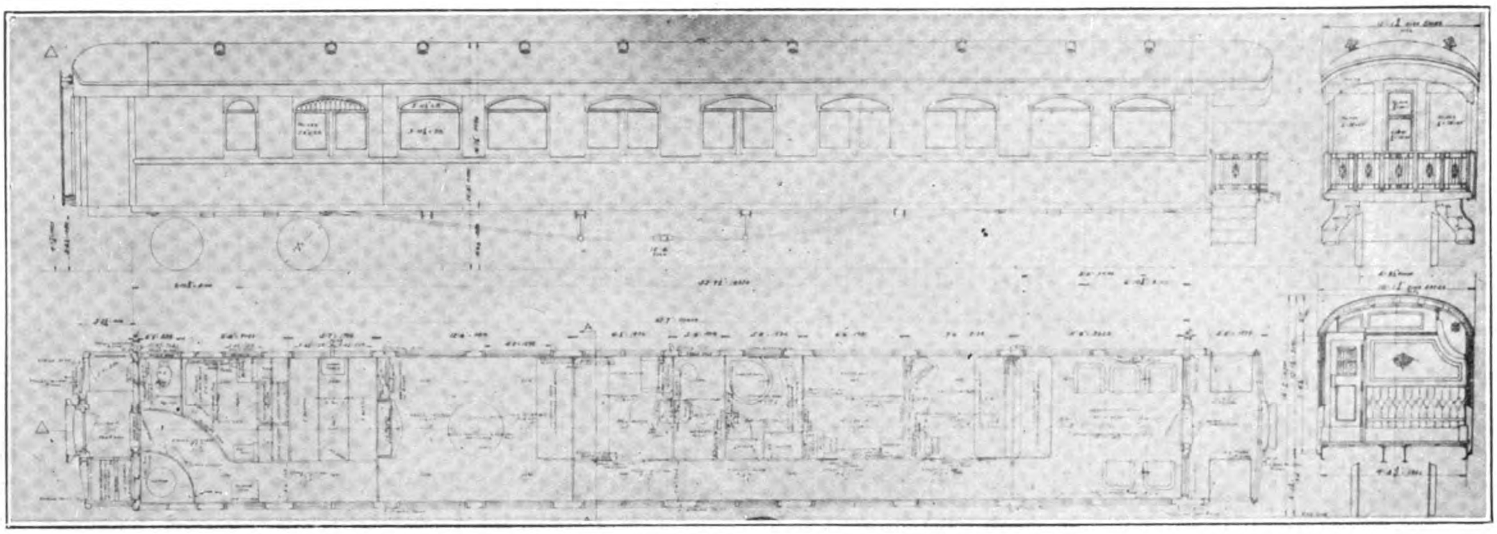

Dining Car



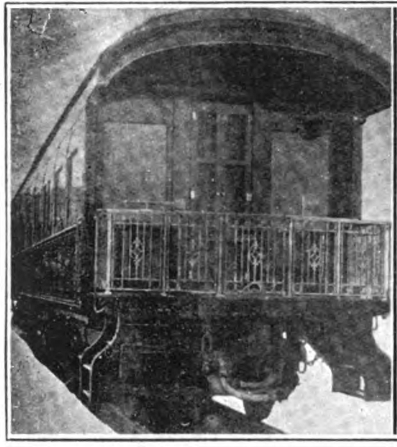

1st Class Sleeping Car




Private Car "Tai-Shan"

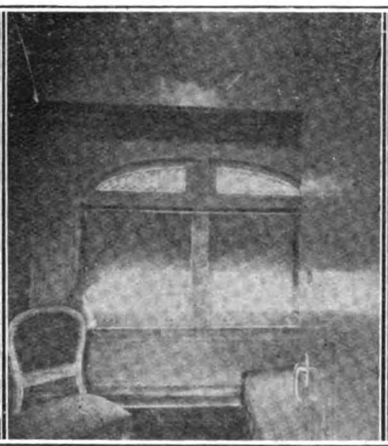


Private Car "Tai-Shan". General Floor Plan

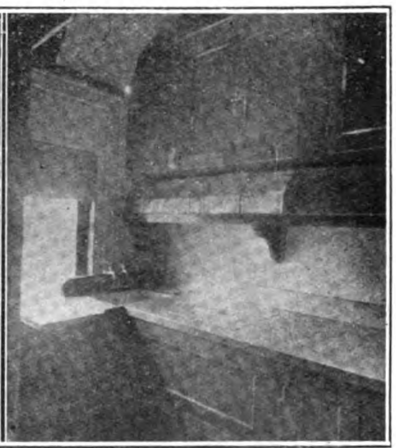


Observation Platform

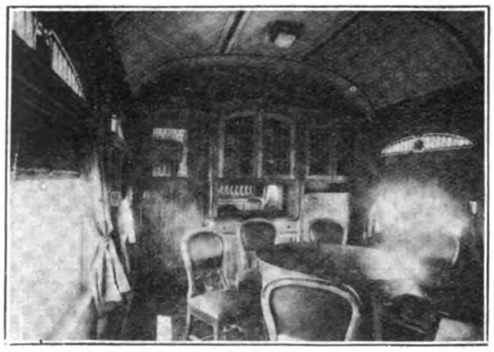
Bed Room



Bed Room

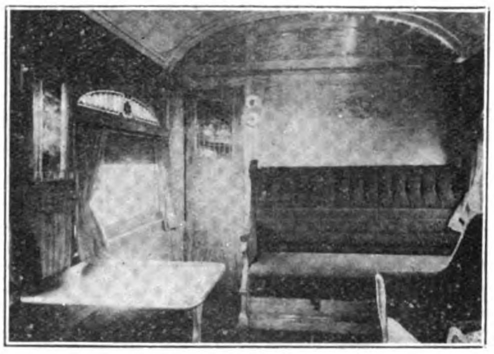


Pantry



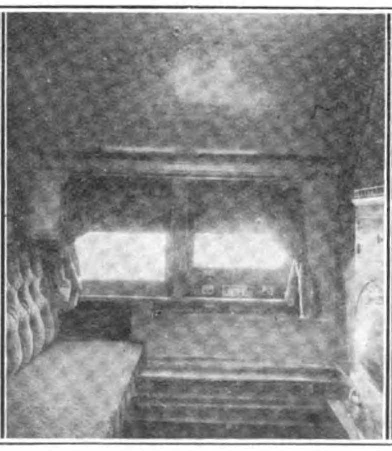
Dining Room

Observation Room



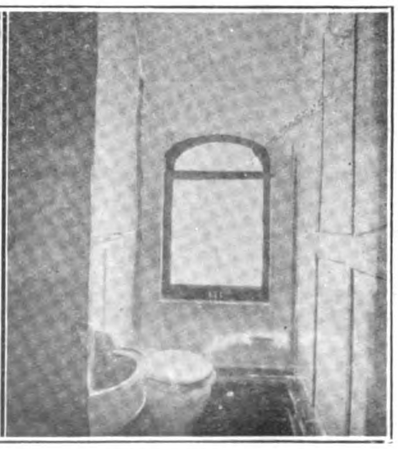
Bed Room

Corridor

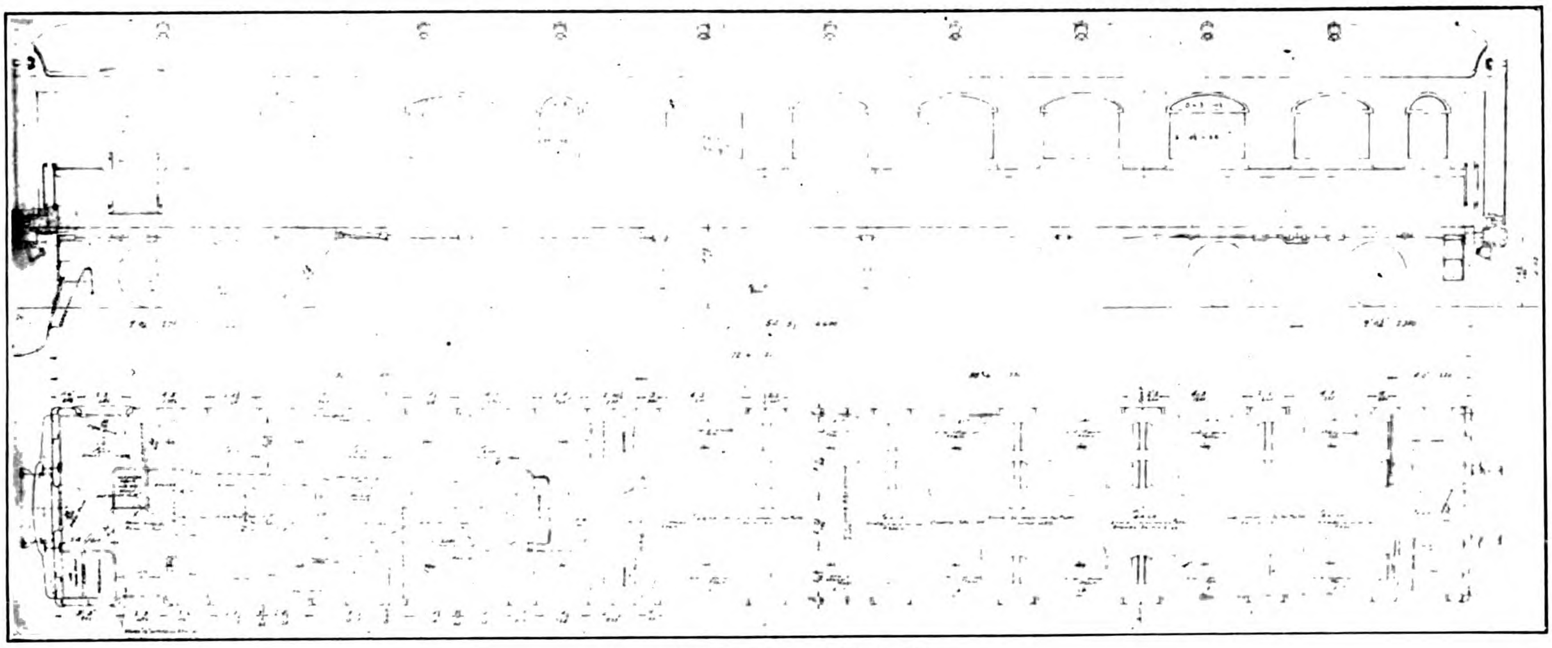


Bed Room

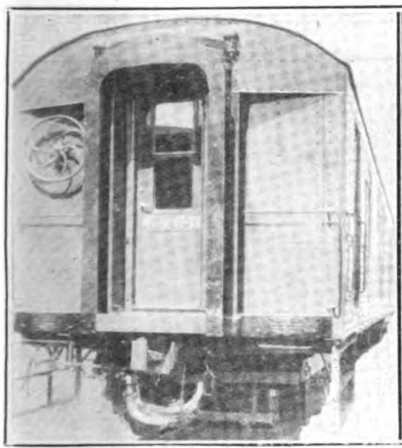
Shower Bath



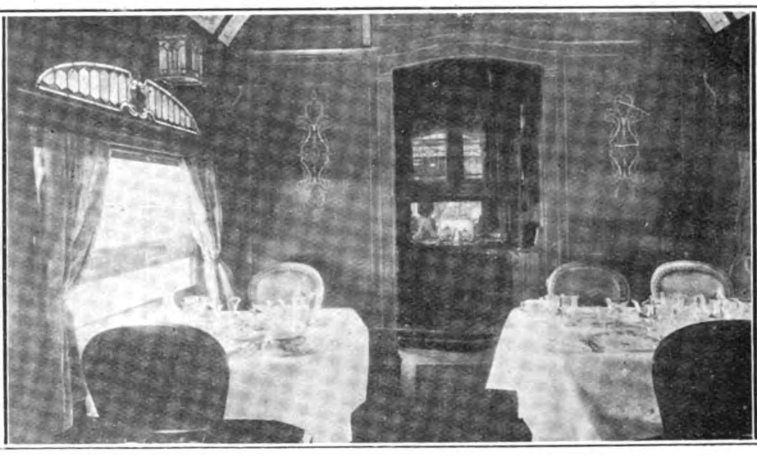
Toilet and Lavatory



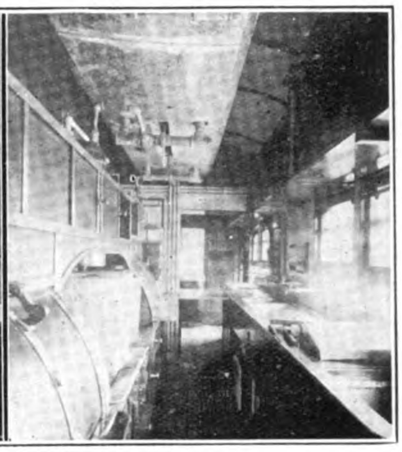
General Floor Plan of Dining Car



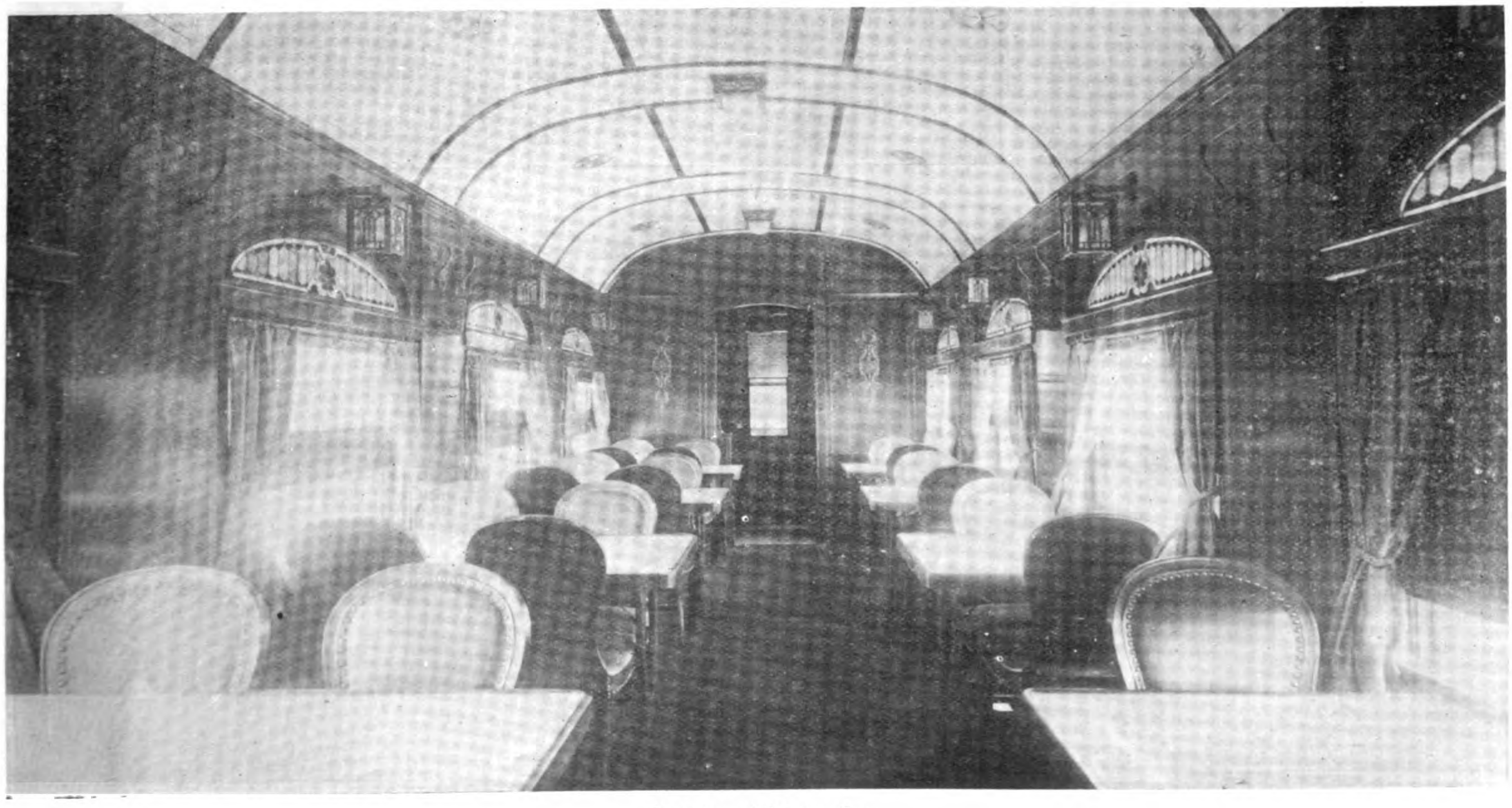
End View



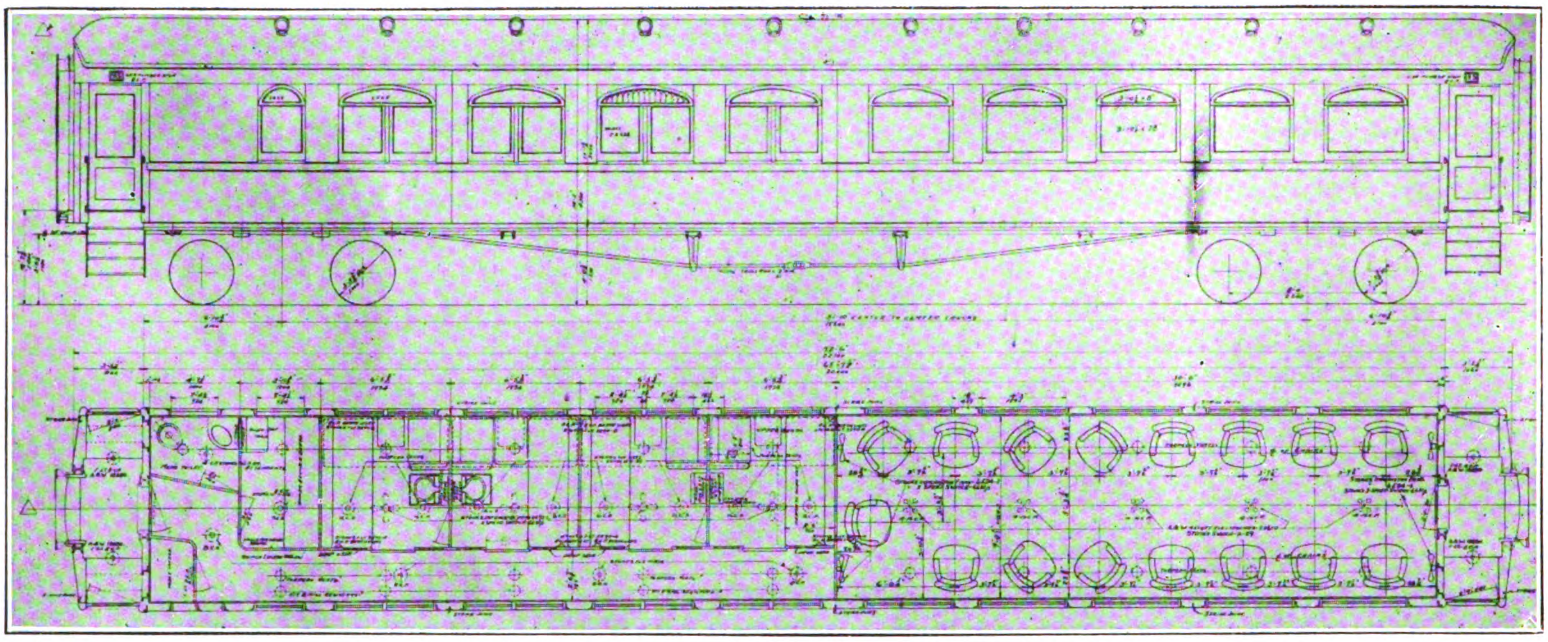
First Class Dining Car: Showing Side Board



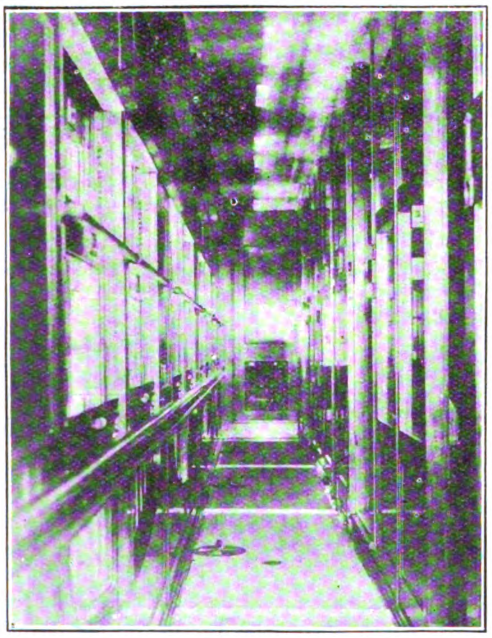
Kitchen



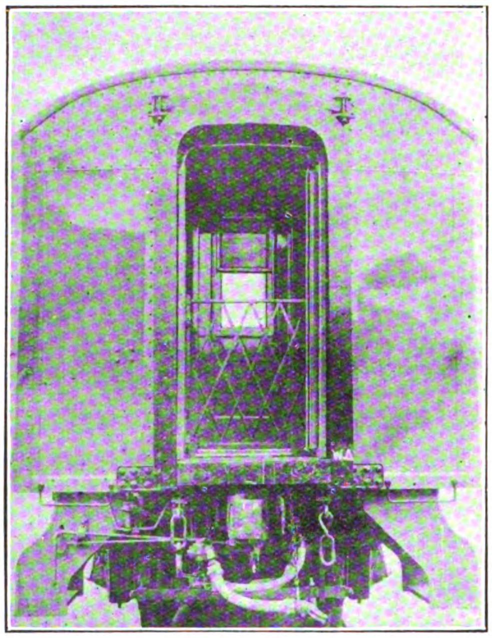
Interior of Dining Car



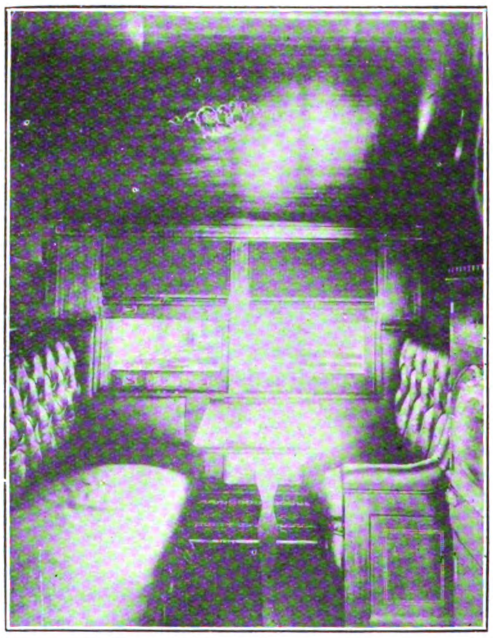
General Floor Plan of First Class Sleeping and Drawing Room Car



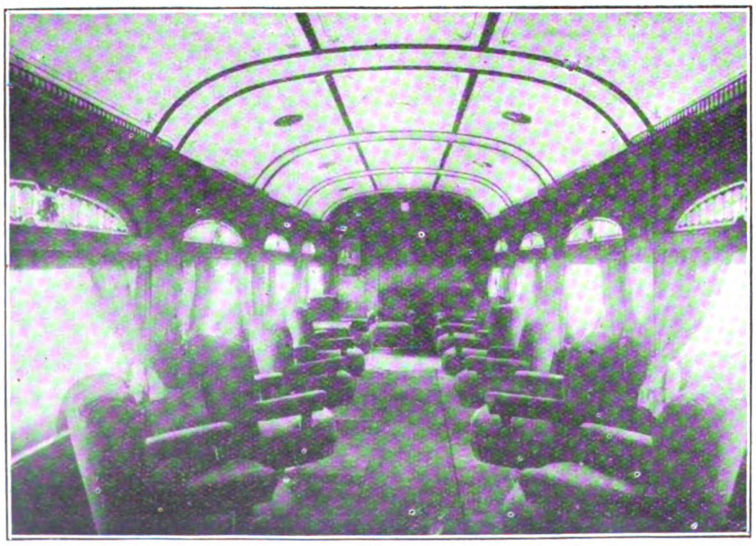
Corridor

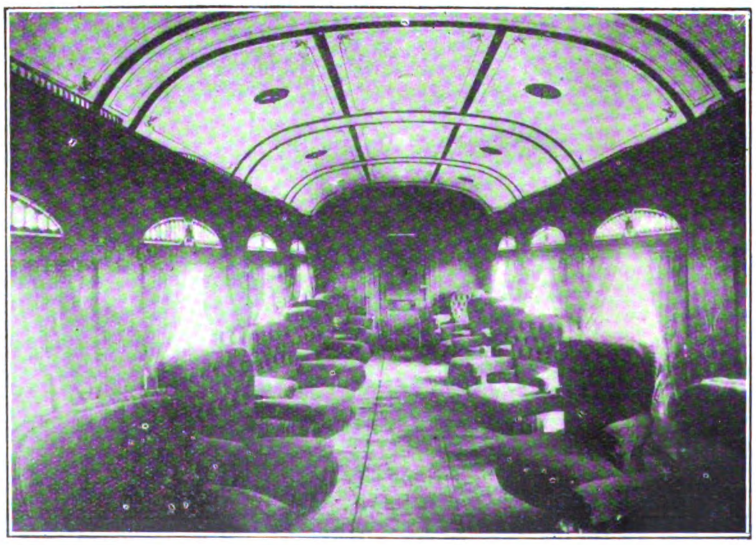


End View

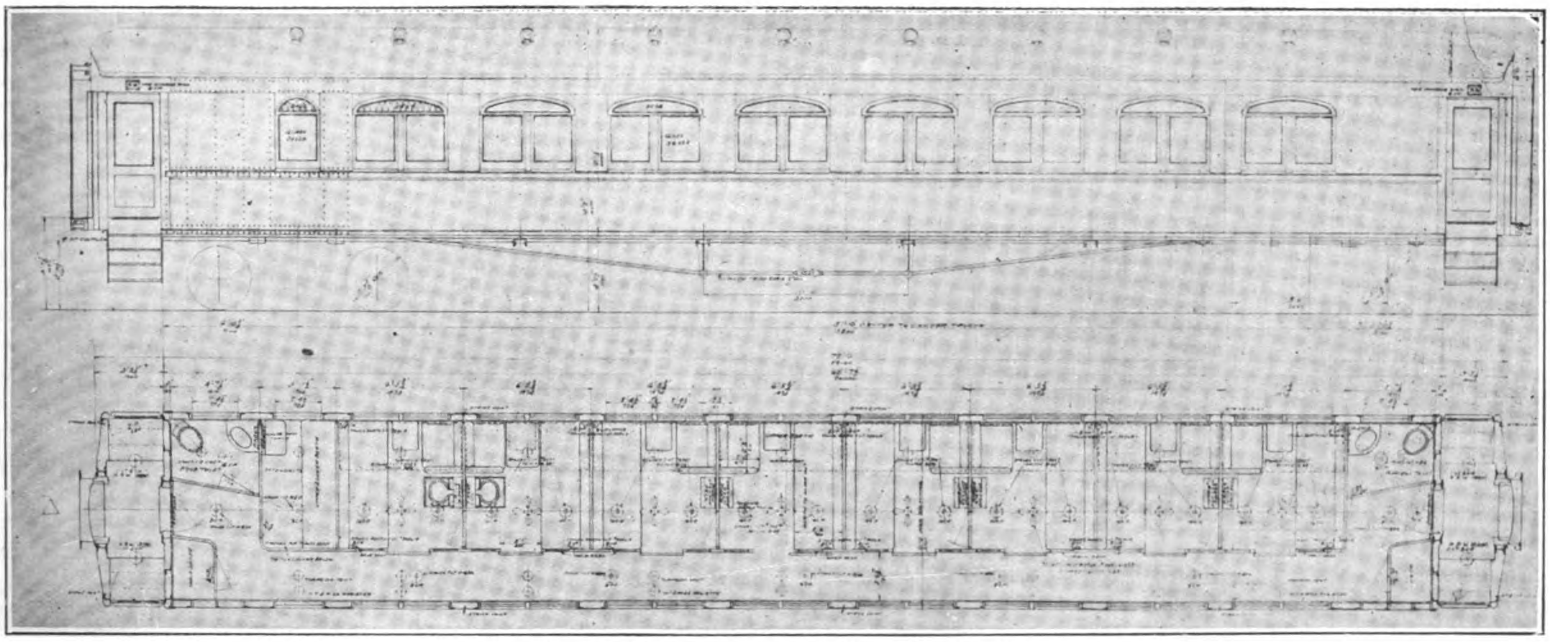


Compartment: showing Pullman Type Upper Berth

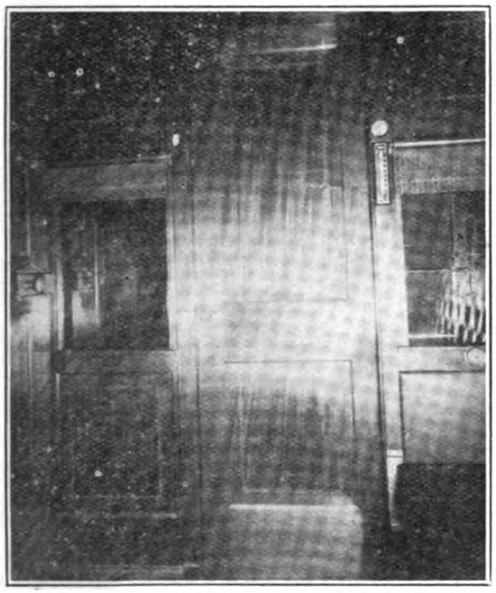




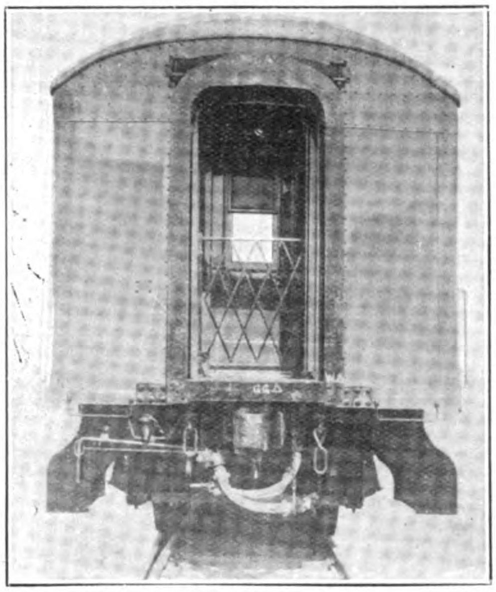
Interior of Drawing or Observation Room



Plan and Elevation of First Class Sleeping Car

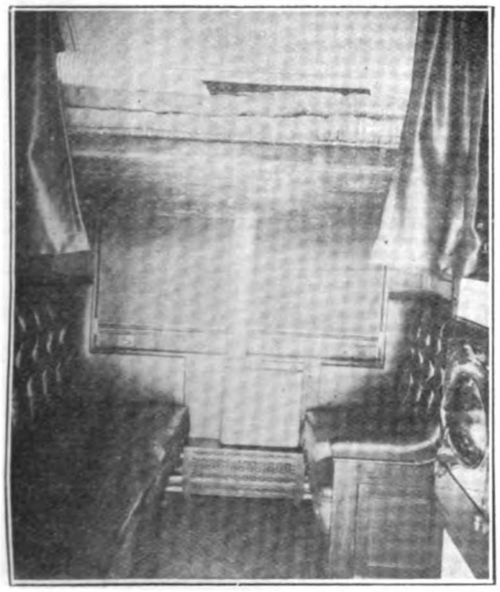


Interior of Sleeping Compartment Showing Door

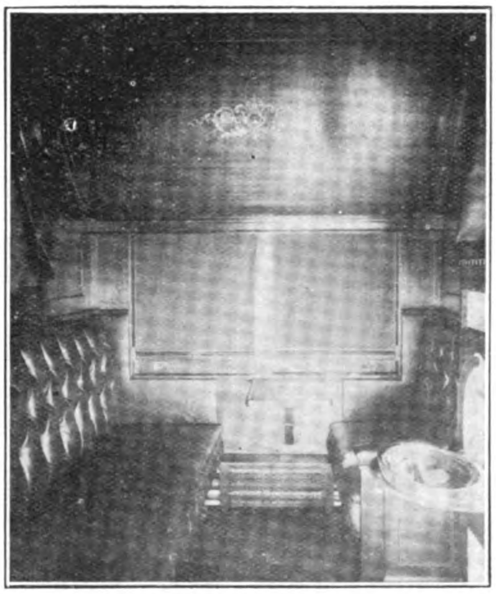


End View

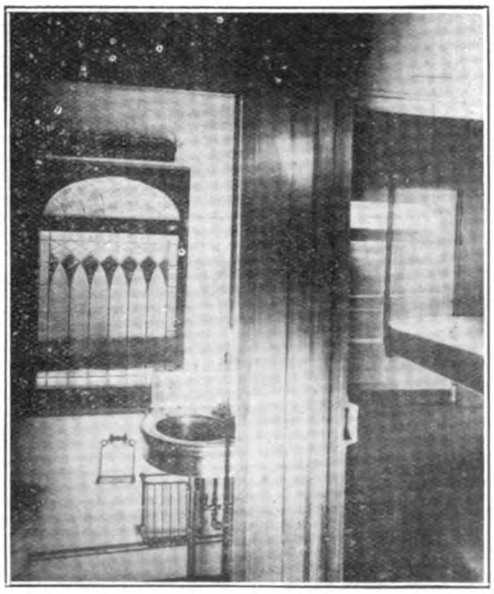
Corridor



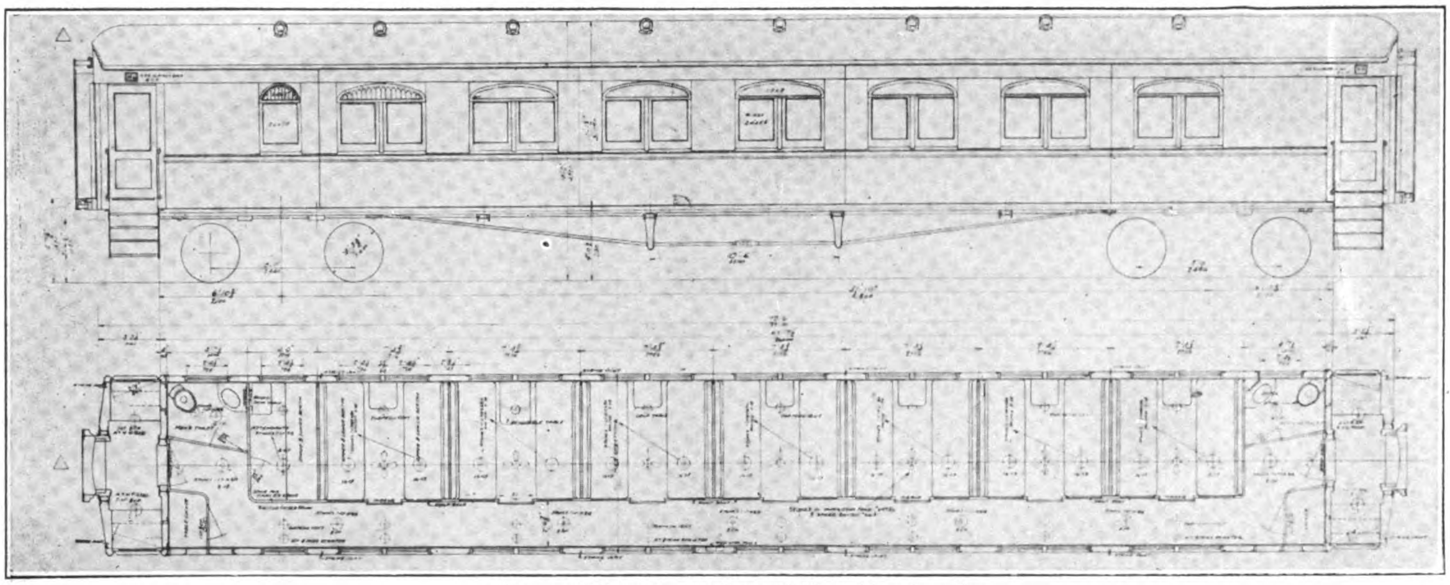
Interio- of Sleeping Compartment Showing Upper Berth Open; Washstand Closed



Interior of Sleeping Compartment showing Upper Berth Closed and Washstand Open

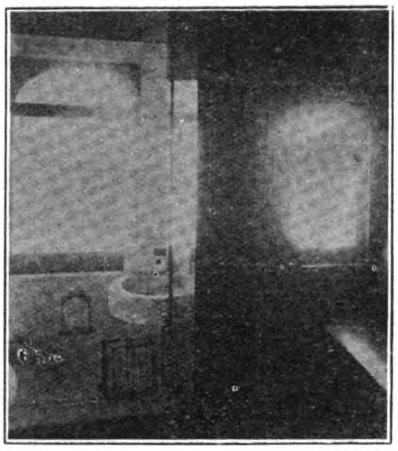


Lavatory and Toilet; Attendant's Room

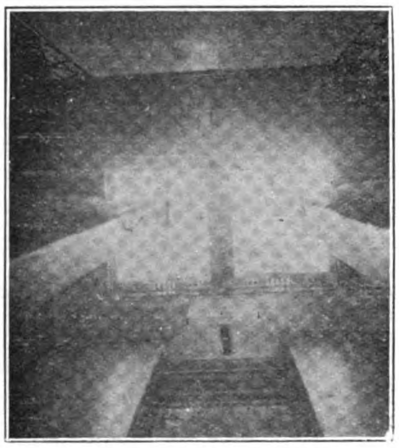


Plan and Elevation of Second Class Sleeping Car

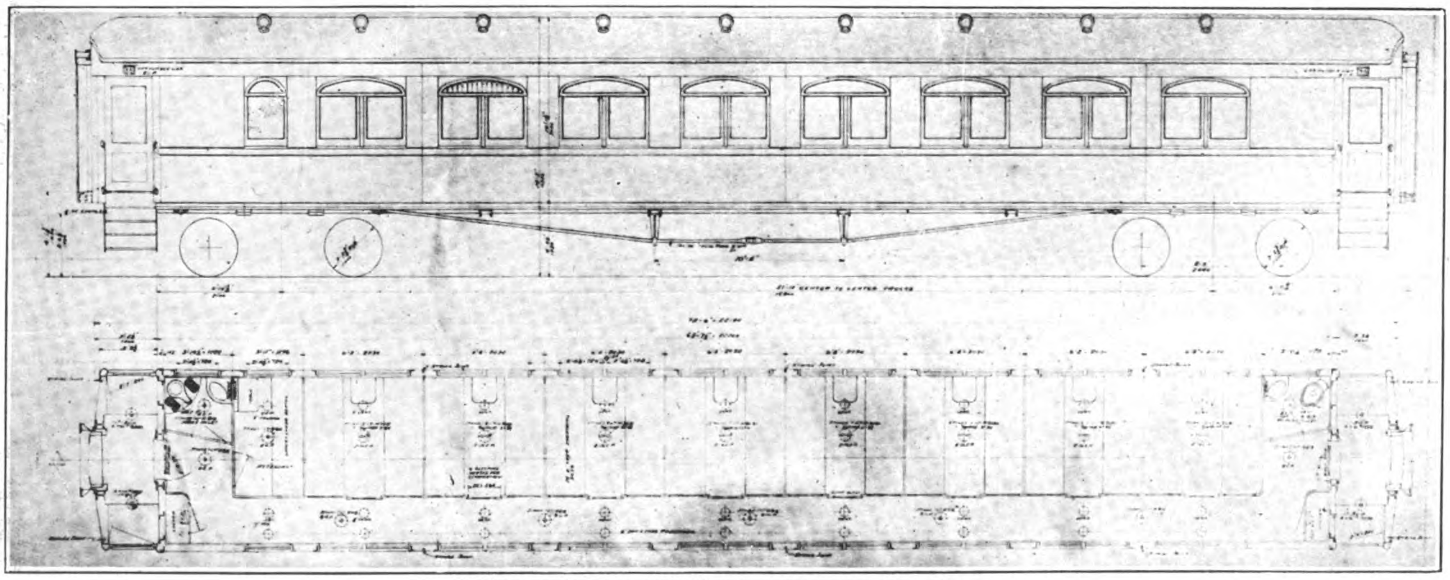
Corridor



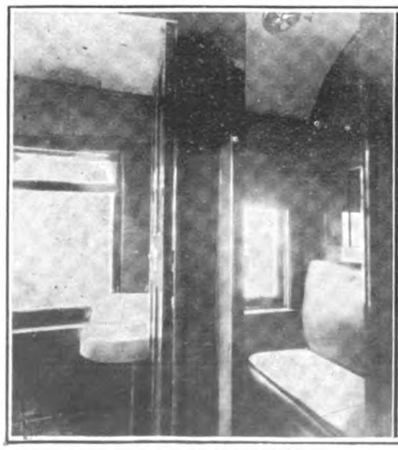
Lavatory and Guard Room



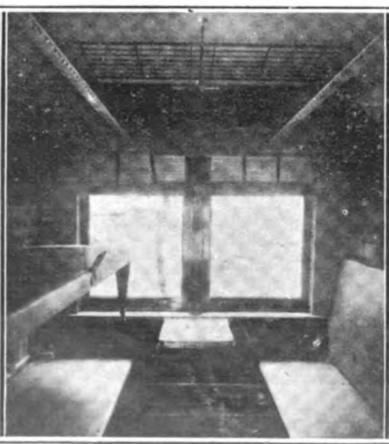
Interior Sleeping Compartment



Plan and Elevation of Third Class Sleeping Car

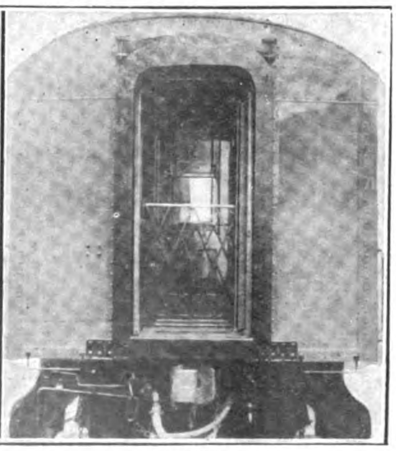


Lavatory and Guard Room



3rd Class Sleeping Compartment: 6 Berths each

Corridor



End View

various types of cars. The belt rail is a 4-in. by ½-in. bevelled edge bar. The side plate is a 3-in. by 3-in. by ¼-in. angle. The side sheets, end sheets and letter board are ⅛-in. levelled steel.

The end construction for the vestibuled cars consists of four vertical 6-in. "H" beams, 23.8-lbs. at each end, one located each side of body end door and at each side of passageway opening at end of vestibule. At the body end between the door and corner there are two vertical 4-in. "Z" bars. The dummy or stub end cars, namely, baggage cars, postal cars and dining cars, have a vertical 12-in eye beam, 31½-lbs. each side of the end door and two vertical 4-in. "Z" bars between the door and each corner of car. The end construction is unusually heavy and strong when compared with other cars in China, due to making this feature conform with American practice of following the United States railway mail service requirements, stipulating a minimum section modulus of 65 for the vertical end members at each end of car, of which those members adjacent to the doors are to have 75 per cent. of this amount. Special attention is drawn to the strong end construction which is intended to withstand impacts from wrecks and collisions, eliminate possibility of telescoping and restrict the damage to the ends of cars, so as to reduce personal injuries to a minimum.

The roof is of ¾-in. tongue and grooved wood covered with canvas to conform with latest tendenies of passenger car construction.

The floor construction consists of a ₁⁄₁₆-in. copper bearing steel sub floor, over which is a 1-in. dead air space, followed by another course of sheet steel on which rests a layer of ¾-in. hair felt insulation. Above the insulation is a course of 1⅛-in. tongue and grooved wood supporting a ⅝-in. thickness of Monolith composition coment secured with wire netting. The sides and ends are insulated with ¾-in. Salamander, secured by means of wire nails arc welded to the sheets.

## Interior Finish

The interior finish for the first class sleeping cars, dining cars, drawing room cars and one of the private cars is red mahogany with neat inlay lines and artistic marquetry inlay designs. The finish for the other two private cars is white mahogany. The finish for second-class sleepers is quartered oak; for the third-class sleepers pitch pine and steel for the baggage cars and postal cars.

The floors for all first-class cars are covered with high-grade Wilton carpets, the halls, toilets and vestibule floors being covered with red and green square rubber tile. The floors of second-class sleeping cars are covered with brown linoleum.

The upholstery for first-class coupés and din'ng cars is brown Spanish leather; for the drawing room green short nap figured plush, and fabricoid for the second- and third-class sleeping cars. Ceilings are white with ornamentation for the first-class cars. The windows in dining cars, drawing room cars and private cars are fitted with draperies of sun fast figured material.

## General Features

The ventilation is the exhaust type by means of torpedo roof ventilators drawing from a continuous space from end to end of car between the roof and ceiling. The ventilation is regulated by "Hit and Miss" type of registers located in the ceiling and arranged so the various coupés or sections of the cars are regulated independently. In addition, air intake ventilators are provided at the bottom of the windows in first- and second-class cars.

The heating is the "Gold" vapor system with independent control for the coupés of first- and second-class sleeping cars. With the vapor system, the steam from locomotive is regulated by an automatic device so that there is no pressure in the pipes inside of car.

All steel used in the cars and bogies, as well as axles and wheels was supplied by the United States Steel Corporation.

The exterior of the cars is royal blue with gold ornamentation and lettering in English and Chinese. At the centre of car there is a coat of arms specially designed for these trains consisting of a wreath of Chinese wheat, surrounding a shield containing the five colors of the Chinese flag with the yellow bridge as representing one of the important engineering structures on the system. There is also included the winged wheel representing progress, and the initials T.P.R. in English and the characters for Tsin-Pu.

The lighting equipment is the Stone 24-volt system with Tonum batteries. All materials for the lighting were supplied by the Stone Co., with the exception of the lamps in the dining room, drawing room and principal rooms in private cars, which were designed and manufactured in America so as to harmonize with the general in terior scheme of these rooms.

The table equipment for the dining cars and private cars was supplied by the builder and include Hotel Ambassador design of forks, knives and spoons, the remaining silverwaie being one of the latest designs of the International Silver Co. The chinaware is Lamberton style. The table covers and napkins are of Irish linen. Glassware, silverware, china and linen are marked with the Railway Company's monogram. The table equipment supplied is in excess of present requirements and will suffice should *a la carte* service be inaugurated at a later period.

Air brakes are the Westinghouse with two shoes acting on each wheel.

The various sleeping cars and drawing room cars have an illuminated car number sign over the steps that can be adjusted to show numbers from 1 to 99. These cars are also fitted with illuminated toilet room designation signs so passengers on looking out of the coupés can determine which direction to proceed.

All first- and second-class cars are fitted with annunciators located in attendants' room so they can determine exactly by which push button the call was made.

## Special Features

The following are special features that represent a new departure for Chinese railway passenger equipment:—

Spring actuated steel gangway connections or diaphragms between cars.

Wide vestibules and platform trap doors with easy access and egress steps covered with anti-slip treads.

Permanent sliding window screens.

Hot as well as cold running water for washbasins of first-class cars.

Large and conveniently located windows that permit of clear view while seated in a comfortable position.

Water tanks underneath of car for first-class cars and forced to faucets by air pressure system.

Brake slack adjusters for automatically maintaining a constant air brake piston travel.

Metal conduit system for wiring, permitting of replacing and repairing wires without disturbing the finish.

Safety chains between cars eliminating possibility of train separation in case of broken coupler or damaged draft gear.

Air train signal allowing of signalling the engine driver from any car in cases of emergency.

Solid rolled steel wheels.

Roller side bearings between body and bogies.

Pivotted head spring centering couplers.

Ground level filling arrangement for overhead water tanks, eliminating necessity to climb to top of cars.

## General Arrangement of Cars

The first-class sleeping cars have eight coupés, each accommodating two passengers, quarters for two car attendants and two toilet rooms. In the coupés there is a sofa extending crosswise of car the full length of the coupé and which is used for the lower berth at night. On the opposite side next to the window, there is an individual seat which permits both occupants to be seated next to the

window. The upper berth is the Pullman fold-up type located above the windows and running lengthwise with the car. This type of upper berth presents a roomy coupé during the day time and is used for storage of bedding. There is a folding lavatory to each coupé and each pair of coupés is connected by a communicating door. Berth reading lamps are provided for both berths also curtain for the upper berth. A small drop down table is provided in each coupé, also sockets for the application of a larger removable table for use when card playing or dining in coupé.

The drawing room car has four coupés exactly like those for the first-class sleeping car and a room with sixteen revolving parlor car chairs in addition to quarters for two attendants and a toilet room. The windows in the drawing room are wide with art colored glass above, and this car might be styled an observation car.

The second-class sleeping cars have seven coupés, each accommodating four passengers ; quarters for two car attendants and two toilet rooms. The seats are used for lower berths, the seat backs for the upper berths, the back being pivotted and held in raised position by two leather covered chains. Each coupé has a small drop table and sockets for a larger removable table.

The third-class sleeping cars have eight coupés, each accommodating six passengers, quarters for two car attendants and two toilet rooms. The uppermost berth is permanent and can be used for luggage during the day time. The seats are used for lower berths and the back for the middle berth by being swung up and supported by two hinged legs.

The dining car has a dining saloon accommodating 36 persons at one time, there being six tables on one side for four persons and six on the opposite side for two persons. The tables are removable and are covered with a milk colored glass. The chairs are loose and can be placed as close to the table as one desires. The windows are spaced central with the tables and are wide so as to give a clear view when seated at the tables. Art colored glass is provided over the windows. At one end of the dining room there is an office for the steward, with linen lockers at the opposite side. At the other end of dining car there is a buffet having a side-board and two refrigerators, one for wines and the other for fruit.

Next to the buffet is the pantry and kitchen of the latest arrangement and containing all the modern conveniences for dining cars. The pantry contains overhead lockers, sink with hot and cold water chill boxes for provisions and iced chambers for milk, etc.

The kitchen is equipped with a Stearn's range, broiler, steam table, refrigerator, chill box, overhead lockers, special containers, sinks with hot and cold water, dish and glass racks, plate warmers, coffee urns, warming ovens. The water supply is from overhead tanks which can be refilled from the air pressure water tank underneath the car. The hot water supply for sinks and steam table is from storage tanks and water backs in range. Provision is made so steam can be drawn from the locomotive as an auxilliary for quick heating steam table, also, so cold water at the sinks can be drawn direct from the air pressure tank.

The refrigerators are porcelain lined with syphons separating the provisions and meat from the ice chamber. Lights inside of refrigerator are turned off and on automatically with the operation of the door. The wine refrigerator is equipped completely with pull out type of bottle racks.

The kitchen is fitted with a large roof ventilator, also an exhaust blower. A hallway is provided at side of kitchen so that passengers pass through the car without going through the kitchen.

The baggage car has a corridor extending the full length of car. The baggage space is partitioned off in two equal sections. At one end of the car there are quarters for the train crew including a bunk room fitted with two berths and a special strong box for station revenue, which can be dropped into the receptacle, but cannot be removed except by unlocking the door. This room also contains a fire extinguisher, stretcher and first aid outfit. At the other end of car there is a toilet room for the train crew.

The postal car has quarters for the train guard at one end, the remaining space being divided into two sections, one for parcels, the other being in accordance with and containing all the appurtenances as used in American postal cars, which permits of assorting and distribution of mail *en route.*

The private cars are alike except two are finished with light wood and one with dark. In addition, the latter has an additional room, fitted with brass bed instead of a library. The general arrangement of the former is as follows : The observation or sitting room contains five large wicker chairs and a sofa which can be made into two berths by swinging up the back and applying curtains. At the observation end there is a platform with brass railing and awning, folding seats being used. Next to the sitting room is a library containing a sofa that can be made into two berths, a large wicker chair, writing desk and a small chair. Accessible from hall or by communicating door at library is a bed room containing a brass bed, wardrobe and dresser. Connected with the bed room is a bath room containing a shower bath, stationary lavatory and hopper. Next to the private toilet is a general toilet room accessible from the hall containing a lavatory and hopper. Next, there is a coupé or guest room which is a duplicate of the first-class sleeping car coupé except a large wicker chair is introduced instead of the small seat.

The dining room contains a side-board, extension table, six chairs, writing desk, book case and a sofa that can be made into two berths by swinging up the back and applying curtain. The servants' quarters adjacent to the dining room have accommodations for four servants. Following this is a kitchen fitted with a Stearn's range and broiler, also sink, chill box, lockers, etc. The refrigerator for supplies is located at one side of vestibule and is the same as described for the dining car. At this end, there is a toilet room for the servants and an individual hot water heater.

The private cars are equipped with a dual heating system, that is, they may be vapor heated with steam from the locomotive when in operation or by an independent hot water system when on a siding where no steam supply is available.

The dining room is upholstered with green leather, the bed rooms and sitting room with green short nap figured plush and the servants' sections with fabricoid. The finish at kichen end of car is of oak.

## Bogies

The bogies or trucks are of the four-wheel American equalizer type of structural steel construction. The wheels are metre diameter of solid rolled steel one piece type. The axles are open hearth steel with 5½-in. by 10-in. journals. The journal or bearing boxes are of cast steel with top hinged spring closing lids. Side bearings are the Stucki roller type. Brake beams are of the trussed type with removable shoes. The trucks are alike for all of the cars except for a slight difference in the springs to compensate for the difference in weight of the various types of cars.

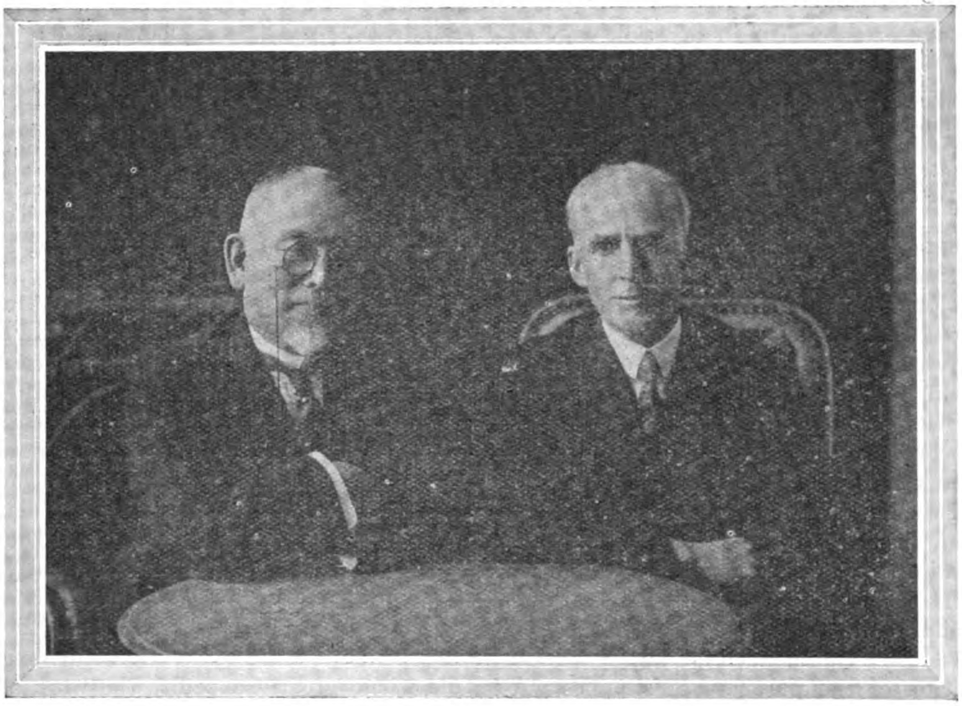
With a trip of the duration of the one from Peking to Pukow it is obvious that trains should be made as comfortable as possible. As many important Chinese as well as foreign visitors and leading foreign business men make this trip, it is just as necessary that the cars should be made safe. It is hoped that the Chinese railway officials and those employed on the cars will take care of the splendid equipment under their care. This remains to be seen, but from the handling of the trains during the past fortnight, it appears that they are going to deteriorate rapidly and prove that they are in advance of what the car attendants might be expected to keep in proper order, unless we have enthusiastic hopes that the Chinese might in time adopt themselves to the modern equipment, keep them in clean and proper condition and handle the various features so the traveling public might benefit by what has been inaugurated for their comfort.

# For a Greater Tokyo

## Dr. Beard Submits His Report on Plans for Consolidation

OF all the large capitals of the world, none is in greater need of municipal improvements than Tokyo. The worst streets, miserable transportation system, lack of sewage or sewage disposal facilities, overcrowded houses and business districts, disease breeding slums, inadequate parks and breathing places for the public, all conduce to conditions which make life anything but pleasant and piles up the death rate. Although great improvements have been planned and are being carried out as far as the finances of the municipality will permit, rapid progress is impossible owing to many complex conditions arising from conflicts of authority, jurisdiction and other causes having their origins firmly imbedded in old traditions and imperial prerogatives all of which combine to deprive the municipal government of initiative and the power to raise adequate taxation to carry out its functions.

In order to find a solution to these problems, Baron Goto, the mayor of Tokyo, some time ago invited Dr. Beard, the well-known American municipal expert, to come to Tokyo and make a most searching investigation into conditions and report without bias on the problems that must be faced in order to consolidate the municipal authority and make possible the crying reforms. After some months of careful study, Dr. Beard has completed the task and submitted his report, the main features of which are here given.



Viscount Goto, Mayor of Tokyo, and Dr. Charles A. Beard, Municipal Expert

The first requirement for the efficient administration of Greater Tokyo is the consolidation of the metropolitan area under one powerful city government. The function of supplying gas, electricity, transportation, water, and sewerage, as well as the successful administration of health, charitable, and other services, calls for unitary treatment to prevent duplication and waste. As long as the city does not control the growth of the suburban areas, it cannot prevent congestion in the environs or relieve it at the centre. While the city does not control the suburbs it cannot compel those who use its streets, transact business in its offices, wear out its pavement and enjoy its benefits to pay their just share of the cost of city government. Without consolidation there can be no genuine city planning in Tokyo. The experience of London, Paris, Berlin, and New York prove this. The city authorities of Tokyo know this and have prepared careful plans for consolidation. The whole matter is in the hands of the imperial government.

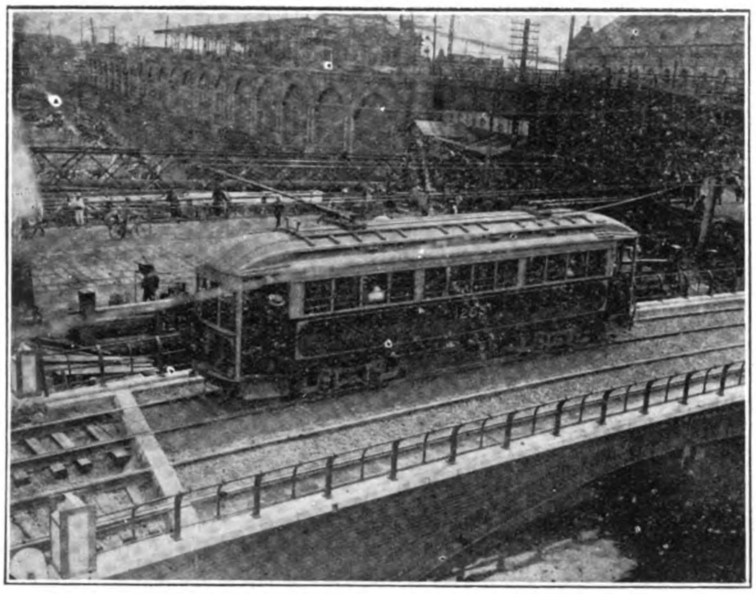
Special emphasis should be laid upon creating powerful municipal government within the area of Greater Tokyo. At the present time the power of government is divided among many agencies, including the city government, the police commissioner, the prefect, and certain ministers of the imperial government. Responsibility for the welfare and prosperity of Tokyo is nowhere fixed. There are many conflicts of authority. Duplication of work and overlapping of functions appear throughout the city. There are long and costly delays due to the absence of responsibility. Therefore there should be one powerful government within Greater Tokyo, subject only to the direct and limited supervision of imperial authorities. If such a city government cannot be created soon, then it would be better for the imperial government to follow the example of France and the United States ; that is, abolish the semblance of self-government for the capital and vest the entire administration in imperial officers similar in power to the prefect of the Seine or the commissioners of the district of Columbta.

### Budget System Good

The budget system of Tokyo, in most respects, conforms to the highest standards established by the New York bureau of municipal research for testing the excellence of budget methods. Some details might well be perfected, but on the whole most American cities could consider themselves fortunate in possessing a budget system comparable to that now in operation in Tokyo.

As regards the municipal debt of Tokyo, it must be said that the city is in a sound financial condition. The net debt of Tokyo for non-revenue producing purposes (that is, excluding such bonds as waterworks and street railway securities) is only Y.26,000,000 in round numbers, or about one per cent. of the estimated value of the real estate of the city. According to American standards, which are conservative, the detb of Tokyo for non-revenue producing purposes would not be excessive if it were ten times its present size.

From every standpoint the system of taxation now prevailing in Tokyo deserves condemnation. The city has no general and independent taxing power. It must rely mainly on surtaxes imposed on imperial and prefectural taxes. At present almost the entire burden falls on business enterprise, income and consumption. Land almost entirely escapes, for it pays only about one million yen a year into the city treasury. Buildings are lightly taxed. Instead of this system I recommend the following : (*a*) a new and scientific assessment of all real estate ; (*b*) the placing of the main burden of taxation on real estate ; (*c*) the application of the special assessment to all kinds of public works which confer a direct benefit upon land owners ; (*d*) the granting of an independent taxing power to the city within certain general limits ; and (*e*) the simplification of the tax system. These recommendations are in accord



Elevated and Street Railway in Tokyo

Paving one of the Main Streets of Tokyo

with the opinions of the Japanese specialists in taxation whom I have consulted. They contain nothing experimental or revolutionary. They are absolutely necessary to the raising of the funds required to make Tokyo a capital worthy of the Japanese empire.

## Government Taxation

The imperial government and the imperial household do not make contributions to the treasury of Tokyo commensurate with the amount of tax exempt land and property which they hold within the city. Justice to Tokyo requires the imperial government to make subventions at least equal in amount to such special assessments as would be laid upon imperial property in case it were taxed like other property. Probably the following would be the best solution of the vexatious problem of subventions: let the imperial government and the imperial household make contributions toward meeting the capital outlays and current expenditures of Tokyo on the same basis as other land owners under a scientific system of assessment and taxation for benefits conferred. Such contribution, like a real property tax, are also necessary to the modernization of the capital of Japan.

The city administration is to be commended for taking certain steps toward the centralization of the purchase of supplies. A great deal remains to be done, however, in the way of establishing standard specifications and improving purchasing methods. I therefore suggest that you make a careful survey of the local problems in the light of Western experience in purchasing.

In the employment of civil servants. I find in Tokyo few of the gross evils which have long plagued American cities—evils which have been partially remedied by civil service reform. However, I venture to call your attention to the importance of this problem and the desirability of making a special study of the subject.

The construction of the new waterworks extensions proceeds rapidly and by the summer of 1924 Tokyo will have the mains laid and will be prepared to supply at least 45 gallons per capita to all the inhabitants of the present city. This is about the average consumption of the smaller European cities, but is considerably lower than that of the leading European and American cities. The new requirements created by the completion of the sewer system, street cleaning, and fire protection will compel the city to take immediate thought about further extensions of the supply.

One large section of the city is now supplied with sewerage and a new disposal, plant is in operation at Mikawashima. In a section of the city the sewer pipes are being laid. Plans have been made for the remainder of the city. The completion of the system waits on financial resources and I urgently recommend the extension of the principle of special assessments to sewer construction. I also suggest the purchase and use of improved labor-saving machinery for making excavations, driving piles, and making refills. This would greatly expedite the work and reduce the cost. The money and labor saved by this process could be used to good advantage in making slum clearages and building new municipal dwelling.

In the field of public untilities I find a state of great confusion. The city government has no control over the granting of charters

Mitsukoshi Department Store, Tokyo

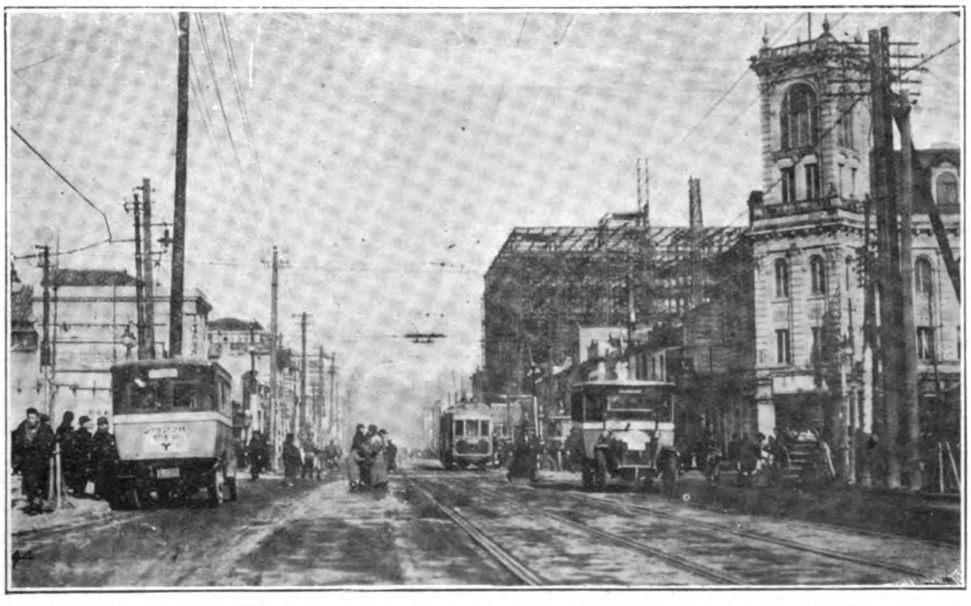
The Tokyo Kaikan (Assembly Hall), Tokyo

to electric light, gas, subway, bus, and other utility companies. It can, by special contract, make certain regulations as to prices and sevices. The regulations which have been made up to the present time do not adequately protect the public interest, and I therefore suggest a thoroughgoing scientific survey of this field. This would involve on examination into the latest western methods of establishing specifications and controlling utility companies. A careful study should be made of the so-called "model franchises" of the United States and also the rise, growth, and limitations of regulation by state and municipal commissions.

Nihonbashi Street, the extension of Ginza Street, Tokyo's Main Thoroughfare and Business Street.

## Advocates Subway

As to transportation, your colleagues in the city government are well aware of the deplorable congestion which now exists and they believe with me that subways offer the only solution. It is unfortunate that the imperial railways department has chartered four subway companies without reference to the plans of the city or the problems of government involved in the creation of a Greater Tokyo. At present, however, they are all at a standstill on account of their inability to secure the capital with which to build subways. Meantime the city having a small sum of Y.7,000,000, now proposes to construct a short experimental line about two miles in length to relieve congestion at certain points. The plans of the city officers are now in a formative stage and I am not prepared to offer any suggestions with reference to them. Nevertheless I urge a reconsideration of the whole problem of transportation with the idea of forming a partnership between the city and one or more companies. In some respects the situation in Tokyo is analogus to that in New York thirty years ago. The city government does not have enough money to build a complete system of subways and private capital hesitates to assume the entire risk. In New York when conditions were similar a partnership between the city and private capital was formed and the subways were built. The experiment has been in many ways unfortunate, but the citizens have been supplied with a remarkable service. If the principle of special assessments were applied to subway construction, the city could readily secure a large part of the money with which to meet its share of the expenditure involved. Before any such plan is adopted, however, a careful study should be made of the successes and failures of the New York city arrangement.



Ginza Street, the Main Artery of Tokyo. The large steel structure on the right is the framework for the new "Ginza Office Building."

## Pavement Problem

It is not necessary to say that the problem of road improvements in Tokyo is both pressing and perplexing. The climate and soil of the city present many difficulties, especially to the builder of wooden block pavements, and the number of steel-shod animals and steel-tired wagons make difficulties for the builder of concrete pavements. These points I have discussed at some length in my report, but here I summarize my important conclusions.

The construction of pavements should follow, not precede sewer construction. Obviously it would entail great waste to lay expensive pavements and then tear them up within a year or two for sewers. Second, I strongly urge the employment of foreign highway contractors during the next few years to work side by side with the engineers engaged in pavement construction. My suggestion on this point is that the city engineers should prepare careful specifications and that experienced foreign construction companies be engaged under iron-clad contracts to construct certain wooden block, stone, concrete, and asphalt pavement and to maintain them in good condition for a period of not less than ten years. I respectfully suggest a study of the experience of Paris. Up until about 1882 every wooden brick pavement built in Paris by local engineers was a failure. In that year the city employed a British construction company under a carefully drawn contract which bound the company to build and to maintain for a period of years the pavements of certain important streets. Later the British Company was united with a French concern, but the work went forward under British control. Result: French engineers learned the technique of pavement construction and then took over the work themselves. To-day French highway engineers are among the first in the world. Tokyo may well profit from this example. Unfortunately American city authorities and engineers refused to follow the precedent set by Paris, and American taxpayers had to pay dearly for the costly experiments which were made by their city governments.

In the field of social welfare, the city of Tokyo has been making rapid strides since 1921. Employment exchanges, model tenements and dwellings for working people, day nurseries, a municipal lodging house, an Elberfeld system of district committees, and many other features of social service indicate intelligence in planning and zeal in

execution. Much remains to be done, however, and nothing stands in the way of the realization of an enlightened social policy in Tokyo except a lack of funds. There is a pressing need for more parks, for playgrounds for children, and for the reservation of park and playground space in the rapidly growing suburban districts over which the city at present has no control. Honjo-ku which has a death rate of 26.55 per thousand —the highest in the city—has no large parks or playgrounds. The park and playground problem is now being studied by the Research Section of the city government and should receive the attention which its importance merits.

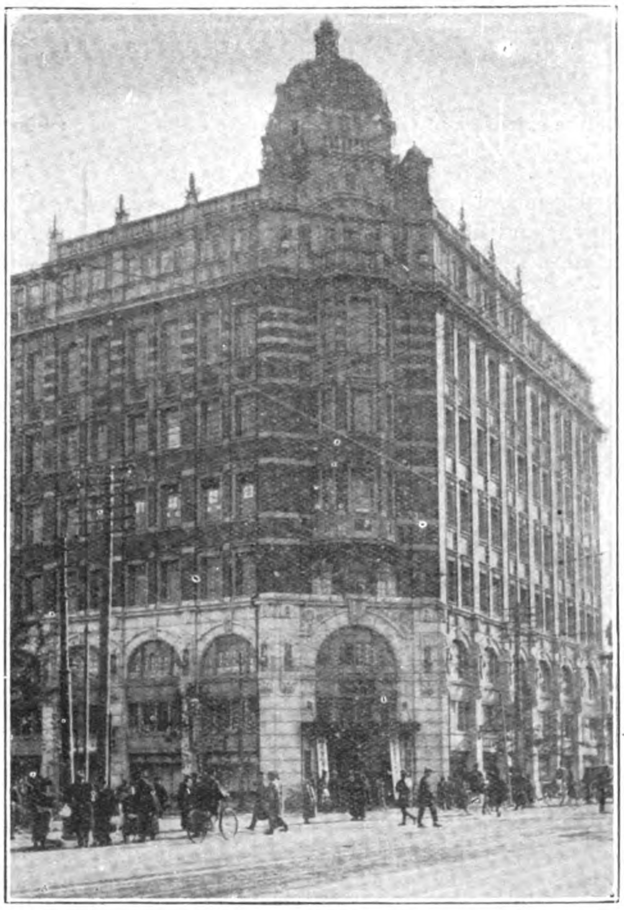
The city administration is well aware of the extent and nature of congestion in Tokyo, but it is also well aware that the problem of congestion cannot be successfully attacked except in connection with an efficient system of transportation, the regulation of housing conditions, and control over the areas around the city which are becoming congested. Moreover large financial resources are required for clearing slum areas.

## Public Health Service

The advance in the public health service of Tokyo during the past ten years has not been marked by the rapid progress which characterizes the science of medicine in general. The death rate of Tokyo—that barometer of public health was 23 per thousand in 1922. The death rate in New York in 1919 was 12.39 per thousand ; the death rate in Liverpool in 1920 was 16.4 per thousand. It will thus be seen that Tokyo has not yet caught up with some of the most efficiently managed cities of the western world in the protection of health. That is not all. The death rate in Tokyo shows a tendency upward rather than downward during the past ten years.

The reasons for this state of affairs involve technical questions of the highest order which can only be answered by specialists in public health after a thoroughgoing inquiry. However attention should be called to the remarkable division of responsibility for public health administration in Tokyo. The police commissioner, the prefectural government, the city administration, and the ward governments all have important duties in connection with public health. There is great duplication of effort ; there is overlapping among the functions of these four governmental agencies ; there is an absence of centralized control. From the point of view of administrative science, the system or lack of system for the protection of the people against disease must be strongly condemned. The chaos in administrative organization, however, cannot be remedied by the city government ; nothing short of imperial legislation can effect the consolidation which is necessary to establish the public health service of Tokyo on a sound basis.

As to the scientific methods employed by the various health agencies now operating within Tokyo, only a complete survey by specialists in public health could produce the data for judgment. It is a matter of gratification to be able to announce that the institute for municipal research is now initiating such a survey.

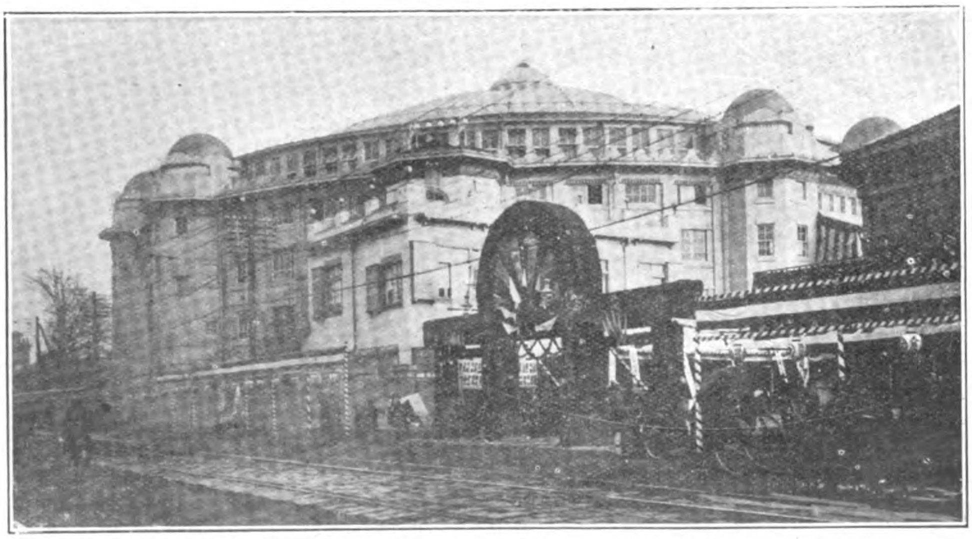


The First Mutual Life Insurance Building, one of the Newest Office Buildings on the Ginza

## Aesthetic Aspect

The aesthetic aspects of city planning in Tokyo should receive more consideration. During the present transition period, the beautiful architecture of old Japan is being destroyed or submerged by all kinds of foreign designs. In every part of the city there appear many architectural monstrosities of foreign origin. Some of these are public buildings and monuments ; many of them are private. This is to be profoundly regretted by those who believe that the city may be beautiful as well as equipped by the conveniences of modern civilization. I venture to call your attention therefore to the work of special civic art commissions in western cities and to suggest the creation of some such commission in Tokyo. Naturally it should represent both municipal and imperial interests.

There is an apparently minor matter which deserves considerations ; that is, the modern naming of streets and the proper numbering of buildings. The present system, besides being a standing nuisance, is exceedingly costly in time and money. Every day thousands of houses are wasted by pedestrians, motor car drivers, and deliverymen in hunting for streets and houses. It appears, however, that this is another matter over which the city government has no power. The present anarchy in naming streets and numbering houses (lots) is founded upon an imperial ordinance and cannot be changed without action on the part of the imperial government.



The New Kokugikan (Wrestling Hall) at Tokyo. A Magnificent New Steel Structure to House the National Sport

The cities and towns of Japan are growing rapidly and nearly all of their problem are common problems. I therefore suggest the establishment of a Japanese municipal improvement association composed of

(Continued on page 277)

# Pulp and Paper Manufacture

## With a Short History of the Development of the Pulp Industry in Northern Japan

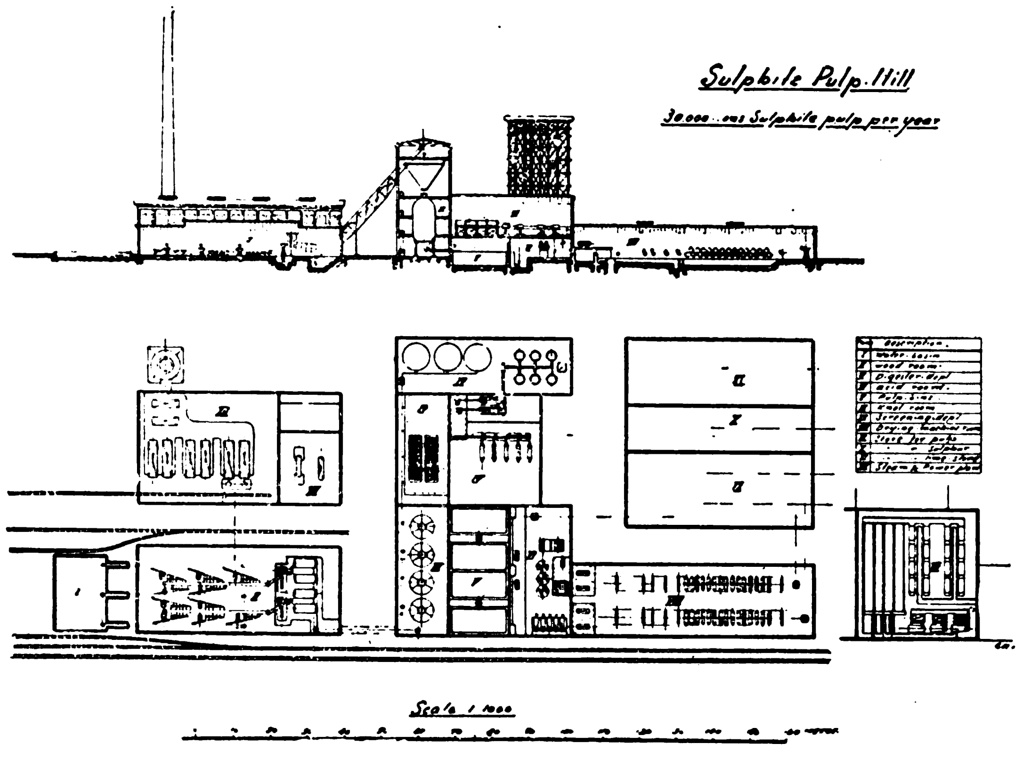
*By Alfred Avall, Pulp and Paper Expert*

THE pulp and paper industry is one of the most important and largest in the world. Pulp and paper are used not only for newspaper and books, for writing and wrapping paper, but also for insulation, pipes, twine, yarn, and box making, as well as for cloth, etc. The raw material consists mainly of various woods, but high grades of paper are manufactured from rags, fibres and grasses. Bamboo is also becoming an important raw material.

Pulp is manufactured by mechanical or chemical process. Chemical pulp may be made either by the sulphite or sulphate and soda processes. Grasses and rags are usually prepared by the latter and wood by the mechanical. Wood is also employed by the various chemical processes, depending on which treatment is the most suitable for the raw material, the site of the mill, and the class of pulp and paper to be manufactured, etc. All these various points must be carefully considered when a new pulp and paper mill is to be built.

### Sulphite Pulp Manufacturing Process

Sulphite pulp is usually manufactured from wood of good quality and yields a white and easily bleached pulp, suitable for printing-paper. The wood is transported from the forest to the pulp mill timber yard, where it is stored until required. At the wood room the logs are either cut into short lengths and barked by a special machine or are barked in whole lengths. The logs are then cut endways in powerful machines, producing chips and chip cakes which break up into lumps which are blown into a disintegrator dividing the cakes into suitable chip pieces. From the desintegrator the chips are carried to the chip screens which remove sawdust, knots and splinters, and thence by a conveyor to an elevated chip storeage above the digesters, to facilitate their automatic filling.




The digesting liquor, a solution of bisulphite of lime and sulphurous acid Ca $H_2$ $(SO_3)$, is pumped into the chip filled digester, and boiled by indirect heating and forced circulation. After being digested the pulp is emptied into large bins, where it is washed, then transferred by pulp-digger, elevator, conveyor or pump, to the screening department.

The digesting liquor is produced either from sulphur in sulphur burners or by pyrites in Wedge or Herreshof-furnaces. The sulphur gas obtained is cleansed and cooled, and then forced through the acid towers by means of a gas fan. These towers are filled with limestone over which water drips down. The acid gas is dissolved in the lime water and the liquor or acid runs off into tanks where it acquires the desired strength by the addition of acid gas recovered from the digester.

Should the plup contain too much water when it reaches the screening department, this is removed by a pulp-thickener or water-extractor. The pulp is then carried to the separators, which liberate and hydrate the pulp fibres rendering it suitable for paper-making, thence into the knot-screen, where knots are removed. From here, it runs over sand-traps, which are long gutters or wooden troughs in which the heavy material and impurities in the pulp settle. The bulk flows on to the final screens, where all the finished fibre is let through and the coarser stuff retained for further treatment in edge-runners or other refiners.

The pulp, when well screened, is carried over a pulp-thickener into stuff-chests, which supply the drying machine. This latter is of a similar design to an ordinary paper-making machine. The pulp passes through the machine in a continuous thick sheet, which at the end of the machine is cut up into boards of the desired size. They are then stacked and pressed into bales and bound up for shipment.

### Strong Sulphate Pulp "Kraft" Manufacturing Process

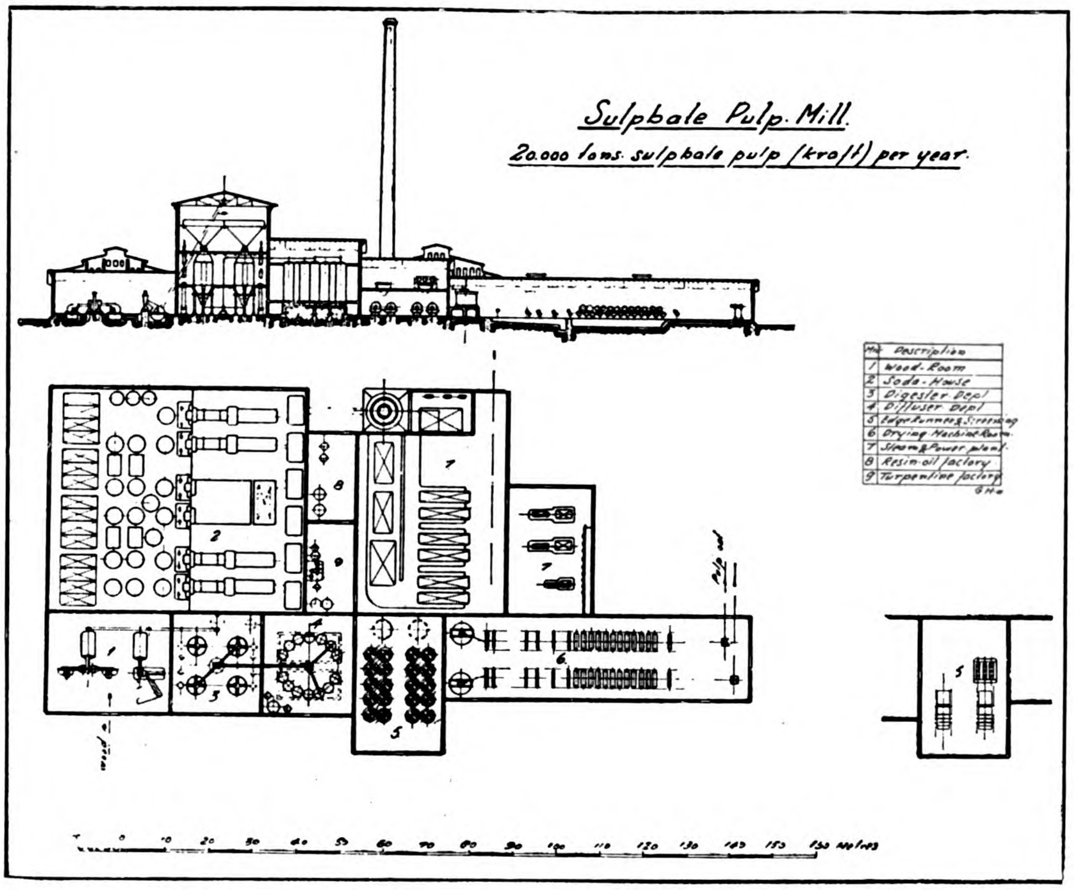
The many advantages obtained by the manufacture of strong sulphate pulp have of late brought this industry into prominence. Practically every kind of wood may be used, and mills are often installed in connection with saw-mills, thereby utilizing slabs and waste wood which otherwise would be of little value.

There is no need for careful barking, and the logs or slabs are cut endways in powerful chipping machines, producing chips and chip cakes which break into lumps, which are blown into a desintegrator, dividing the cakes into suitable chip pieces. From the desintegrator the chips are carried to screens which remove sawdust, knots, and splinters, and thence by a conveyor to an elevated storage bin to facilitate automatic filling of the digesters. The digesters, which usually work with a pressure of six to seven atmospheres, are filled with chips and then with liquor, which is heated externally and circulated by a suitable system where scum and impurities are removed. The acting agent in the liquor consists mainly of various chemical combinations with sodium as well as sulphur.

When the digesting process is finished, the pulp is blown out through a pipe system to a battery of diffusers. At this stage the pulp contains a large amount of " black liquor " which has to be removed by washing. When the pulp is cleaned it is let down into large bins or stuff-chests, from which it is conveyed as required to

the screen-room. The " black liquor," which is washed out of the pulp in the diffusers, is conveyed to storage tanks in the soda recovery plant. From here it goes through a system of evaporators and from these into rotating soda burners, so that when water has been removed, only a black powder remains. This powder is poured into a melting furnace together with some sulphate of sodium, and here all burns and melts under a powerful air-current. The molten stuff flows from the furnace into the solution mixers, where the raw soda is dissolved in the "weak liquor." When the solution is sufficiently strong, it is pumped up into lime mixers where limestone is added, and the whole solution well stirred and mixed. This solution is called the " white liquor," and has to be altered carefully before being used in the digesters. The deposit left at the bottom of the lime mixers (called " mesa," mainly containing $Ca\ CO_3$) is against stirred, washed, and treated in a lime filter, and the effluent constitutes the " weak liquor " Suitable tanks or containers for these various liquors must be arranged.

In the screening department the pulp is treated as follows: First it goes to knot screens and thence over large dehydraters, from which the pulp comes out in the shape of a thick wet sheet. This is torn up in special machine, and the pieces taken by a conveyor to battery of edge runners submitted to a lengthy and thorough treatment, to insure that all fibres are completely separated. It is now conveyed to a stuff-chest placed immediately in front of the drying machine. This is arranged on the same principle as an ordinary paper-making machine, and the pulp sheets leave the machine in a continuous sheet, which is cut up into boards. These are stacked, pressed together, and baled for shipment.




In cases where the wood is suitable, it is advisable to combine the pulp-making with complete by-products recovery plant, as such valuable and marketable stuff as turpentine oil and resin may be easily recovered.

## Mechanical Wood Pulp Manufacturing Process

In a mechanical wood pulp mill the logs are usually cut into suitable lengths and carefully barked, ready for grinding into so-called " white mechanical." In some mills the wood is steamed in special boilers before grinding and the so-called " Brown mechanical " pulp produced. This process can be done either by " hot " or " cold " grinding. Cold grinding is effected under moderate pressure between wood and stone, the pulp being washed away by an ample quantity of water. In hot grinding the pressure is extremely high and the water quantity reduced to a minimum, so that a very high temperature is obtained by means of friction between wood and stone. Hot grinding has been in more general use of late years owing to its being more economical and the pulp obtained of higher quality. The grinding is done by means of hydraulically operated pressure, pistons mounted on the grinders force the logs hard against the rotating sandstone, whilst water is flushing away the pulp fibres as they are ground off the logs. The pulp passes through coarse and then through finer screens. through which only the fibre of sufficiently fine quantity can pass, The coarser pulp is pumped to the refiners, and when well refined, back again to the screens. The screened pulp flows to the wet machine (pulp vat) where most of the water is extracted, so that the pulp comes out in solid sheets. These sheets are pressed in presses and more water extracted. The pulp sheets leave the presses containing about 50 per cent. moisture. In some mills more water is extracted by drying. Usually the pulp sheets are taken from the wet presses to the baling presses, where the sheets are made up into suitable packages, which are then ready for transport to paper mills to be further treated for paper.

Water power is very important for a mechanical pulp mill. The power station as well as the pulp machinery must be of good design, and naturally the power department and the pulp department must be built in conjunction with each other to suit local conditions. In some cases it may be advantageous to build the pulp mill at some distance from the water power station, which is then electrified and the power transmitted to electric motors driving the machinery in the mill.

## Paper Making and Paper Machines

Pulp sheets require a further extensive treatment such as bleaching, beating, refining, coloring and sizing before fit for paper making. Space does not admit an elaborate description of these various processes and it may only be said, that most of this refinement and treatment takes place in the so-called beating engine or hollander, where the fibre is exposed to a series of continuous mixing, desintegration, beating, brushing, softening, etc. The treatment of the fibre in the beater is most important and varies greatly for different kinds of papers.

From the beater the pulpy mass of fibres is emptied into stuff-chests with agitators, suitably diluted with water and then pumped on to the sand tables where heavy and gritty particles are kept back. The diluted pulp is then passed through strainers, where knots and dirt are separated and it is then ready to enter the paper-making machine proper to be made into paper.

## Paper Machines

The paper machines for various qualities of paper can be divided into four different groups: (*a*) *Multicylinder machines*: (*b*) *one cylinder machines* (Yankee machines); (*c*) *combined machines*: (*d*) *card-board machines.*

(*A*) *Multicylinder machines* may be further divided into several sub groups:

(*A* 1) *Machines for Printing Paper and News.*—These machines are usually built for great outputs of up to 75 tons (or more) of newspaper per 24 hours. They have a width of up to 160 or 200 inches and a speed of paper of up to 1,000 feet per minute.

(*A* 2) *Machines for Book Paper, Writing Paper, Drawing Paper, etc.* These higher qualities of paper necessitate a machine having slower speed, usually not more than 300 feet per minute, and a width of paper of seldom more than 120 inches.

(*A.* 3) *Machines for Wrapping Paper.*—These machines are built similar to the above types with variation in design for different requirements, such as "Manila" paper, "Java" paper, etc. Machines for "grease proof" for instance are among other things designed with especial consideration for the immense shrinkage of the paper web during its run through the machine.

(*A.* 4) *Machine for Cigarette-Paper.*—The manufactures of such thin paper requires the utmost skill in the treatment of the fibre as well as an exactly suitable design of the paper machine.

Comparatively short wire-net with powerful shaking motion, easily movable and well adjusted rolls and presses, and small drying section are some of the features for this type of machine. The width of the machine is usually 40-60 inches and the speed seldom more than 100-125 feet per minute.

(*B*) *One Cylinder Machines.*—These machines have the wire-section and wet-press section built in the usual way, but the special feature of the machines is that the drying section consists of only *one* large drying cylinder of 10 to 12 feet diameter. A highly polished surface on the drying cylinder is of paramount importance with the result that the side of the paper which comes in contact with the cylinder gets a glazed and well finished surface. *One cylinder machines* are built up to 160 inches width and for capacities of up to 30 tons M. G. paper per 24 hours.

(*C*) *Combined Machines* may be further divided into several sub groups:

(*C.* 1) *Machines for Tissue Paper.*—This type of machine has the usual design of *wire* and wetpress section from which the paperweb is automatically carried over *one large* drying cylinder and thereafter, while it still is moist, over three ordinary dryers. Both sides of the paper receive thereby a uniform surface before passing through a callander.

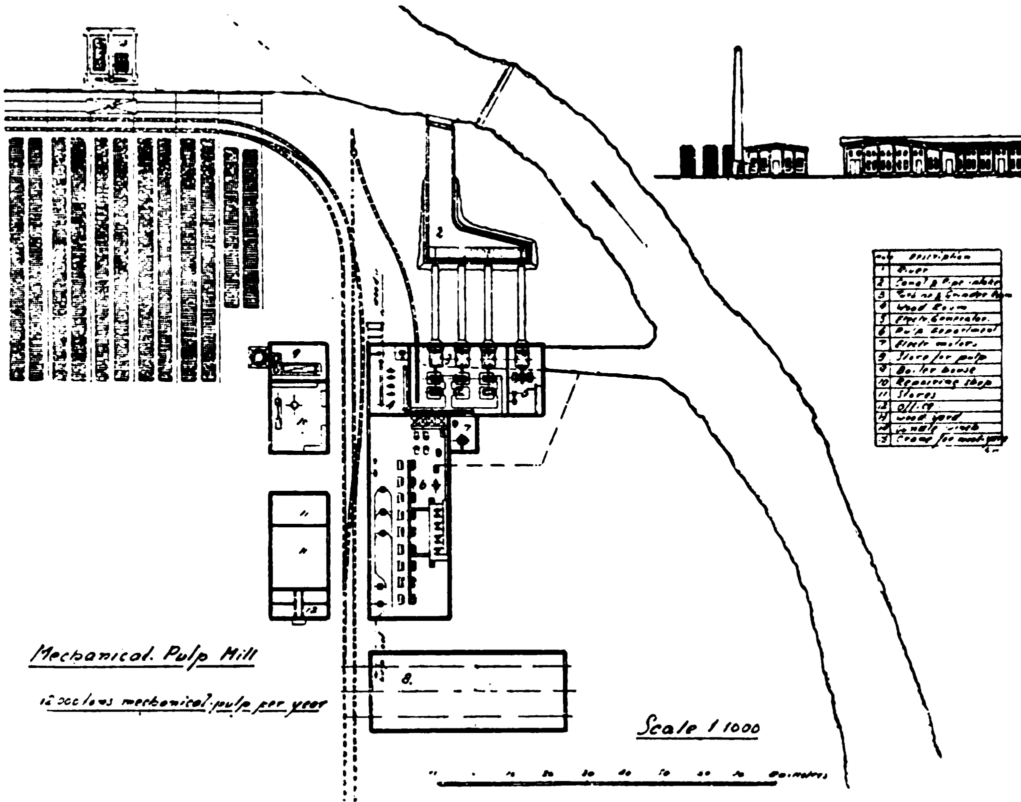
The best qualities of tissue paper are usually manufactured from pure cellulose pulp in the weights of from 12 to 25 grams per sq. m.

(*C.* 2) *Machines for thin printing paper* are of similar design as the machine for tissue paper but with the addition of several more ordinary drying cylinders.

These type of machines are usually built for a width of 80-120 inches or more and a speed of 150-250 feet per minute. They are especially suitable for manufacturing of thin news-paper and thin printing papers with a weight of 25-45 grams per sq. m.

(*C.* 3) *Machines for Thicker Qualities of Paper.*—This type of machine is a combination of a *multicylinder machine* and a *one cylinder machine* in such a way that the large drying cylinder is placed *after* the ordinary cylinders in the drying section. If one-side glazed paper is required the last large cylinder can produce a sufficient glazing without the use of a callander. This type of machine is also suitable for making ordinary news and printing paper of usual qualities, and is built for any normal speed and capacity.

(*D*) *Card Board Machines.*—For making thin or thick card board, duplex or triplex papers, etc., a machine of different design than the usual Fourdrinier machine is used. Instead of the wire net there is a serie of up to eight large vats, in each of which a large drum or cylinder revolves. The cylinders are covered with wire cloths and have outlets at both ends with tightening bands against the ends of the vat.



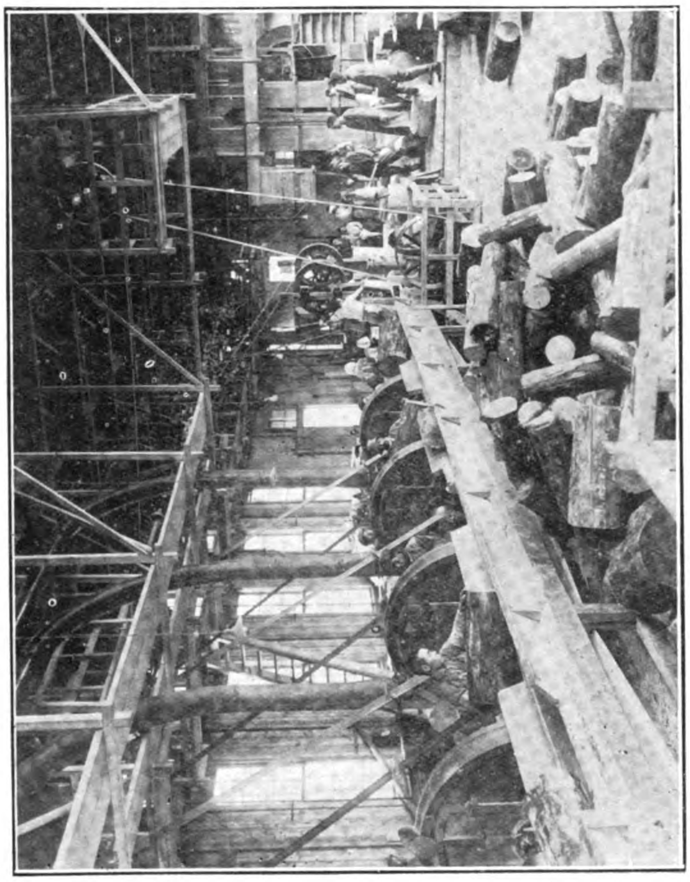

The diluted pulp is led into the vats, the paper web is formed on the cylindrical wire-clothed surface as the cylinder revolves, and the water passes through. The paper sheet is taken away by an endless felt, which passes over a serie of several vats. In this way the paper webs from different cylinders are couched in succession as superposed layers on the same felt. In this way a thick paper board can be obtained which afterwards receives the usual treatment through wet-presses and drying cylinders before reaching the callander and cutting apparatus. This type of machine is built up to 120 inches or more in width and for a capacity of 20-30 tons of card-board per 24 hours. Thickness of board is usually up to 2,300 grams per sq. m.

## Development of Pulp Manufacture in Saghalien and Hokkaido

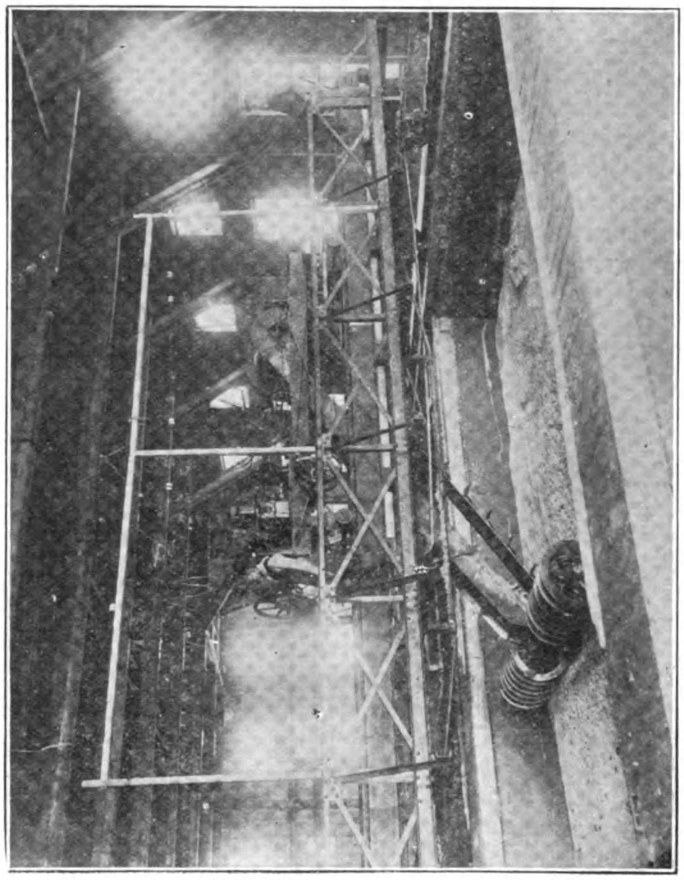
The first pulp mill erected in Japan was built by American engineers for the Tomakomai Paper Mill of the Oji Paper Manufacturing Co. In 1914, the first pulp mill in Saghalien was built at Otomari for the Oji Paper Mfg. Co., the equipment consisting

# OCHIAI MILL OF THE FUJI PAPER MFG. CO., LTD.

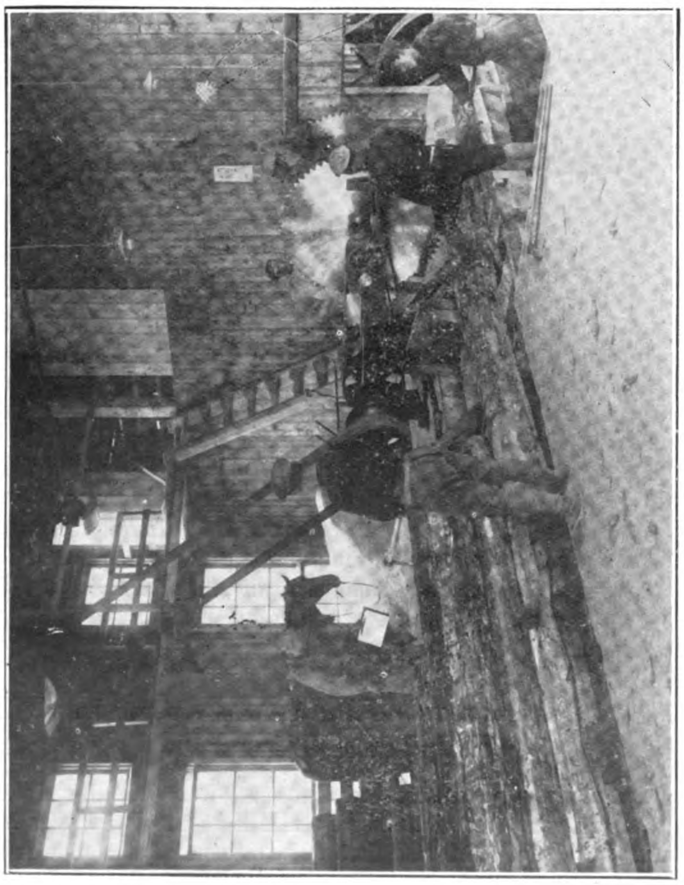
## Erected at Ochiai, Saghalien, by Boving & Co., Ltd. with Karlstad Machine Works Equipment



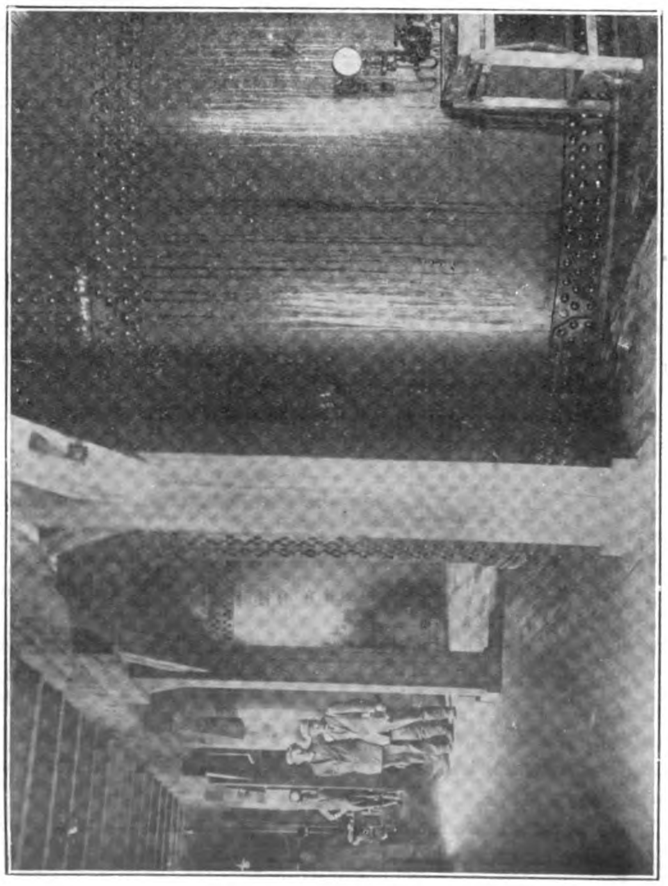
Barking and Wood Cleaning Machines



Pulp Digging Apparatus Operated by One Man



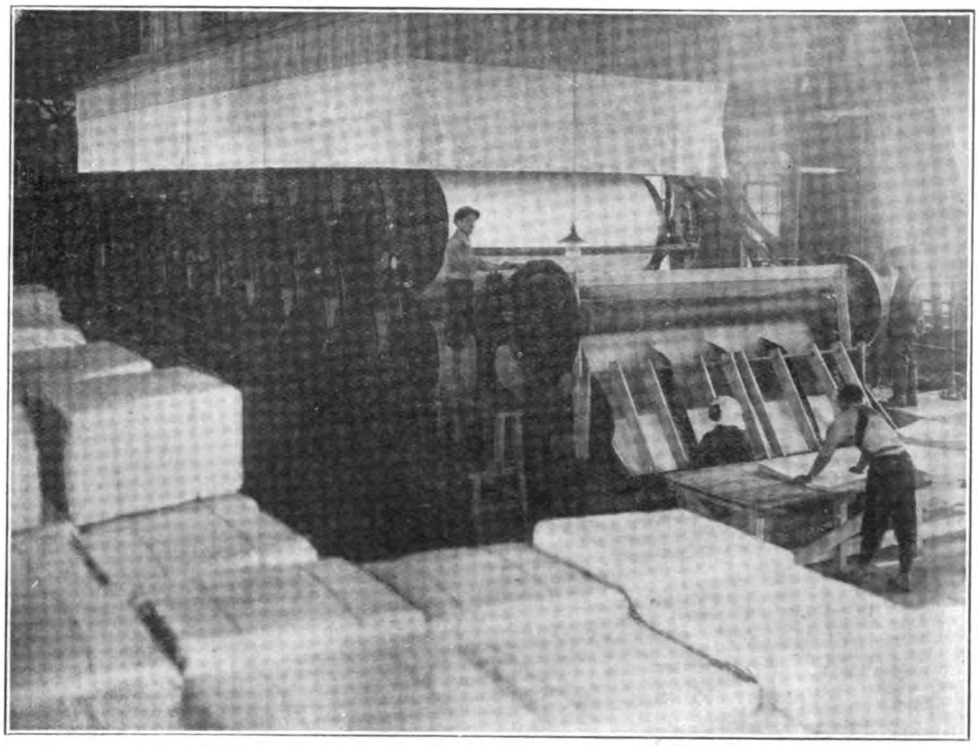
Cutting Off Saw



Digesters: 5 metres diameter, capacity 160 Cu. M., steam pressure 75-lbs. per sq.-in., each cooking lasts 15 hours and produces 11 tons of pulp

of Babcock and Wilcox boilers, Escher Wyss steam turbines and all the paper machinery from the Karlstad Engineering Works, of Sweden.

At the end of 1914, the second pulp mill in Saghalien was ordered by the Karafuto Industrial Co., Ltd. The mill was built at Tomarioro, and all the machinery supplied by the Karlstad Engineering Works. The Oji mill was started up in the spring of 1915, and the Tomarioro mill in August of the same year. Three weeks later, the Karafuto Industrial Co., Ltd., ordered equipment to double the capacity of the mill. Its capacity is now 15,000 tons a year, and the equipment consists of four 11-ton digesters, two automatic pulp digging machines, two pulp separators, four knot screens, and eight screens for fine pulp, four water extractors, and two drying machines, each having 18 drying cylinders. The acid department consists of two sulphur burners, two gas cookers, three acid towers; and the wood cutting department is equipped with one cutting off saw, with automatic feeding arrangement, four barking machines, one chipping machine with chip crusher, one chip screen; and in addition all the accessory machines and conveyors, pumps, etc , in each department. Later on the Tomarioro added another digester with accessory machinery which increased capacity 9,000 tons.



**"Karlstad" Drying Machine in full operation at the Ochiai Chemical Pulp Mill in Saghalien**

In 1916, the Nippon Chemical Pulp Co , Ltd , installed a new pulp mill at Ochiai, in Karafuto It is equipped with four digesters, and two drying machines, besides all accessory and intermediate machinery, as at Tomarioro. This is the first Japanese pulp mill operating with the indirect cooking system. This company was later amalgamated with the Fuji Paper Mfg. Co , Ltd , and in 1917 the mill was started up. At the same time the Fuji Paper Company was building another Sulphite Pulp Mill in the Hokkaido, at Ikeda, which consists of three digesters, and similar intermediate and accessory machinery as at Tomarioro, and one drying machine with 26 drying cylinders. The capacity of this mill is 15,000 tons a year.

In 1917, the Oji Paper Mfg. Co. ordered another mill to be erected at Shingishu, Korea, at the mouth of the Yalu river. This mill consists of two digester, one drying machine with 18 cylinders, and with all intermediate and accessory machinery, to produce 9,000 tons of pulp a year. This mill was started up in 1918. At the present time owing to the rather depressed condition of the domestic pulp industry it is closed down.

In 1920, the Oryokko Paper Co. erected a Sulphite Pulp Mill at Antoken, near Shingishu, Korea. Its equipment consists of three digesters, with all intermediate and accessory machinery. The drying machine for this mill was supplied by Horne & Co., and is of American manufacture. It is the only machine since 1914 not supplied from Sweden. This mill produces 15,000 tons a year, when in operation to capacity. It is now closed down.

Beginning in 1920, the Oji Paper Mfg. Co. built another mill at Nodasan in Karafuto which consists of two digesters, one drying machine with 20 cylinders, and all accessories to produce 9,000 tons of pulp a year. In 1921, an extension was made to this company's Komakomai mill, one digester, being imported from Sweden, which increased production to more than 15,000 tons a year.

Japan now is able to produce a minimum of 100,000 tons of pulp a year. The country annually uses about 180,000 tons of paper for export and domestic use. The balance of the pulp required is imported from Sweden, Canada, and European countries. The fact that the domestic production is not sufficient to supply demand is a favorable factor in the future of the industry. But industrial depression has so lowered prices in Japan that it has been difficult for the home manufactured pulp to compete with imported pulp. The strike in Sweden, and the rise in Anglo-American exchange have somewhat assisted the Japanese market to get back on its feet since the first of the year. However, the future does not promise prices higher than those now prevailing; say 8-9 sen per pound for unbleached and 10½ sen for bleached.

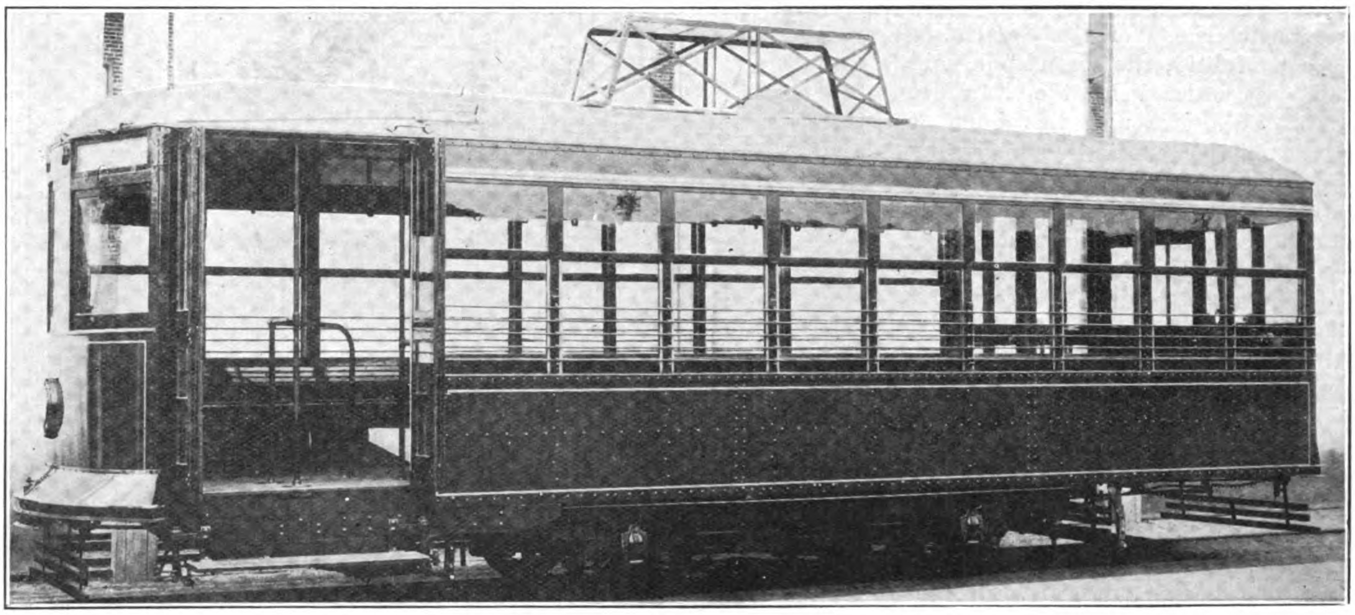
## A HYDRO-ELECTRIC PLANT IN HOKKAIDO

*(Continued from page 252)*

power house, built of stone and concrete, is equipped with a Hidachi "Frontal" turbine having a maximum of 3,330 h.p. operating at 375 r.p.m. direct connected to a Hidachi revolving field type alternator of 2,750 k.v.a. 3 phase, 50 cycles, 6,700 volts, 375 r.p.m. and 80 per cent. power factor. The exciter is 35 k.w., 110 volts, compound wound direct connected to the generator shaft. The water turbine governor is of the automatic oil pressure type made by the Hidachi Works.

The station transformer is 25 k.v.a. single phase, 50 cycle, automatic oil cooled, transforming from 6,770 volts to 105 and 210 volts. There is also a three-phase induction alternating motor of 200 volts, 1,000 r.p.m. 50 cycles connected to a direct current generator of 35 k.w., 110 volts.

Between the generator and the busbar there is a time limit relay with automatic oil circuit breaker to regulate the phase. The brake is operated by hand or by the direct current brake of the switchboard, operated by magnet coils. The 6,770 volt busbar has a three-phase static ground detector between the primary coil of the transformer for the induction motor and the 6,770 volts busbar, there is a similar automatic oil circuit breaker, but instead of a time limit relay, a reverse time limit relay is installed. All the instruments and other equipment of the switchboards were manufactured by the Shibaura Engineering Works of Tokyo.

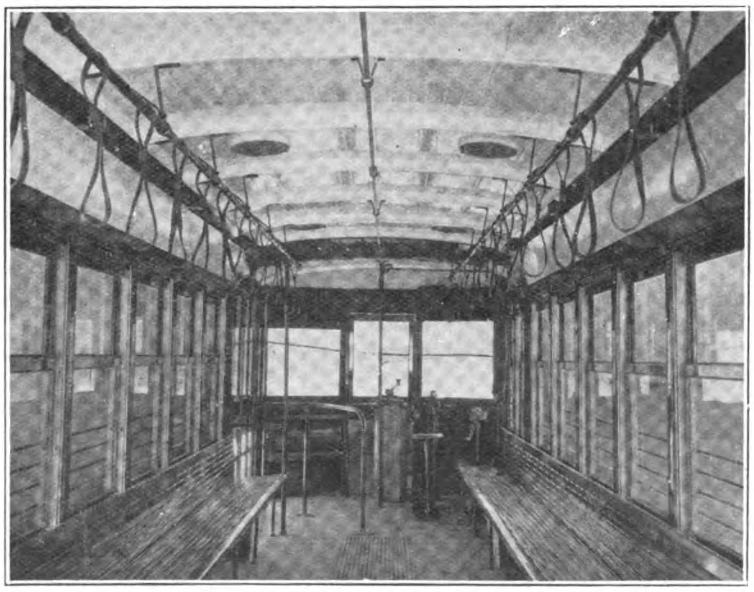


**Exterior of Birney Safety Cars operated by the South Manchuria Railway Company at Dairen, Built by the Brill Company**

# Public Transportation

## The J. G. Brill Company, Philadelphia, Largest Builder of Electric Railway Cars and Trucks in the United States, since its Inception 55 Years Ago, has Produced Many Interesting Types of Public Transportation Vehicles

"FROM horse-drawn to electric railway cars" expresses the progressive development which has been characteristic of the history of this foremost American car and truck builder. Electric railways as a transportation agency, are of comparatively recent origin, the first successful operation in the United States being that at Richmond, Virginia, in 1885. The leadership which the Brill Company has retained throughout the various changes of motive power on railways is attributed to its ability to adapt itself and its product to the changed requirements, and to the many inventions contributed by its engineers, which have had a most progressive influence upon the development of public transportation in the United States.



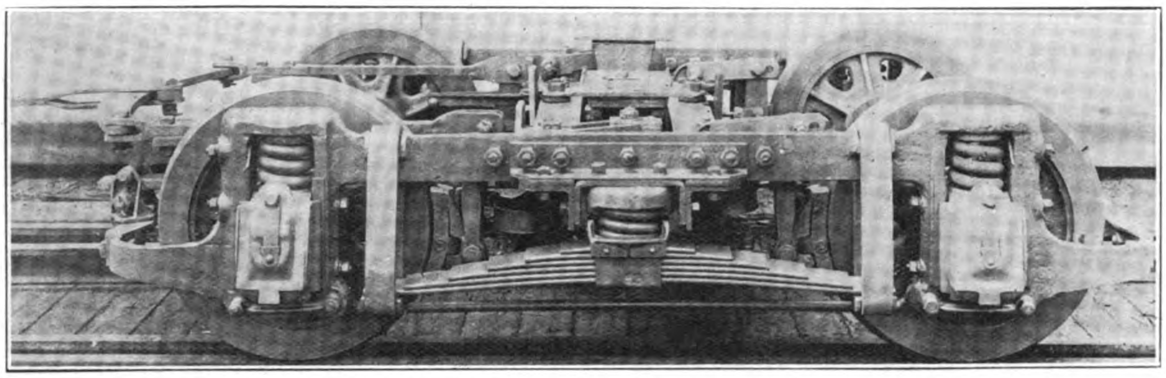
**Interior of Birney Safety Car for Dairen, made by the Brill Company**

When it was evident that the electric motor was best adapted to the propulsion of street railway cars, the advantage of a truck independent of the carbody was recognized, and the development of the first system of electric car trucks resulted from the inventions of Mr. John A. Brill, the youngest son of the founder of the company. The J. G. Brill Company had its beginning in 1868 when Mr. John G. Brill and his son, G. Martin Brill, formed a partnership known as J. G. Brill & Son for the construction of horse-drawn cars, which then constituted the only type of street railway equipment known. Therefore, while the Brill Company may not be the oldest carbuilder in existence, it has the record in America for continuous service.

In addition to its large Philadelphia plant it owns and operate three other large plants, American Car Company, St. Louis, G. C. Kuhlman Car Company, Cleveland, and the Wason Manufacturing Company, Springfield, Mass., together with a plant at Gallardon, 40 miles west of Paris, France, known as the Cie J. G. Brill. The Brill plants in the United States cover a total area of 92 acres (12,369 *tsubos*).

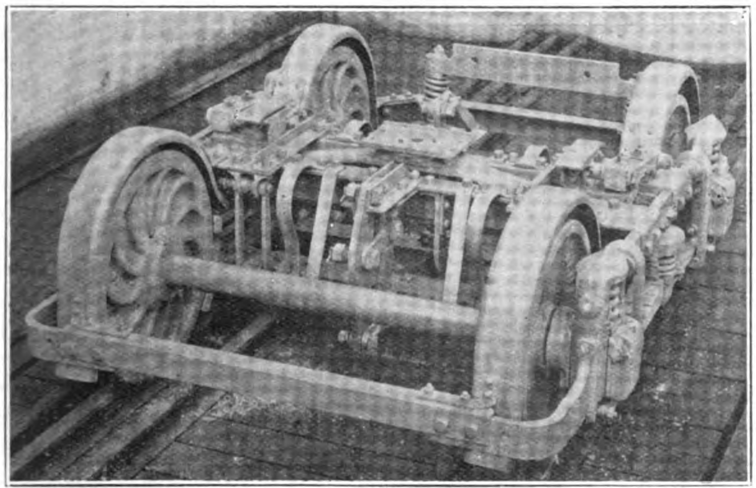
The ability of the Brill organization to construct horse car equipment to satisfactorily meet the wishes of a rapidly increasing *clientèle* attracted the attention of many foreign companies to this American builder, so that in 1873, the first Brill order of cars for operation outside of the United States was shipped into Mexico. Commencing with this shipment of street railway equipment abroad to practically every country in the world has resulted in a most extensive foreign business.

The South Manchurian Railways at Dairen have in operation five (5) Birney safety cars which were constructed in

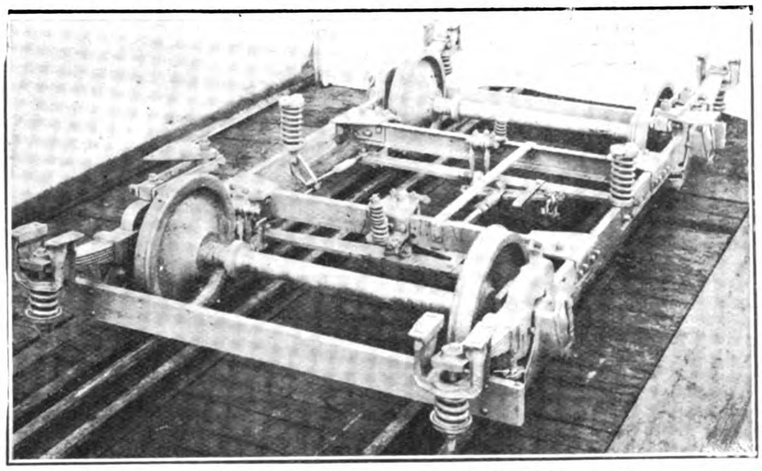


Brill 77-E Trucks for Osaka Tramways

the Brill plant in Philadelphia. These cars represent the "last word" in street cars. To their comparatively light weight is attributed an appreciable saving in power consumption and other operat-

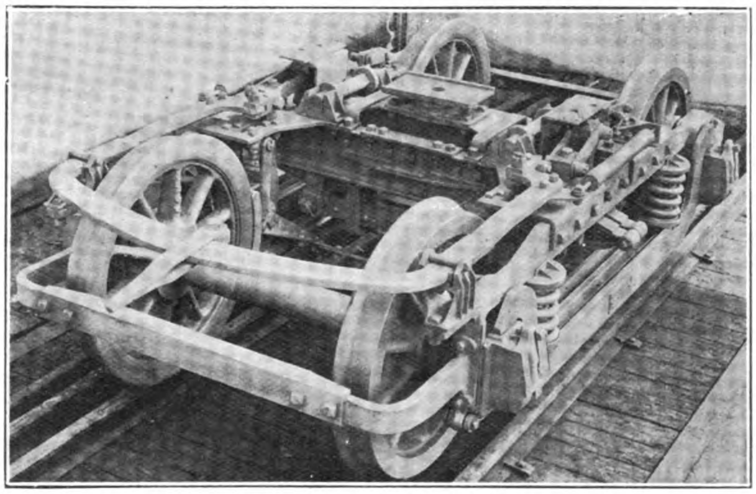


Brill 76-E Trucks for the Keio Electric Tramways, Japan



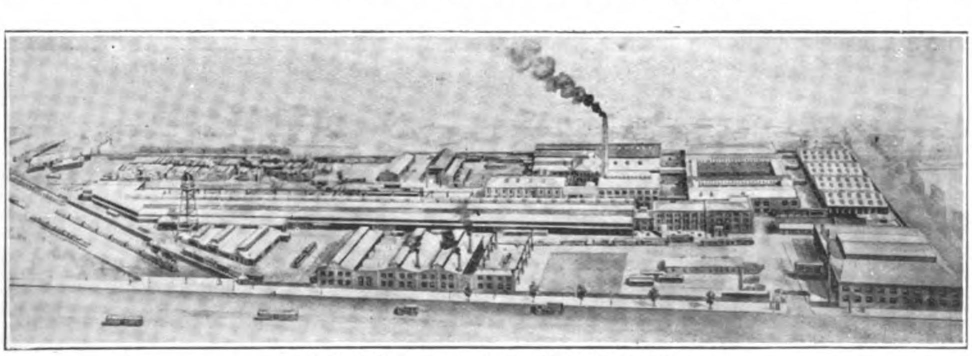
Standard Birney Safety Car Truck: Brill No. 79-E

ing costs. Being adapted to one-man operation, the mechanical devices which control the motors and brake equipment have been so interlocked that their operation is simplified and the "one-man crew" has less to do in their actual operation. The same handle which applies the air-brakes also opens and closes the air-operated doors and, at the same time, when necessary sands the track. In order to guarantee utmost safety, it is necessary for the operator to keep his hand upon the controller handle which includes the "dead man's" feature.



Brill 26-MCB Trucks for the Nankai Railway, Japan

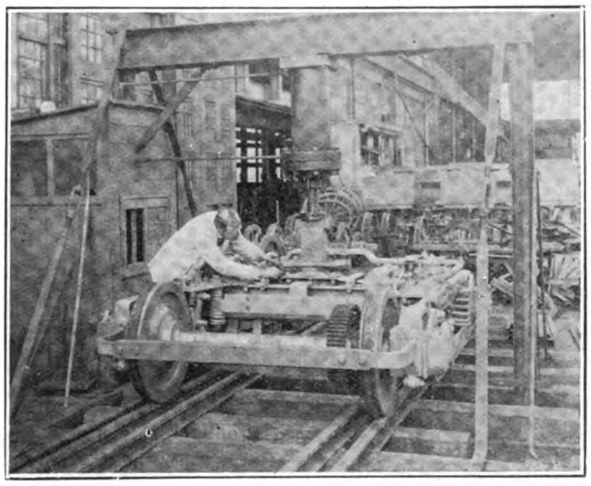
Upon the removal of his hand in an emergency without any further action on his part the power is automatically shut off, the air brakes applied and the pressure on the door engines released so that they may be opened by hand. A foot valve is provided to relieve the strain on the motorman. When this foot valve is depressed the hand may be removed from the controller without setting the emergency equipment in action but if the foot is removed, this same automatic operation of the safety devices occurs.



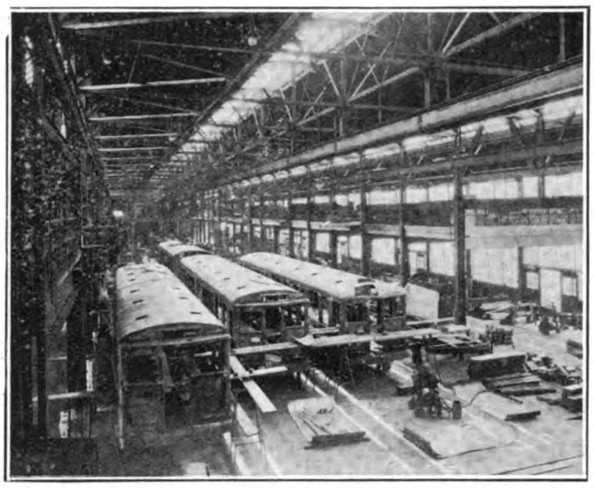
Philadelphia Plant of the Brill Company

Also included among the products of this American firm has been many large truck orders for service on the most important electric railways in Japan. A few of these are represented by the accompanying illustrations of high-speed trucks for Nankai, two-motor city trucks for Keio and long wheel-base small wheel-trucks for Osaka.

An idea of the extent to which Brill cars are used in the United States is given by the fact that of the 14,000,000,000 passengers carried annually by electric railways, which is ten times more than those carried by the steam railways, three-fifths of them ride in Brill cars, and it is practically impossible to ride on the cars in any city of importance without coming in contact with equipment built either by the Philadelphia plant or one of the sub-

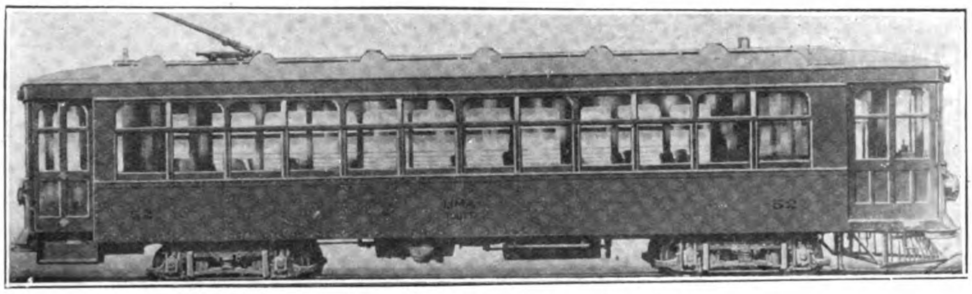


Testing Brill Trucks for Spring Capacity by the use of Hydraulic Testing Machines



Interior of Steel Car Department, Brill Works

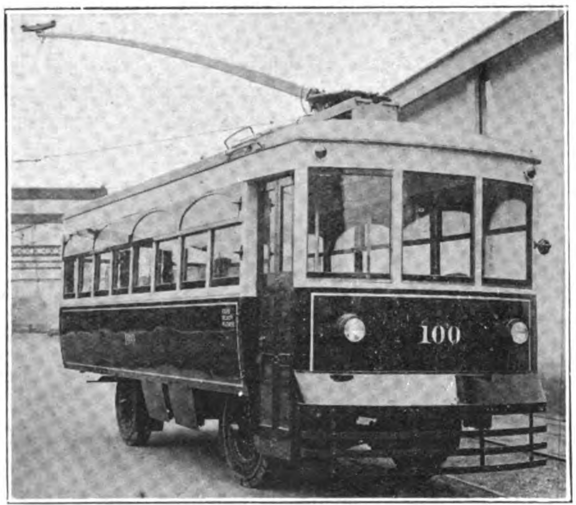
sidiary plants owned by the Brill Company. Up to the present time over 50,000 cars and as many as 150,000 trucks have been shipped from the Brill plants.



New Light Weight Brill Interurban Car

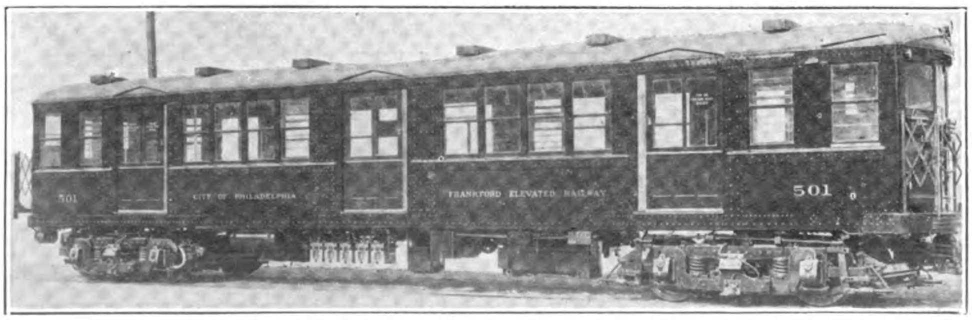
Recently the gasoline-driven motorbus has found a place in America's transportation system. While the facilities of the Brill organization are primarily devoted to the construction of electric railway equipment, this company is actively interested in all types of transportation vehicles. Therefore, its subsidiary plant at Cleveland is almost entirely occupied in the production of steel frame motorbus bodies.

Also approximately 80 per cent. of the gasoline-driven motor rail cars ordered in 1922 for steam railroad service in the United States have been shipped from the Brill plant in Philadelphia. The low operating cost of these units make it possible for branch steam rail-roads to meet the transportation demands of the district served by their lines and enables them to stimulate traffic by the operation of more cars, giving increased service. The car illustrated weighs about 27,000-lbs. complete, seats 46 passengers and is operated by a 68 h.p. gasoline engine.



Brill Rail-less Car

Another recent innovation in the public transportation field is represented by the Brill rail-less car. While retaining the economy characteristic of electric propulsion, this vehicle has equal flexibility in operation on the highway which is possessed by the motorbus. Thisvehicle is particularly adapted as a feeder to electric railways, for extensions of railway lines where it is not certain that there is sufficient demand for transportation to warrant the laying of steel rails and the operation of railway cars.



All Steel Brill Car for the Frankford Elevated Railway

The electric railways in the United States have recognized that their high cost of operation has been due largely to the use of heavy rolling stock. The remarkable success attending the introduction of the safety car has turned the attention of the interurban lines to the possibilities of light-weight equipment. Consequently, much attention is now being given to the development of cars which will meet the high-speed requirements of intercity service from the standpoint of durability and comfortable riding and, at the same time, obtain the maximum reduction in operating costs. Many cars have been placed in service on interurban lines where the speed requirements are low but the most recent development has been the type of car now in service on the Western Ohio Railway where a speed of 45 miles per hour is reached. These cars are of combination passenger and baggage type and were produced by the Brill plant at Cleveland. They are mounted on Brill 77-E low level trucks, weigh 33,000-lbs. complete and seat 48 passengers.

The reputation which has been built up by the Brill Company in America is so well established that its name and street cars are practically synonymous.

This reputation has also spread throughout the world. In Central and South America, Europe, Asia and Africa, there are in existence rolling through the streets of some of the most principal cities street cars which bear testimony to the enterprise of this foremost American carbuilder.

# Amazing Growth of Japanese Shipping

## The Story of the O.S.K.

A STUDY of the balance sheet and accounts of the Osaka Shosen Kaisha, familiarly known all over the Pacific as the "O.S.K.," as shown in a recent issue of *Fairplay*, brings forcibly to mind the tremendous progress made by Japanese shipping during recent years.

This company started in 1884 with an authorized capital of Y.1,800,000 ($900,000), of which a little more than half was paid up, and a fleet of 92 steamers, aggregating 16,458 tons gross, running between ports on the Inland Sea of Japan.

It was formed by a combination of many small independent steamship owners, mostly operating from Osaka, and was directly encouraged by the Japanese government, which was anxious to put an end to the reckless competition on freight rates then going on.

### Battle for Life

The original capital was represented principally by the steamers which were turned over to the company, all small boats, averaging less than 200 tons each, many of them badly in need of repairs, as the low freight rates had prevented the necessary expenditures, being made for their upkeep.

The first few years of its existence the company had a hard struggle, owing to the strong competition of the individual owners who had remained outside the combine and the lack of sufficient capital to replace its old, worn-out steamers with more efficient tonnage.

In 1888, although its freight and passenger earnings had increased about 50 per cent. over 1884, its fleet had decreased to fifty-nine steamers of 13,156 tons gross.

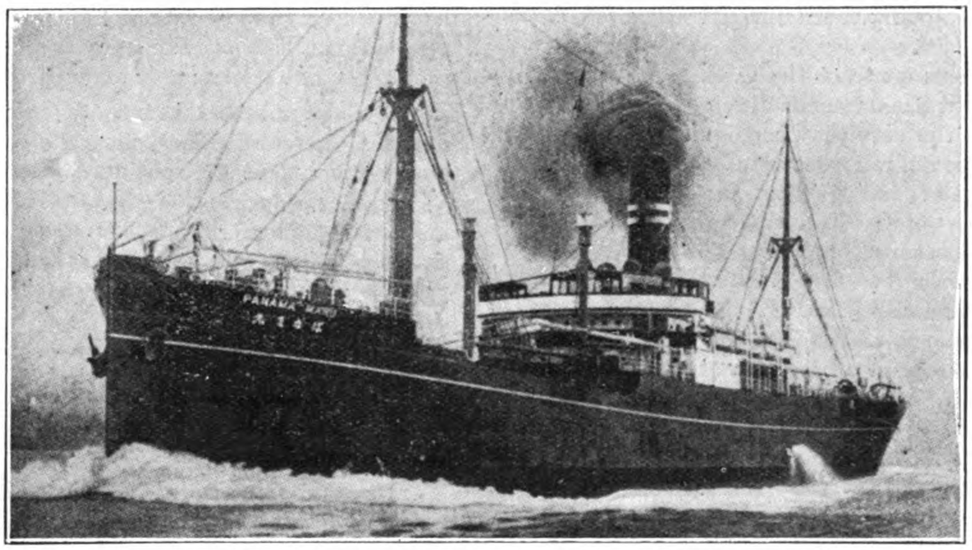
In that year, however, in response to the appeal for assistance, the Japanese government granted it an annual subsidy of Y.50,000 ($25,000), running for eight years. This subsidy was granted on the condition that the company keep open, free of charge, the regular routes on which mails were to be carried and also that it should improve its fleet by gradually desposing of its older vessels and adding new ones. From this time on the company began to go ahead, although its progress was comparatively slow for the next few years.

### A Navigation Law

In 1896 the Japanese navigation encouragement law was passed, providing for a general shipping subsidy based on mileage covered and tonnage. This was superseded in 1910 by the ocean lines subsidy law, granting a subsidy to steel liners of over 3,000 tons gross and twelve knots speed, running to North and South America, Europe and Australia.

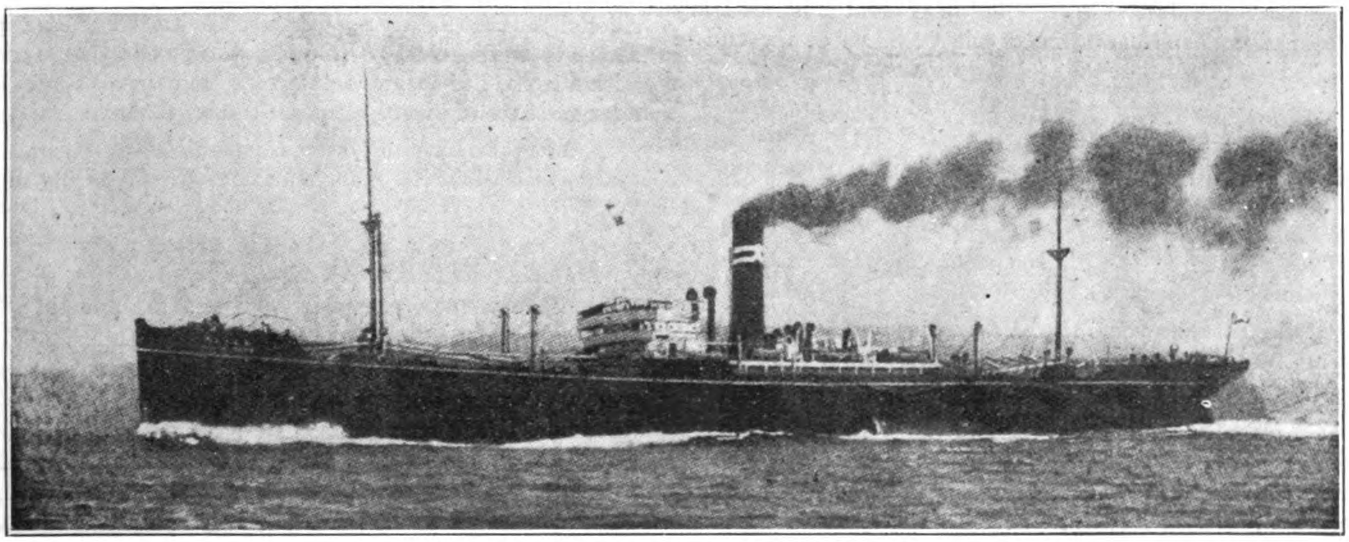
The latter law also provided that the subsidized ships must con-

## TYPES OF O. S. K. STEAMERS



**Passenger and Cargo Steamer "Panama Maru"**

**400-ft. by 51-ft. by 32-ft. 6-in. moulded ; 2-Triple expansion engines (3 Boilers—14-ft. 3-in. by 11-ft. 6-in.; 1 Boiler—12-ft. by 11-ft. 6-in.) by 200-lbs. pressure; Water ballast 1,797 tons; Cubic capacity 343,000 cft. ; Total bunker 1,500 tons ; 13 Steam winches ; Gross tonnage 5,000 tons; Deadweight 7,130 tons ; Speed 14 knots ; Passengers : 1st class.........9, 3rd class.........186.**



**Passenger and Cargo Steamer "Africa Maru"**

**475-ft. by 61-ft. by 32-ft. 9-in. to upper deck moulded. Shelter deck type ; 2-Triple expansion engines ; 5 Boilers ; 15-ft. by 12-ft. by 200-lbs. pressure ; Water Ballast 2,368 tons ; Cubic capacity 530,600 cft.: Total bunkers 2,700 tons ; 14 Steam Winches ; Gross Tonnage 9,500 tons; Deadweight 11,000 tons; Speed 16½ knots; Passengers: 1st class.........42, 3rd class.........304**

form to government requirements, especially with regard to freight and passenger rates and general conduct of business. Up to the end of 1916 over Y.144,000,000 ($72,000,000) had been paid out by the Japanese government in shipping subsidies under these two laws.

In 1890 the company began its first run outside of the Japanese coasting trade with a line to Korea. This was followed by a line to Formosa in 1896, gradually followed by services to the various Chinese ports.

The company suffered from the prevailing depression in shipping after the war between Japan and China, but at the end of 1898 had a fleet of 54 steamers, of 40,139 gross tons, averaging less than 800 tons each. With its various services gradually extending, strongly aided by the government subsidy, it soon, however, began to make better progress.

The O. S. K. first came to the Pacific coast of America in 1909. The Chicago, Milwaukee & St. Paul Railroad had built through to the coast in that year and a contract was made by it with the Osaka Company providing for a steamship service from Tacoma and Seattle to the principal Japanese and Chinese ports.

A similar contract had been made several years earlier between the Great Northern railroad and the Nippon Yusen Kaisha (Japanese Mail Steamship Co.) Both these contracts are still in existence, despite the efforts of the shipping board during the last few months to have them cancelled.

On the strength of this contract the O. S. K. contracted for six cargo steamers of about 8,000 tons deadweight each, to be built in Japanese yards, and the service was begun by the *Tacoma Maru* in 1909. These boats ran successfully for several years, practically without accident, but some of them have since been replaced by larger steamers of 12,000 tons deadweight capacity.

In 1913 the O. S. K. started a regular line to British India and in 1916 a line to the east coast of South America, by way of the Cape of Good Hope, and also a line to Australia.

It began sending steamers to Europe soon after the outbreak of the war, but its regular European service did not start until the end of 1918 and shortly afterward it began despatching its steamers from New York to the Far Eastern ports, by way of the Suez Canal.

In 1922 the Osaka Shosen Kaisha operated in all forty-four services, including its various Japanese home services, its lines to North and South China, Korea, Formosa, the Dutch East Indies, Australia, Bombay and Calcutta, Europe and South America.

It operated three lines of steamers in the North American trade, the transpacific line from Puget Sound, the New York line and a service from New Orleans, by way of the Panama Canal. Its fleet consisting of one hundred and forty-two steamers of 432,541 tons gross.

But fully to appreciate the great progress which has been made by this company and Japanese shipping in general it is necessary to compare the financial condition of the O. S. K. at the end of 1913 with its latest figures at the end of June last:

| | Dec. 31, 1913 Yen. | Ju. 30, 1922. Yen. |
|---|---|---|
| Capital (paid-up) .. | 16,500,000 | 62,500,000 |
| Debentures .. .. | 7,100,000 | — |
| Total reserves .. .. | 5,514,917 | 43,433,960 |
| | 109 Steamers | 142 Steamers |
| Fleet (tons gross).. .. | 176,913 | 432,541 |

During the last nine years the company has paid dividends at the following rates :—

| | | | | | |
|---|---|---|---|---|---|
| 1914.... | 10% | 1917.... | 45% | 1920.... | 15% |
| 1915.... | 11% | 1918.... | 60% | 1921.... | 10% |
| 1916.... | 24% | 1919.... | 40% | 1922.... | 10% |

This averaged 25 per cent. annually. But as the increases in its capital since 1913 have practically all been made from the reserves, the net return to the stockholders has averaged over 50 per cent. on their 1913 investment.

Of the present fleet, forty-seven steamers, of 216,447 tons gross, were built since 1916, or, in other words, 57 per cent. of the O. S. K. boats are less than seven years old and represent the best type of modern freight liners.

Practically all of these steamers were built in Japan, and when it is considered that the cost of these boats at war prices must have been enormous, contracts for new vessels having been placed in Japan during the war as high as 700 yen per gross ton, the fact that the book value of the fleet at the end of June last stood at slightly over 161 yen ($80.50) per gross ton shows that the company has not neglected its depreciation account while paying its large dividends and accumulating such substantial reserves.

## Hit by Slump

The O. S. K. is suffering to-day from the world-wide slump in shipping, and after setting aside for the six months 4 per cent. on the reduced book value of the fleet for insurance, 5 per cent. for repairs and depreciation at the rate of 4 per cent. per annum on the original cost of the fleet, the net balance amounted to 859,732 yen, so that it was necessary to transfer Y.2,000,000 from the dividend equalization fund, in addition to the balance brought forward from the previous half year, to make up the dividend payment.

But when it is considered that the United States shipping board is losing at the rate of $1,000,000 per week in operating expenses alone, without taking any account of insurance and depreciation, the above figures do not compare unfavorably.

It is also notable that in spite of the wonderful prosperity of the Japanese mercantile fleet, since the outbreak of the war, the Japanese government still continues its subsidy payments, although on a somewhat reduced scale, the O. S. K. reporting the receipt for the six months ending June 30 last of Y.1,132,424 in government navigation bounties, and Y.78,073 in mail transport receipts, being at the rate of about $1,200,000 annually for the two items.

## Huge Assets

The company has liquid assets amounting to Y.29,611,973, consisting of negotiable securities, accounts receivable and cash, and its debts are negligible.

Its semi-annual statement itemizes most clearly its various assets and liabilities, as well as giving in detail its earnings and operating expenses, and contrasts most favorably with the statements of the English companies, in which the value of the fleet and the investments and also the cash and amounts receivable, are so lumped together that even the stockholders themselves have difficulty in finding out what their investment is really worth.

When the strong financial position, efficient modern fleet and complete organization, of this Japanese steamship company is considered it must be admitted that the Osaka Shosen Kaisha is a factor to be reckoned with in the world's carrying trade, and that, with a revival of ocean commerce, it is in a position to obtain even a larger share of business than it to-day controls.

And it also must not be overlooked that the Japanese mercantile marine as a whole has made enormous strides during the last thirty years.

Up to the beginning of the war it was largely stimulated by the government navigation subsidies, as well as by the shipbuilding encouragement act, passed in 1896 and amended in 1910 to cover steel vessels of not less than 1,000 tons gross.

Up to the end of 1916 over Y.15,000,000 ($7,500,000) had been paid out under this act and 182 vessels of over 700 tons gross, totaling 637,230 tons gross, had been constructed. This bounty was discontinued in 1917, owing to the prosperous condition of the industry, but the shipbuilders are now asking that it be reinstated as, in spite of their cheaper labor, they cannot successfully compete with the better equipment of the British and Continental shipyards.

After the outbreak of the war the immense increase of business across the Pacific and the gradual withdrawal of the British ships, their chief competitors in the trade, gave the Japanese an oppor-

tunity which they were not slow to avail themselves of. During the earlier years of the war the large shipments for Russian account created a great demand for tonnage at rapidly advancing rates, and later on the Turkish attacks on the Suez Canal and the submarine campaign in the Mediterranean diverted much of the Southern Asiatic trade to the Pacific coast.

Since the end of 1918 this trade has largely resumed its former route through the Suez Canal and the Japanese have had to look elsewhere for the employment of part of their largely increased fleet.

Some of the other companies in addition to the O. S. K., have established lines to South America and Europe, as well as to the Eastern Coast of America, and in addition to this many modern Japanese freighters are to be found in the tramp trade of the North Atlantic.

### The 1922 Fleet

On June 30, 1922, according to returns issued by Lloyd's Register, the Japanese merchant fleet consisted of 3,325,000 gross tons of seagoing, steel and iron steamers and motor ships and ranked third in the world's mercantile marines, slightly exceeding the French. Of this tonnage 46.1 per cent. was built since 1918, the Japanese possessing a larger percentage of new vessels than any other nation, with the exception of the United States.

And in this connection the figures in regard to the traffic through the Suez and Panama Canals are most instructive.

In the last year before the war the Japanese tonnage represented 1.7 per cent. of the total tonnage passing through the Suez Canal and exactly the same percentage of the Panama Canal tonnage, while in 1920 it had risen to second place at Panama, representing 9.1 per cent. of the total, and had also increased to 9 per cent. of the total tonnage passing through the Suez Canal.

With their fine modern fleet, well managed, efficiently manned and cheaply run, and their complete business organization covering the principal ports of the world, there can be no question but that the Japanese are in a position to successfully compete for an increasing share of the world's carrying trade.

## A French Resurrection

THE resurrection of the Banque Industrielle de Chine is now pretty well assured, the senate having followed the example of the chamber in approving the governmental project for application of the boxer indemnity instalments still due to France to the purpose of paying off its bad debts. These instalments are reckoned at 225,000,000 francs gold, or 562,000,000 francs paper. From this sum 13,000,000 francs gold are to be taken to finance Franco-Chinese educative enterprises, and also 10,000,000 to pay up the shares taken by the Chinese government in the bank but not called, this being really the price of Peking's consent to the scheme. The rest of the money will be used to reimburse creditors of the bank. It is believed it will suffice, and will even leave something over.

According to the latest figures the bank's liabilities amount to 972 million francs paper, as follows :—

| | Francs. |
|---|---|
| Bank of France and consortium of banks in aid of B.I.C. .. .. .. .. .. | 237,000,000 |
| Creditors in Far East .. .. .. .. .. | 474,000,000 |
| Other creditors.. .. .. .. .. .. | 210,000,000 |

As for the assets, they are put at about 500,000,000 francs. A sum of 50,000,000 francs out of these assets has been placed at the disposal of the Company administering the affairs of the bank as working capital. Incidentally, it is stated that out of the 68,000,000 francs due by shareholders (including the Chinese government) on unpaid-up capital, only 12,000,000 has been received to date. It remains to be seen whether the balance will ever be paid, but meantime, thanks to the boxer indemnity, the 500 franc shares are quoted as high as 200.

The unhappy affair, which began two years ago with the closing of the doors of the B.I.C. and has been dragging through the courts and through parliament ever since, thus seems to be drawing to a more or less satisfactory close, with the French reputation in China salved at the expense of the French taxpayer, with Pernotte, the former director and leading spirit of the whole enterprise, in prison, and with the prospect of a new B I.C. under the control of the French government, but with a one-third Chinese participation, rising out of the ashes of the old one.

## Sinclair Sakhalien Interest Protected

IN the opinion of officials of the American government, the Sinclair oil interests in Sakhalien will be fully protected. The Japanese government, it was declared, will throw no obstacle in the way of the Sinclair company in exploitation of the Sakhalien oil fields.

John Hays Hammond, who has made an investigation of that district and knows its oil possibilities, and recently mentioned as ambassador to Japan, believes the Japanese government will give every consideration to development of the resources of Sakhalien. While skeptical of oil possibilities there, he declared the Sinclair interests are evidently willing to invest a considerable sum in exploitation of the fields.

" The section in which the Sinclair interests are located," said Mr. Hammond, " has been investigated before, and oil possibilities were not alluring. I am not trying to discredit reports there are valuable deposits there, but surveys made in the past did not disclose remarable potentialities."

Mr. Hammond also exploded another theory of Chinese coal producing possibilities, and asserted they are not so extensive as has been thought. He denied China could supply the world with coal for years and added it could furnish only enough for Japanese and Chinese consumption.

" Japan," Mr. Hammond said, " Should be permitted to exploit the coal and iron possibilities of China, Mongolia and the Far East republic."

### FOR A GREATER TOKYO

(*Continued from page 273*)

representative of all Japanese cities and towns of more than 10,000 inhabitants. This association should hold an annual convention ; it should have able officers and a powerful executive committee. It should prepare drafts of laws and ordinances for presentation to the imperial government. It should have able representatives to speak for the cities and towns before the committees of the imperial diet. Such an association would be great force in the advancement of self-government and home rule for, Japanese cities and towns. No cabinet, one matter how powerful could utterly disregard its suggestions and recommendations.

The grand conclusion must be therefore that the key to the creation of a splendid capital in Tokyo lies in the hands of the imperial government. If the city to be made worthy of the empire, then the imperial government must ither establish a powerful consolidated government for Greater Tokyo or it must itself assume direct responsibility for planning and building the new capital.

Such are the conclusions to which I have been led by an independent examination into the local situation.

They are based upon a long study of the experience of London, Paris, Berlin, and New York in their attempts to solve the pressing problems of administration inevitably presented by a great city. The details supporting my general conclusions are to be found in my report.

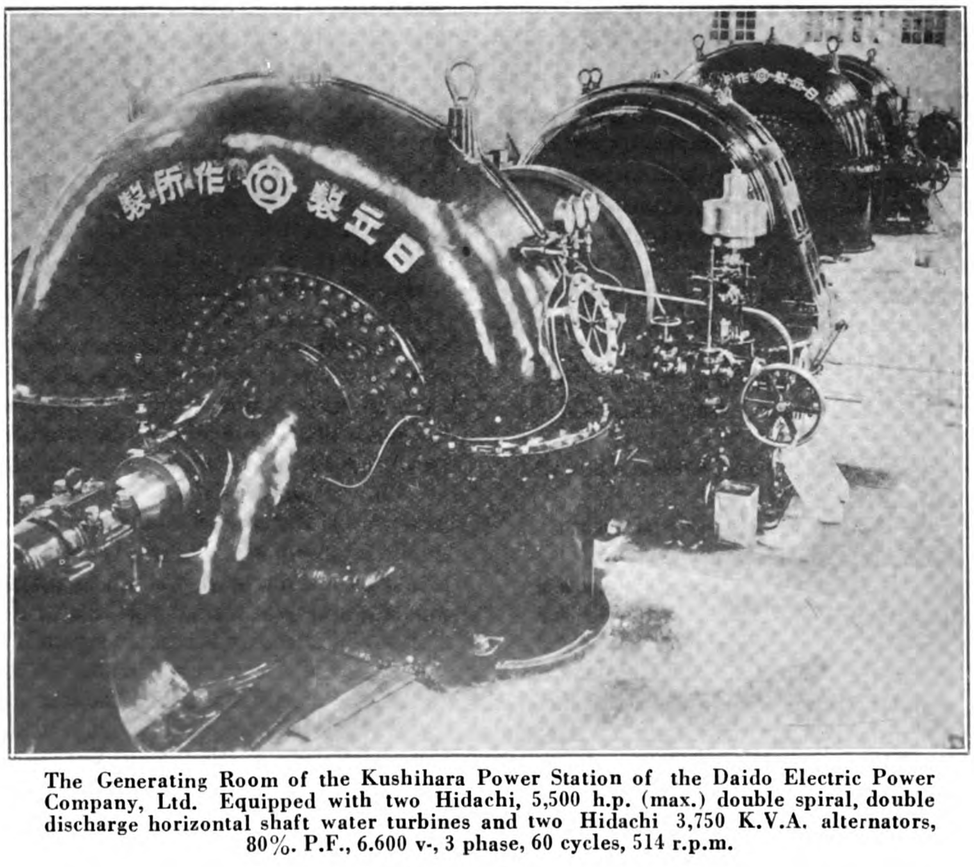
# A Super-Power Zone in Japan

## The Program of the Daido Electric Power Company, Ltd.

HEADING a combination of fourteen associated power companies and thirteen power consuming enterprises with a capital exceeding Y.370,000,000 (Y.176,000,000 paid up), the Daido Electric Power Company has embarked upon the gigantic task of creating a super-power zone in the most intense manufacturing district of Japan. Taking Mount Ontake, 75 miles northeast from Nagoya, in the heart of the Japanese Alps, as a centre of distribution, a circle of 75 miles radius embraces the central portion of the main island and includes all the important rivers and basins capable of hydro-electric development. The territory within the circle embraces the principal power markets of Japan, while a circle with 150 miles radius includes *all* the great manufacturing districts. On the east is Tokyo, Yokohama and their surrounding districts: to the south, Nagoya, Hamamatsu, Yokkaichi, Gifu, Toyohashi, Shidzuoka, Nara and their environs and on the west, Osaka, "the Manchester of Japan," Kyoto, Kobe, and their sub-districts. Within this circle, it may be said, lies the great manufacturing centres of Japan, in which, as time passes, the industrial development of the empire must be accommodated.

Mr. M. Fukuzawa,
President of the Daido
Electric Power Co., Ltd.

In the centre of this circle, the heart of Japan, are many rivers of sharp gradient having their sources in the numerous small mountain lakes fed by the snows of the Japanese Alps and an abundant rainfall. It is here that Japan must seek the solution to the ever pressing problem of fuel and rising costs of labor. To develop these great resources of national wealth and enable Japanese industries to compete successfully in the markets of the world, the Daido Electric Power Company together with its associated companies, has entered into a construction program which calls for an increase of 82,080 kilowatts to their present output of 42,110 k.w. and 119,200 k.w. under actual construction. These plants will furnish power over a gigantic network of transmission lines covering the middle western part of Japan and deliver current to Osaka over 212 miles of 154,000 volt lines. Similar lines will be extended to Tokyo, and when completed, the entire transmission system will approximate 1,100 miles in length and located so as to be available for the electrification of the state railways.



The Generating Room of the Kushihara Power Station of the Daido Electric Power Company, Ltd. Equipped with two Hidachi, 5,500 h.p. (max.) double spiral, double discharge horizontal shaft water turbines and two Hidachi 3,750 K.V.A. alternators, 80%. P.F., 6.600 v-, 3 phase, 60 cycles, 514 r.p.m.

One of the interesting features of this development scheme is the part taken by American manufacturers of electrical machinery in furnishing the equipment for the Daido plants. Most of the equipment installed in the power plants, substations and transmission lines, including water turbines, generators, switchboards, transmission towers, insulators and other machinery are of American manufacture. To date, the foreign machinery and equipment used in the Daido construction work amounts in value to over Y.14,000,000, of which, 90 per cent. is from America. The policy of the company is to co-operate as far as possible with American capital and to reciprocate in the purchase of American equipment. As will be noted in the list of equipment of the various power stations belonging to the company, the main turbines and generators have been supplied in large part by American manufacturers with a liberal patronage to home and European concerns.

As this combination ranks as one of the largest corporations of its kind in the world, the following outline of its program will convey some idea of the magnitude of its operations and the prospects for an enlarged market for electrical machinery manufacturers.

The present Daido Electric Power Company is the result of a combination of the Kiso Electrical and Industrial Company established in 1918 with a capital of Y.18,600,000, the Osaka Transmission Company established in 1919 with a capital of Y.20,000,000, and the Nippon Hydraulic Company established in 1919 with a capital of Y.50,000,000. Mr. Fukuzawa, now president of the Daido, was president of the first two companies, and Mr. Yamamoto, now a director of the Daido, president of the last named company. The purpose of all these companies was to transmit power to Osaka, Kyoto and their surrounding districts—one from the Kiso River and the other from the northern part of the country. For the purpose of bringing about a desirable adjustment of their various competing activities these men, together with other pro-

minent capitalists, came together and in November, 1920, decided to establish a limited corporation under the name of the Daido Electric Power Company, Limited. The head office was located at Tokyo with branches at Nagoya and Osaka and the following directorate elected: President, Momosuke Fukuzawa: Vice-President, K. Miyazaki; Managing Directors, J. Masuda, K. Ota, S. Mine, S. Kondo and H. Sekiguchi; Auditor, C. Asano; General Manager and Director, S. Murase; Assistant Manager, S. Moroh.

The company is capitalized as follows:

| | Yen. |
|---|---|
| Authorized Capital, Par Value Y.50 .. .. | 100,000,000 |
| Capital Paid-up: | |
| Preferred Stock, 372,000 shares @ Y.30 .. | 11,160,000 |
| Class "A" Common Stock, 120,000 shares @ Y.25 .. .. .. .. .. .. | 3,000,000 |
| Class "B" Common Stock, 1,508,000 shares @ Y.20 .. .. .. .. .. .. | 30,160,000 |
| Total Yen | 44,320,000 |

There is outstanding Y.29,140,064 of 7 per cent. debentures. After paying interest on the debentures in May, 1922 there was paid 6.4 per cent. dividend on the common and preferred stocks and 6 per cent. additional dividend on the preferred stock.

## Relation Between the Daido and the Toho Electric Power Company

The relations between these two companies have been very close since their establishment and at the formation of the Daido in 1920 a mutual arrangement was made whereby the Daido undertook the duty of power development and transmission and the Toho to act as the distributing agent in direct control of the demands of consumers. The relation between the two companies goes back to the foundation of the Kiso Electric Power and Steel Company which developed in 1918 with a capital of Y.17,000,000 from the Nagoya Electric Light Company, the predecessor of the present Toho Electric Power Company. The Kiso Electric Power and Steel Company was later renamed the Kiso Electrical and Industrial Company, and in 1920 the Daido was formed by combining this organization with two other companies. The distribution of the stock of the Daido held by the Toho and its stockholders is as follows: Shares held by the Toho, 529,150: Shares held by its stockholders, 632,440: Total, 1,161,590, or, more than one-half of 2,000,000 total shares are at present held by the Toho Electric Power Company and its shareholders.

## Associated Companies

The distinctive feature of the Daido is the union of capital combining all associated companies which possess available sites for hydro-electric power development in well located positions in relation to the power market. In addition to the financial combination, the company forms a ring of interlocking corporations connecting with manufacturing and industrial enterprises, the importance of which will be gathered from the following properties under the managing control of Mr. Fukuzawa which form the combination.

ASSOCIATED POWER PRODUCING COMPANIES

| Name of Company | Location | Authorized Capital Yen. | Capital Paid-up Yen. |
|---|---|---|---|
| Toho Electric Power Co. ... ... | Tokyo | 139,821,200 | 99,994,235 |
| Hakusan Water Power Co. ... ... | ,, | 10,000,000 | 2,500,000 |
| Nōhi Electric Co. ... ... ... | Nagoya | 3,000,000 | 750,000 |
| Bisan Electric Power Co. ... ... | ,, | 5,000,000 | 1,250,000 |
| Yahagi Water Power Co. ... ... | ,, | 5,750,000 | 3,450,000 |
| Fukui Electric Power Co. ... ... | Fukui | 500,000 | 125,000 |
| Tateyama Water Power Co. ... | Toyama | 2,000,000 | 1,500,000 |
| Hokuriku Transmission Co.... ... | ,, | 2,000,000 | 500,000 |
| Tenryugawa Electric Power Co. ... | Hamamatsu | 50,000,000 | 500,000 |
| Gifu Electric Power Co. ... ... | Tokyo | 5,000,000 | 1,250,000 |
| Nanshin Electric Co. ... ... | Nagano | 1,000,000 | 500,000 |
| Kameoka Water Power Co. ... | ,, | 5,000,000 | 1,250,000 |
| Oshirakawa Water Power Co. ... | ,, | 2,000,000 | 500,000 |
| Nagaragawa Water Power Co. ... | Gifu | 1,000,000 | 250,000 |
| | | 232,071,200 | 114,319,235 |

ASSOCIATED POWER USING COMPANIES

| Name of Company | Location | Authorized Capital Yen. | Capital Paid-up Yen. |
|---|---|---|---|
| Daido Fertilizing Co. ... ... | Fukui | 3,000,000 | 2,520,000 |
| Daido Steel Works ... ... ... | Nagoya | 1,000,000 | 1,000,000 |
| Electric Steel Works ... ... | Tokyo | 2,788,000 | 1,644,000 |
| Hokoku Cement Co. ... ... | Nagoya | 7,500,000 | 4,700,000 |
| Nagoya Refrigerating Co. ... ... | ,, | 150,000 | 150,000 |
| Kitayena Railway Co. ... ... | ,, | 2,000,000 | 200,000 |
| Tokai Soda Mfg. Co.... ... ... | ,, | 1,250,000 | 662,500 |
| Aichi Electric Railway Co. ... ... | ,, | 15,162,500 | 4,675,000 |
| Tokai Electrode Mfg. Co. ... ... | Tokyo | 1,000,000 | 525,000 |
| Yahagi Cableway Co. ... ... | Gifu | 250,000 | 125,000 |
| Yahagi Reclaiming Co. ... ... | ,, | 500,000 | 250,000 |
| Nagoya Warehouse Co. ... ... | Nagoya | 3,600,000 | 900,000 |
| Togen Industrial Co. ... ... | ,, | 320,000 | 320,000 |
| | | Y.38,520,500 | Y.17,671,500 |

Briefly the total capital of this great combination exceeds Y.370,000,000 and the amount paid up is over Y.176,000,000.

## Supply and Demand of Power in Central Japau

On the mainland of Japan there are 31 prefectures, including 15 large cities and about 200 towns. From the point of view of supply and demand of power, it may be divided into the following three divisions: I, Tokyo, Yokohama and their surrounding districts; II, Nagoya and locality; III, Osaka, Kobe, Kyoto and their surrounding districts.

It is estimated that these three divisions will require approximately 70 per cent. of the total power demand on the mainland. A statement as to the supply of power to these districts up to June, 1922 is:

| | Steam Power | Water Power | Total Present Supply |
|---|---|---|---|
| Division I ... | 15,000 k.w. | 200,000 k.w. | 215,000 k.w. |
| ,, II ... | 10,000 ,, | 60,000 ,, | 70,000 ,, |
| ,, III ... | 130,000 ,, | 50,000 ,, | 180,000 ,, |
| | 155,000 k.w. | 310,000 k.w. | 465,000 k.w. |

According to the statistical report of the government since 1911 the annual rate of power demand in these three divisions is as follows: I, 20,000 k.w.; II, 10,000; III, 20,000; Total, 50,000 k.w.

With the above ratio of annual increase of power demand, total requirements for each division at the end of five years and ten years would be as follows:

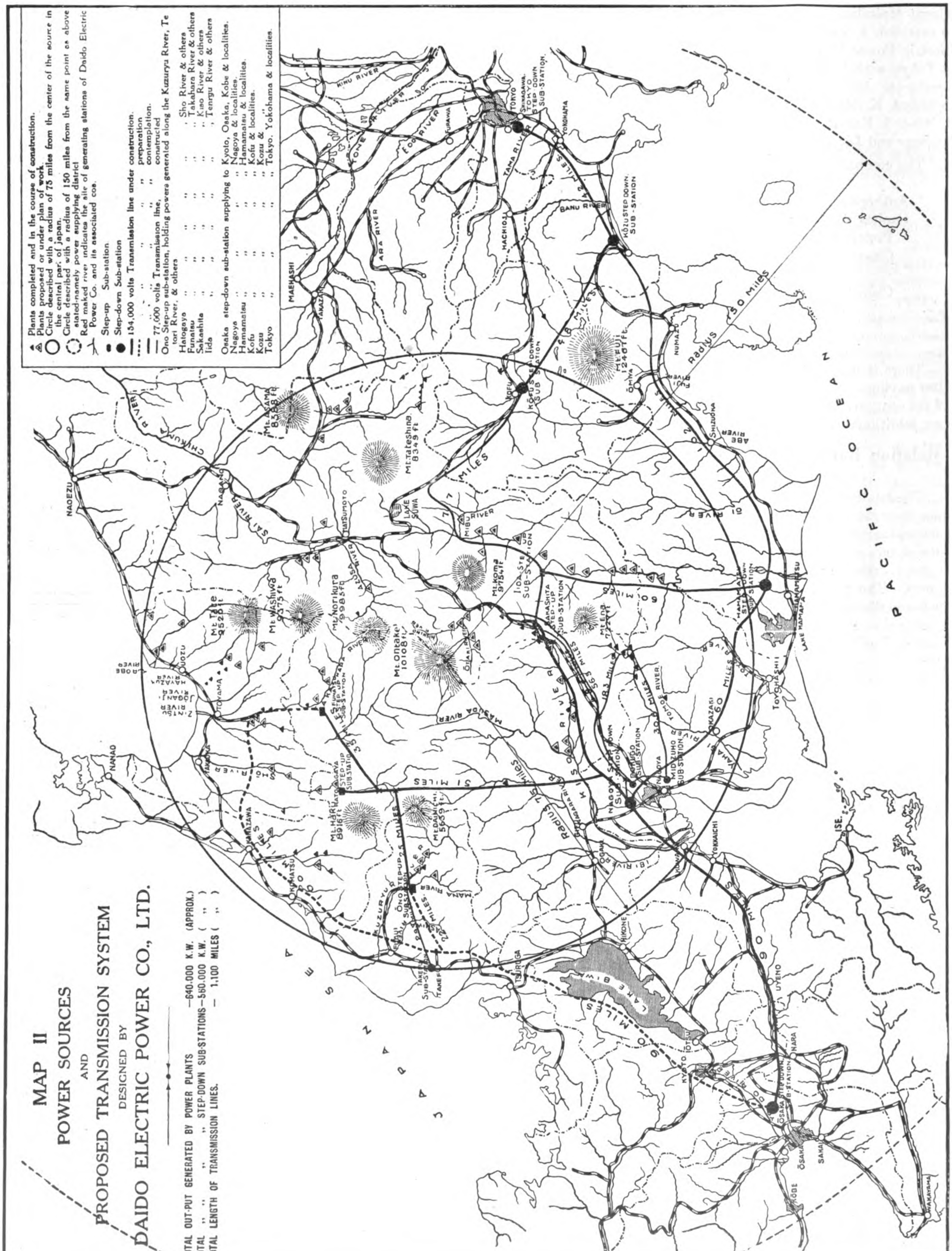
| | Present Supply | Total Requirements after 5 Years | Total Requirements after 10 Years |
|---|---|---|---|
| Division I ... | 215,000 k.w. | 315,000 k.w. | 415,000 k.w. |
| ,, II ... | 70,000 ,, | 120,000 ,, | 170,000 ,, |
| ,, III ... | 180,000 ,, | 280,000 ,, | 380,000 ,, |
| Total Requirement ... | 465,000 k.w. | 715,000 k.w. | 965,000 k.w. |
| Total Increase | — | 250,000 ,, | 500,000 ,, |

## Power Requirements for Railway Electrification

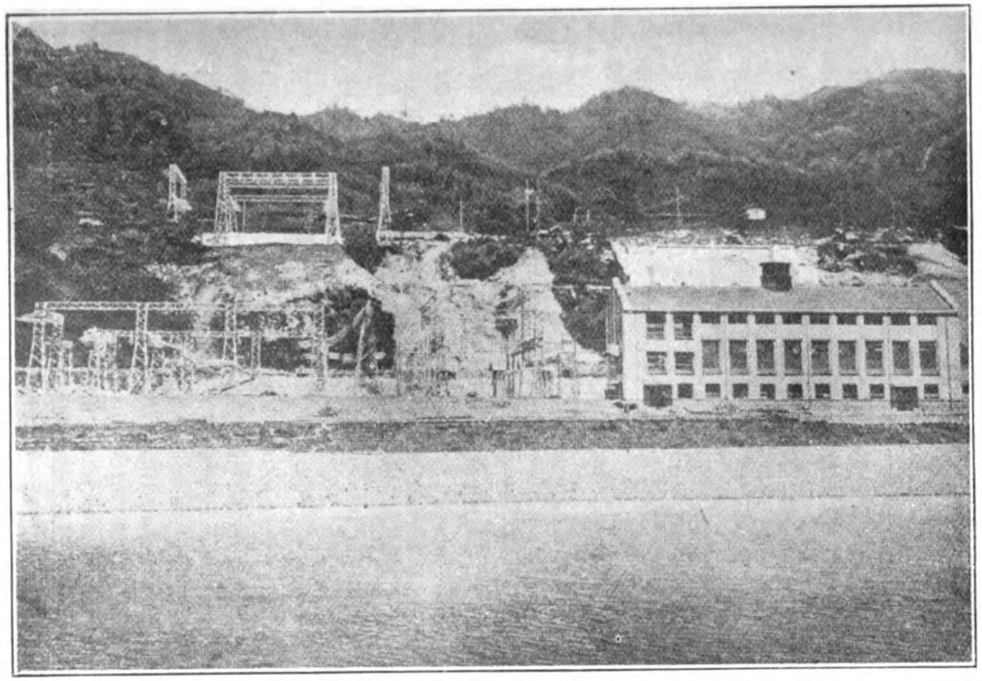
A very important matter to be considered is the power which will be required for railway electrification. The work of electrifying the imperial government lines is expected to be under way in the very near future. It is a question whether the supply of power will be furnished by existing public service corporations or by new generating system to be built by the government. The Daido's program, however, is based on the belief that the final conclusion will result in the purchase of power from existing operating companies.

The estimated power requirements for electrification of the various railroad sections in Central Japan are as follows:

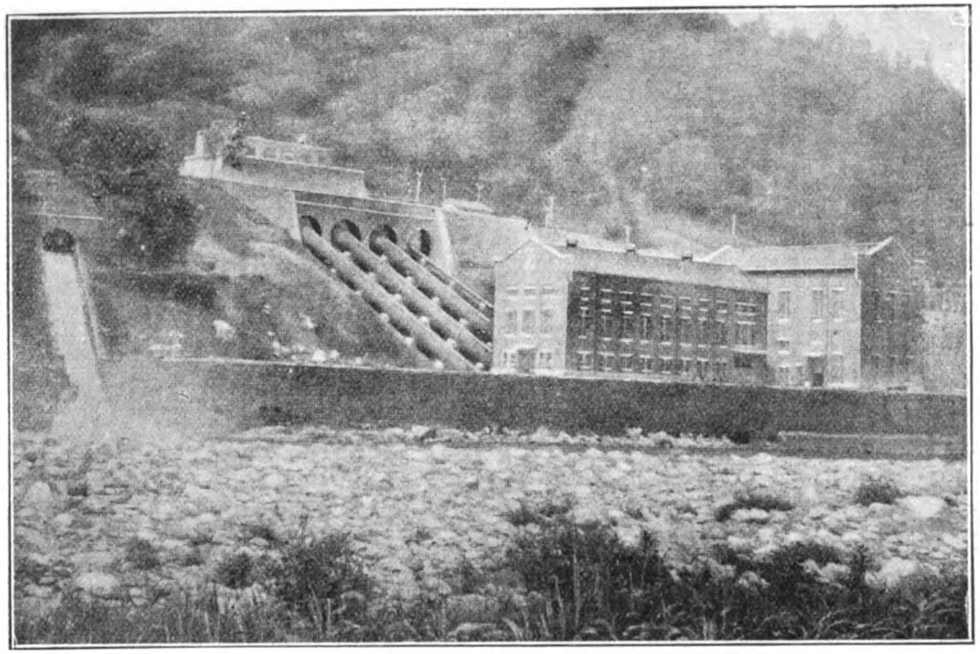
| | Miles | K.W. per Mile | Power Required |
|---|---|---|---|
| Tokaido Lines ... ... | 374 | 200 | 74,800 |
| Chuwo ,, ... ... | 301 | 150 | 45,150 |
| Hokuriku ,, ... ... | 228 | 150 | 34,200 |
| Kansai ,, ... ... | 119 | 150 | 13,350 |
| Sangu ,, ... ... | 45 | 150 | 6,750 |
| Tokyo and vicinity ... | 197 | 150 | 29,550 |
| Osaka, Kyoto and vicinity | 150 | 150 | 22,500 |
| Total ... ... | 1,414 | | 226,300 |


MAP II
POWER SOURCES
AND
PROPOSED TRANSMISSION SYSTEM
DESIGNED BY
DAIDO ELECTRIC POWER CO., LTD.
TOTAL OUT-PUT GENERATED BY POWER PLANTS —640.000 K.W. (APPROX.)
TOTAL " " " " STEP-DOWN SUB-STATIONS—560.000 K.W. ( " )
TOTAL LENGTH OF TRANSMISSION LINES. — 1.100 MILES ( " )
Plants completed and in the course of construction.
Plants proposed or under plan of work.
Circle described with a radius of 75 miles from the center of the source in the central part of japan.
Circle described with a radius of 150 miles from the same point as above stated-namely power supplying district
Red maked river indicates the site of generating stations of Daido Electric Power Co. and its associated cos.
Step-up Sub-station
Step-down Sub-station
134,000 volts Transmission line under construction.
" " " " " preparation
" " " " " contemplation.
77,000 volts Transmission line, constructed
Ono Step-up sub-station, holding powers generated along the Kuzuryu River, Tetori River, & others
Hatogaya " " " " " , Sho River & others
Funatsu " " " " " , Takahara River & others
Sakashita " " " " " , Kiso River & others
Iida " " " " " , Tenrgu River & others
Osaka step-down sub-station supplying to Kyoto, Osaka, Kobe & localities.
Nagoya " " " , Nagoya & localities.
Hamamatsu " " " , Hamamatsu & localities.
Kofu " " " , Kofu & localities.
Kozu " " " , Kozu & "
Tokyo " " " , Tokyo, Yokohama & localities.
JAPAN SEA
PACIFIC OCEAN
Radius 75 Miles
Radius 150 Miles
Mt. Tate 9520 ft
Mt. Washiwa 9375 ft
Mt. Norikura 9983 ft
Mt. Ontake 10108 ft
Mt. Asama 8388 ft
Mt. Tateshina 8349 ft
Mt. Koma 9754 ft
Mt. Ena 7229 ft
Mt. Fuji 12467 ft
Mt. Haku 8916 ft
Mt. Dainichi 5639 ft
LAKE BIWA
LAKE SUWA
LAKE HAMANA
TOKYO
YOKOHAMA
KOFU
NAGOYA
KYOTO
OSAKA
KOBE
NARA
SAKAI
WAKAYAMA
SHIZUOKA
HAMAMATSU
TOYOHASHI
OKAZAKI
TSURUGA
KANAZAWA
TOYAMA
NAGANO
NAOEZU
NANAO
MAEHASHI
URAWA
HACHIOJI
NUMAZU
OMIYA
HIKONE
OGAKI
YOKKAICHI
UYENO
ISE
KISO RIVER
TAMA RIVER
CHIKUMA RIVER
SAI RIVER
AZUSA RIVER
FUJI RIVER
ABE RIVER
TENRYU RIVER
KUZURYU RIVER
MASUDA RIVER
TOMOE RIVER
YAHAGI RIVER
IBI RIVER
ARA RIVER
TONE RIVER
KINU RIVER
BANU RIVER
OI RIVER
JOGANJI RIVER
ZINTSU RIVER
HAYATSUKI RIVER
KUROBE RIVER
SHO RIVER
NAGARA RIVER
KOZU STEP DOWN SUB-STATION
SHINAGAWA TOKYO STEP DOWN SUB-STATION
KOFU STEP DOWN SUB-STATION
IIDA STEP-UP SUB-STATION
SAKASHITA STEP-UP SUB-STATION
NAGOYA STEP DOWN SUB-STATION
BORUGO SUB-STATION
MIDZUHO SUB-STATION
HAMAMATSU STEP-DOWN SUB-STATION
OSAKA STEP DOWN SUB-STATION
HATOGAYA STEP-UP SUBSTATION
FUNATSU STEP-UP SUB-STATION
ONO STEP-UP SUBSTATION
TAKEFU SUB-STATION
51 MILES
60 MILES
90 MILES
48 MILES
42 MILES
71 MILES
30 MILES
56.3 MILES
18.3 MILES
25 MILES
22 MILES
33 MILES

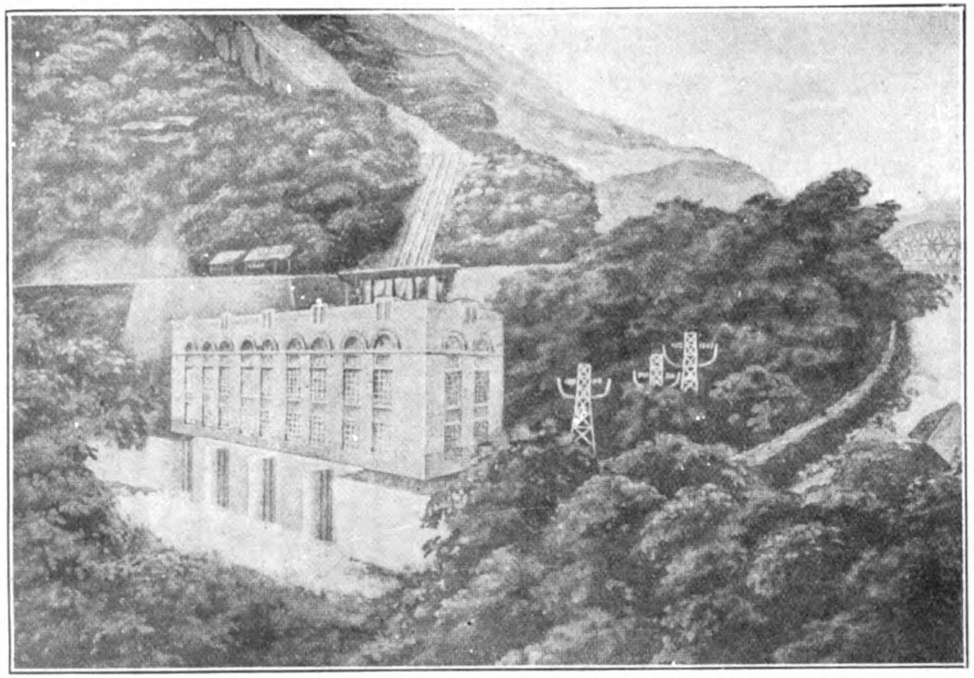
# POWER HOUSES OF THE DAIDO ELECTRIC POWER



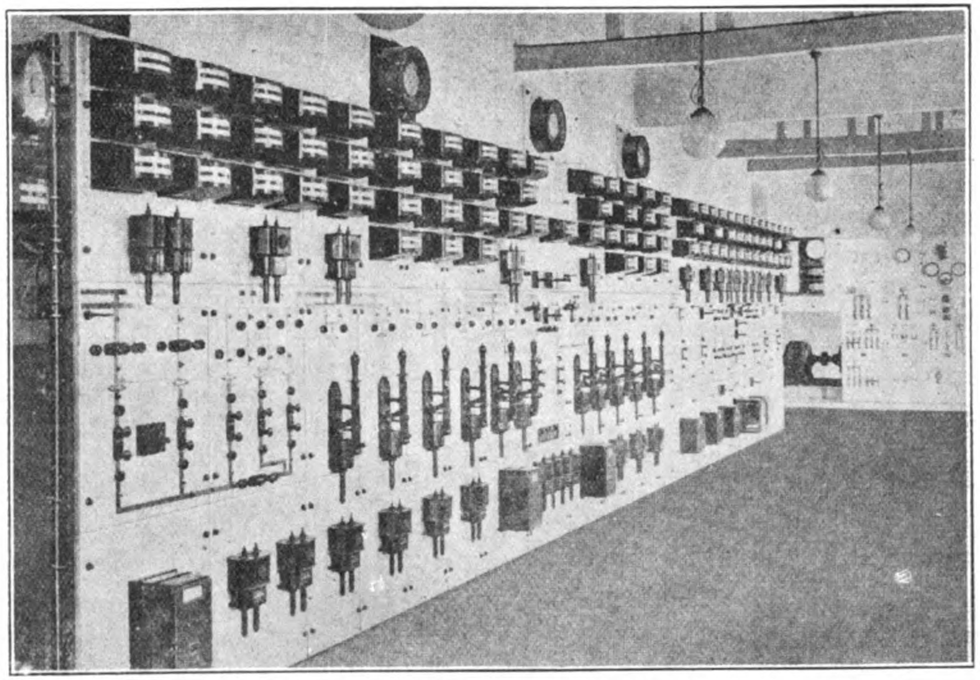
Suhara Power House in Operation and Sub-Station under Construction



Okuwa Power House



Yomikaki Power House as it will appear when completed



Switchboard, Rokugo Sub-Station: Made by the Shibaura Engineering Works of Tokyo

It is expected that electrification of the railroads will be completed in approximately ten years, and in estimating the probable demand, consideration is given to the probable increase of transportation on all lines. These figures show the great importance to the country of the development of hydro-electric power particularly in the central portion, the industrial heart of the country.

## Estimated Water Power in Central Japan

According to the investigation of the hydraulic bureau of the government, the total estimated value of the water power in the whole of Japan is approximately 10,000,000 k.w. of which 7,000,000 k.w. is to be found on the mainland of the country and may be classified as follows: Economically applicable, 5,500,000 k.w.; economically inapplicable, 1,500,000.

The rivers running through the central portion of Japan, which are commercially practicable for the development of long distance transmission and have a combined capacity of 4,550,000 k.w. are listed with their estimated capacities as follows : Abukuma, 200,000 ; Tone, 500,000 ; Sagami, 150,000 ; Sakai, 70,000 ; Fuji, 150,000 ; Ohi, 150,000 ; Akano, 500,000 ; Shinano, 750,000 ; Arakawa, 60,000 ; Hime, 100,000 ; Tenryu, 300,000 ; Yahagi, 70,000 ; Kiso, 500,000 ; Kurobe, 200,000 ; Jintsu, 250,000 ; Shokawa, 150,000 ; Tetori, 100,000 ; Kuzuryu, 100,000 ; Kumano, 120,000 ; Yodo, 130,000 ; Hida, 70,000 ; Others, 30,000 ; Total, 4,650,000 k.w.

Of the above rivers, the last named eleven are considered to have the most economical sites for power development. Their aggregate capacity is 2,900,000 k.w. Of these eleven rivers all except the Kurobe, Kumano and Yodo are either under operation or in some stage of development. The aggregate capacity which is under the control of the Daido and its associated companies as shown by the following table is over 1,000,000 k.w.:—

| Name of Companies | Power in Operation | Power under Construction | Power under Plan of Work | Total | Power under Application | Grand Total |
|---|---|---|---|---|---|---|
| | K.W. | K.W. | K.W. | K.W. | K.W. | K.W. |
| Daido ... ... | 48,100 | 119,200 | 82,080 | 249,380 | 264,042 | 513,422 |
| Toho ... ... | 37,769 | 3,772 | 44,745 | 86,286 | 162,235 | 248,521 |
| Yahagi ... | 8,050 | 5,000 | 8,000 | 21,050 | 40,000 | 61,050 |
| Bisan ... ... | 1,431 | 6,513 | 6,912 | 14,856 | 2,348 | 17,204 |
| Nōhi ... ... | 144 | 3,950 | 1,170 | 5,264 | 55,166 | 60,430 |
| Hakusan ... | — | 32,000 | 14,982 | 46,982 | 45,565 | 92,547 |
| Gifu ... ... | — | 6,000 | 57,560 | 63,560 | — | 63,560 |
| Tenryugawa ... | — | — | — | — | 143,303 | 143,303 |
| Total ... | 95,494 | 176,435 | 215,449 | 487,378 | 712,659 | 1,200,037 |

## Power Plants and Capacities

A summary of the power plants now operated by the Daido together with those under construction and in other stage of development is given below.

1 *Power Plants in Operation.*—Shizumo, 14,700 k.w. ; Okuwa, 11,000 ; Kushihara, 6,000 ; Nishikadohara, 7,200 ; Suhara, 9,200 ; Total, 48,100 k.w.

2 *Power Plants under Construction.*—Kema (Steam), 12,500 k.w. ; Yomikaki, 40,700 ; Ohi, 42,900 ; Momoyama, 23,100 ; Total, 119,200 k.w.

3 *Power Plants Contemplated.*—Nezame, 7,300 k.w. ; Ochiai, 13,700 ; Kasagi, 17,000 ; Nishikitsu, 18,000 ; Imawatari No. 1, 8,490 ; Imawatari No. 2, 3,990 ; Hanafusa, 10,000 ; Higashikadohara, 1,300 ; Shimouchinami, 2,300 ; Total, 82,080 k.w.

## Transmission Lines

The proposed plan is to have a gigantic network of transmission lines covering the middle western part of Japan.

1 *Completed and in Operation* : 163 miles of 77,000 volt line of which 100 miles has steel tower construction, and 63 miles wooden poles from power plants along the Kiso and Yahagi rivers to Nagoya. 90 miles of 154,000 volt line, steel tower construction, from Kiyosu to Osaka. 30 miles of 66,000 volt line from power plants along the Kuzuryu river to Takefu.

2 *Under Construction* : 76 miles of 77,000 volt line, steel tower construction, from power plants along the Kuzuryu river to Nagoya, to be completed by April, 1923. 65 miles of 154,000 volt line, steel tower construction, from Suhara power plant on the Kiso river to Kiyosu, to be completed by August, 1923.

3 *Under Preparation* : 212 miles of 154,000 volt line, steel tower construction, from Hokuriku to Osaka, to be known as Hokuriku transmission trunk line. 70 miles of 77,000 volt line, steel tower construction, from the Jintsu river power site to Nagoya. 51 miles of 55,000 volt line, steel tower construction, from Osaka to Wakayama. 35 miles of 77,000 volt line, steel tower construction, connecting power plants between the Seki and Kiso river.

There are also plans covering the transmission of power to Tokyo, and in general, the main transmission system will, when completed, extend for approximately 1,110 miles, and be so advantageously located along the government railways that it will be available for their electrification.

## Hydro-Electric Power Development on the Kiso River

The power plants of the Daido situated along the whole course of the Kiso river are as follows :—

| Plants | Volume cu. ft. | Head ft. | Capacity K.W. | Water Way mile | System |
|---|---|---|---|---|---|
| Nezame ... | 1,100 | 110.0 | 7,300 | 2.8 | Canal |
| Momoyama ... | 1,300 | 267.0 | 23,100 | 2.7 | ,, |
| Suhara ... | 1,200 | 115.0 | 9,200 | 2.0 | ,, |
| Okuwa ... | 1,300 | 129.0 | 11,000 | 2.6 | ,, |
| Yomikaki ... | 1,600 | 370.0 | 40,700 | 6.7 | ,, |
| Shizumo ... | 1,300 | 153.0 | 12,600 | 3.0 | ,, |
| ,, Extension | 200 | 165.0 | 2,100 | — | ,, |
| Ochiai ... ... | 1,600 | 130.0 | 13,700 | 4.7 | ,, |
| Ohi ... ... | 4,500 | 140.0 | 42,900 | — | Dam |
| Kanda... ... | 4,500 | 117.0 | 33,600 | — | ,, |
| Futamata ... | 3,500 | 114.0 | 25,500 | — | ,, |
| Maruyama ... | 3,500 | 119.0 | 26,600 | — | ,, |
| Imawatari No.1 | 2,000 | 63.0 | 8,490 | 2.0 | Canal |
| ,, No.2 | 2,000 | 30.0 | 3,990 | 1.9 | ,, |
| Total Capacity ... ... ... | | | 260,780 K.W. | | |

Of the total power to be developed on the Kiso river, 34,900 k.w. is now in operation, 110,700 k.w. under construction, and 118,540 k.w. under contemplation. Besides 6,000 k.w. on the Yahagi and 7,200 k.w. on the Kuzuryu are now in operation. According to the power hydrograph of the Kiso river, approximately 545,000,000 k.w.h. of minimum power and 985,000,000 k.w.h. of maximum power will be produced annually at the sites located on the stream above the Shizumo power house. It is estimated that the total construction cost for these power plants on the Kiso river from Nezame to Ohi will amount to approximately Y.48,700,000 and the average cost per kilowatt Y.315.

## Ohi Power Plant-Dam System

The Ohi plant is intended to undertake the supply of power for peak load of Osaka sub-station, thus keeping the load of other plants such as Momoyama, Suhara, Okuwa and Yomikaki nearly constant. This base load will amount to approximately 100,000 k.w.

The load factor for Ohi plant will be certainly below 50 per cent. but the average load factor for all plants running together in parallel is estimated to be about 75 per cent. as the other plants with the exception of Ohi will have naturally very good figures due to the nature of their loads.

The present work of the Daido is in the primary stage. The secondary period of power development on the Kiso and its tributaries will begin in the near future, and upon its completion most of the power produced will be taken for base load at the Ohi plant.

## Otaki Reservoir

The rivers having their sources in the plateau of the "Japan Alps" are usually low in run-off during the two winter months of January and February. The principal purpose of Otaki reservoir is to supply water during this dry season, and to regulate the discharge at other times.

The reservoir is to be constructed by a dam wall 300 feet high and the capacity will be 3,200,000,000 cubic feet. The regulated flow from this reservoir will produce an additional 320,000,000 k.w.h. during the dry season, and upon completion of the whole

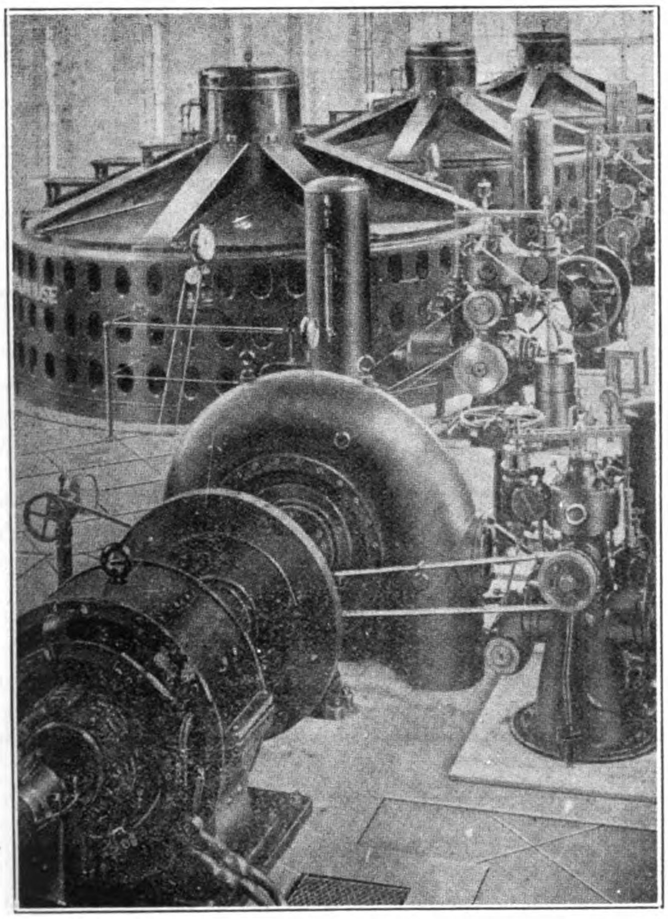
power development on the Kiso river, the total capacity of 823,000,000 k.w.h. It is expected that the reservoir will be completed by the end of 1924.

## Proposed Scheme of Power Development on the Tenryu River

There are ten sites along the Tenryu river suitable for power development and their total capacity is approximately 250,000 k.w. Data on these sites are as follows :

| Sites | Volume cu. ft. | Head ft. | Capacity K.W. | Water Way mile | System |
|---|---|---|---|---|---|
| No. I ... | 1,200 | 37.5 | 2,832 | 0.5 | Canal System |
| No. II ... | 1,300 | 46.0 | 3,763 | 2.2 | ,, |
| No. III ... | 1,360 | 251.0 | 21,324 | 6.4 | ,, |
| No. IV ... | 1,700 | 215.0 | 23,000 | 7.5 | ,, |
| No. V ... | 1,900 | 51.0 | 6,058 | 2.4 | ,, |
| No. VI ... | 3,500 | 140.0 | 30,837 | 1.1 | Dam System |
| No. VII ... | 3,700 | 72.0 | 16,765 | — | ,, |
| No. VIII... | 4,000 | 100.0 | 25,551 | — | ,, |
| Otami ... | 4,310 | 140.0 | 41,150 | — | ,, |
| Sakuma ... | 4,780 | 250.0 | 85.500 | — | ,, |
| Total capacity ... | | | 252,780 K.W. | | |

At the upper end of the Tenryu river, Lake Suwa, having a catchment area of over 208 square miles, forms a natural storage reservoir. For about 40 miles from Tokimata to Futamata the river flows through the great Tenryu canyon, a place of grand scenic beauty, bordered on either side by ranges of steeply rising hills and providing sites most suitable for dam construction.



**Okuwa Power House of the Daido Electric Power Co., Ltd. Equipped with three 5,800 h.p. (max.) 277 r.p.m. single spiral, single discharge Allis-Chalmers water turbines and three 5,000 k.v.a., 80% P.F., 6,000 v. 3 phase, 60 cycles, Westinghouse alternators.**

The company is now rapidly carrying out the work of surveying, locating, etc. This river is in striking contrast to many others in that the volume of water is so constant that the minimum run-off for eleven months can be taken as the basis for power development, and no provision for steam power plants for emergency use is necessary. If, however, a steam reserve is provided and the design changed to the eight months minimum run-off, a total capacity of 400,000 k.w. can be obtained with a total construction cost of Y.300 per kilowatt.

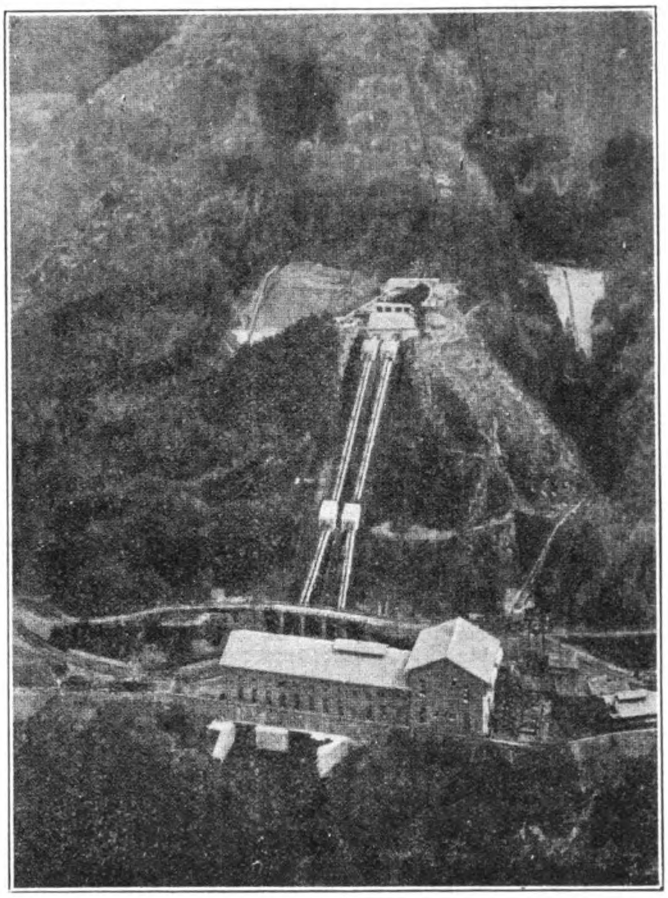
It is estimated that total construction cost for these ten power plants will amount to approximately Y.87,000,000 or Y.344 per kilowatt. The Tenryu river is undoubtedly one of the finest rivers for power development in Japan.

## Principal Power Market

One of the most important considerations involved in the sale of power is location. Fortunately the source of hydro-electric power in the central portion of Japan is easily within reach of Tokyo, Yokohama, Nagoya, Kyoto, Kobe and Osaka, the principal power markets of the country. The following illustrations show the importance of the Daido's position as a supplying company with reference to the most intensive manufacturing centres of the country. The principal consumers are as follows :

1. The Toho Electric Power Co. with Nagoya as the principal centre and extending to Toyohashi, Gifu, Hamamatsu, Okazaki, Yokkaichi, and Nara in the central district.

2. The Osaka Electric Light Co. dealing in light and power, and other urban and interurban traction companies, and industrial companies located in and near the city of Osaka.



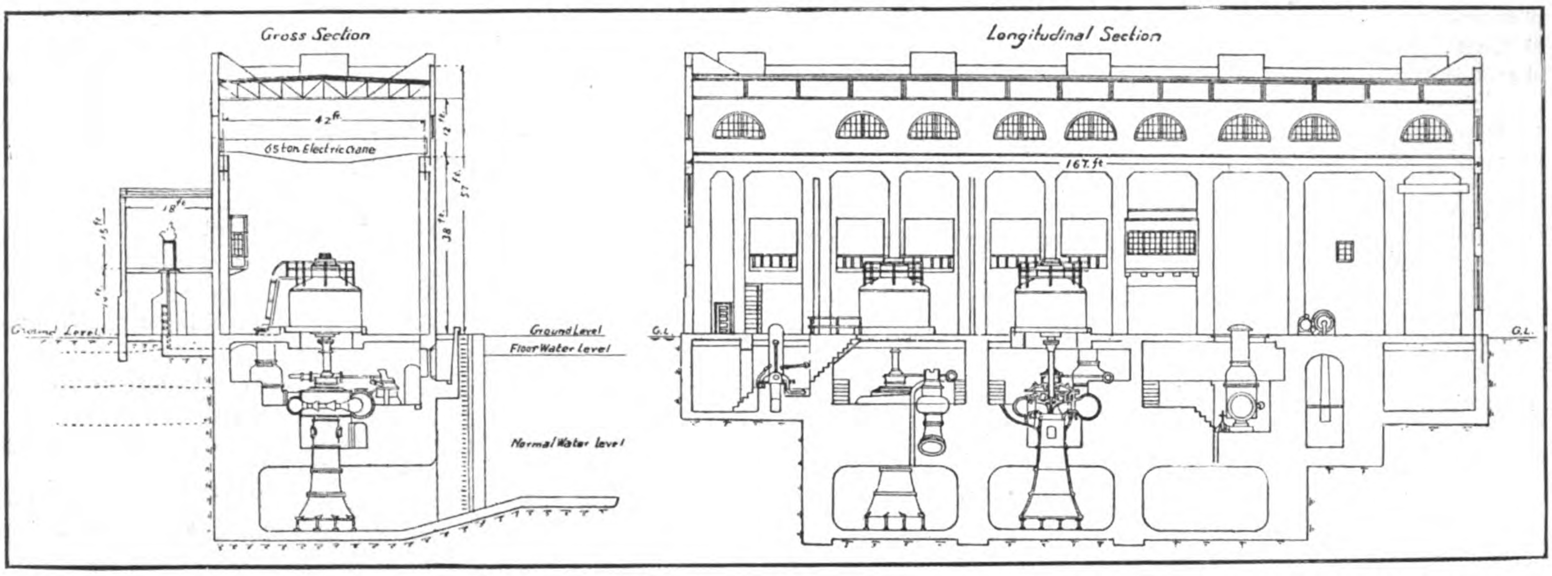
**Kushihara Power House of the Daido Electric Power Co., Ltd.**

3. The Kyoto Electric Light Co. which is supplying light and power in the city of Kyoto and the neighboring district, and also in the prefecture of Fukui.

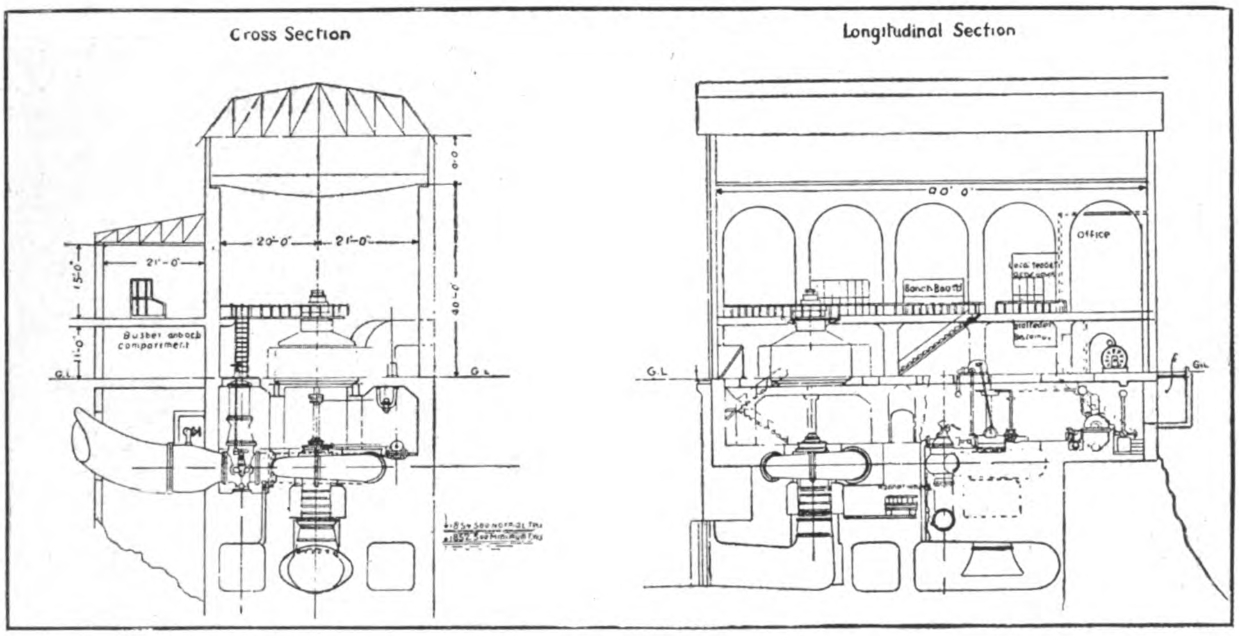
4. The Keihan Electric Traction Co. which carries on a traction business and also supplies light and power, and other industrial companies located in Kyoto, Osaka and their surrounding districts.

5. The municipal government of Kobe, Kawasaki Dockyard, and other industrial companies located in Kobe and its environs.

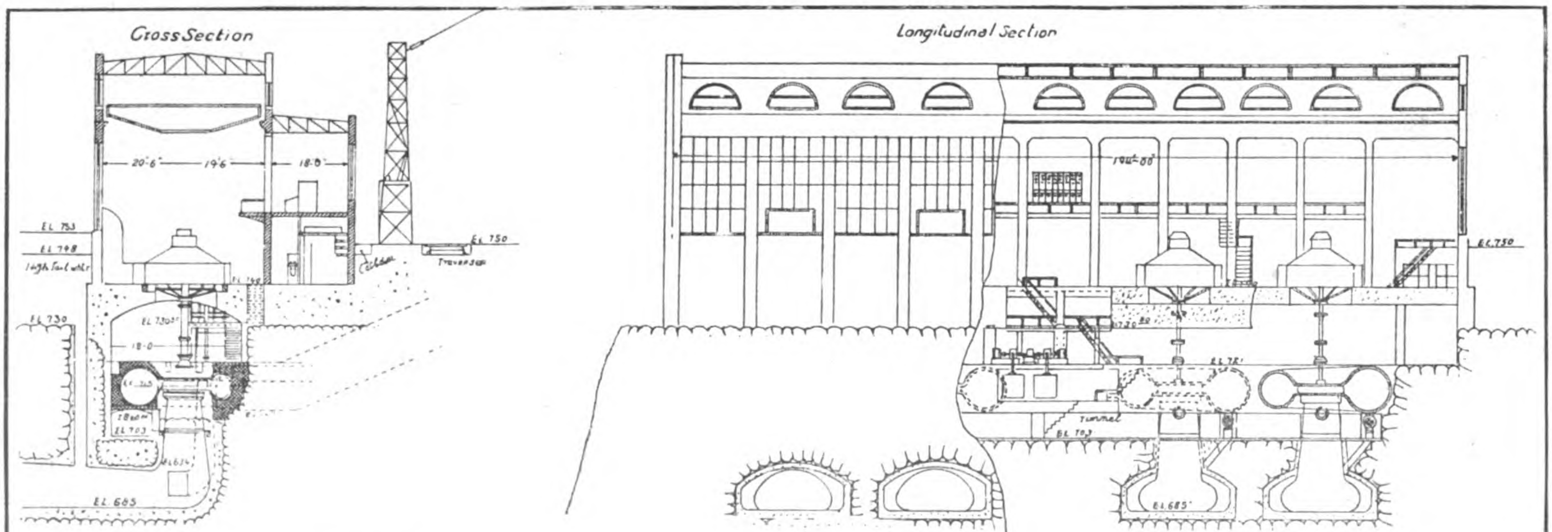
6. The municipal government of Tokyo and the Tokyo Electric Light Co. are the principal factors with which the Daido should




General View of the Yomikaki Power Station. Equipped with three 22,000 h.p. (max.) single spiral, single discharge, vertical type Escher, Wyss water turbines, 360 r.p.m. and three 17,000 k.v.a., 80% P.F., 6,600 v., 3 phase, 60 cycles, Westinghouse alternators




Momoyama Power House: Equipped with two single spiral, single discharge, vertical type Escher, Wyss water turbines, 20,000 h.p. (max.) 300 r.p.m. and two 15,000 k.v.a., 80% P.F., 6,600v., 3 phase, 60 cycles, Westinghouse alternators




Ohi Power Station: Equipped with four 18,000 h.p. (max.) 180 r.p.m. single spiral, single discharge, vertical type Allis-Chalmers water turbines and four 13,750 k.v.a., 80% P.F., 6,900 v., 3 phase, 60 cycles, General Electric alternators

co-operate in supplying power to Tokyo, Yokohama and their surrounding districts upon completion of the proposed Tokyo transmission system.

Thus the greater part of the power generated is delivered over the transmission lines to the substations of the wholesale consumers who in turn distribute it to the smaller consumers.

Light and power to be consumed by these cities and companies are as follows :

| | Lights Installed | Power Sold H.P. |
|---|---|---|
| Osaka Electric Light Co. ... | 1,538,927 | 87,222 |
| Osaka City ... ... ... | — | 5,830 |
| Kyoto Electric Light Co.... ... | 593,903 | 28,406 |
| Kyoto City... ... ... ... | 235,403 | 10,012 |
| Keihan Electric Traction Co. ... | 96,903 | 11,668 |
| Kobe City ... ... ... ... | 423,182 | 20,372 |
| Tokyo City... ... ... ... | 707,438 | 31,291 |
| Tokyo Electric Light Co.... ... | 2,367,823 | 235,394 |
| Toho Electric Power Co. ... ... | 1,904,438 | 114,597 |
| Total ... ... ... | 8,868,017 | 544,792 |
| Whole Country ... ... ... | 14,167,685 | 1,359,208 |
| Per cent. of Whole Country ... | 62% | 40% |

### General Balance Sheet, May 31, 1922

*Assets*

| | Yen. |
|---|---|
| Uncalled capital .. .. .. .. | 55,680,000.000 |
| Power house construction .. .. .. | 16,478,649.942 |
| Transmission line .. .. .. .. | 2,366,803.092 |
| Sub-station construction .. .. .. | 1,455,081.386 |
| General construction account .. ... | 7,054,562.326 |
| Telephone line .. .. .. .. .. | 16,609.270 |
| Distribution line .. .. .. .. .. | 35,732.074 |
| Real estate .. .. .. .. .. .. | 5,519,332.320 |
| Furniture, etc. .. .. .. .. .. | 169,457.690 |
| Future extension & development account | 29,522,492.575 |
| Stores account .. .. .. .. .. | 415,235.509 |
| Commission on sale of debentures .. | 392,855.000 |
| Pending account receivable .. .. | 6,612,996.879 |
| Bills receivable .. .. .. .. .. | 337,058.460 |
| Account receivable .. .. .. .. .. | 405,037.880 |
| Stock of other companies invested .. | 7,832,823.900 |
| Securities deposited.. .. .. .. .. | 2,029,452.500 |
| Deposit in bank .. .. .. .. .. | 410,218.140 |
| Cash on hand .. .. .. .. .. | 46,545.510 |
| Total Assets .. .. .. | Y.136,780,944.453 |

*Liabilities*

| | Yen. |
|---|---|
| Authorized capital .. .. .. .. | 100,000,000.000 |
| Legal reserve .. .. .. .. .. | 303,608.000 |
| Debentures .. .. .. .. .. .. | 10,000,000.000 |
| Debts and bills payable .. .. .. | 19,140,064.980 |
| Employee's savings .. .. .. .. | 84,686.330 |
| Pending account payable .. .. .. | 3,790,643.210 |
| Account payable .. .. .. .. .. | 1,795,183.490 |
| Unpaid dividends .. .. .. .. .. | 38,917.710 |
| Balance brought down .. .. .. .. | 59,210.143 |
| Surplus .. .. .. .. .. .. | 1,568,630.590 |
| Total Liabilities .. .. | Y.136,780,944.453 |

### Condensed Financial Statement

For the six months ending May 31, 1922

*Income*

| | Yen. |
|---|---|
| Business income .. .. .. .. | 1,873,460.850 |
| Interest and profit on securities .. .. | 304,071.167 |
| Miscellaneous income .. .. .. | 32,073.235 |
| Total .. .. .. .. | Y.2,209,605.252 |

*Expense*

| | Yen. |
|---|---|
| Operating expense .. .. .. .. | 194,259.829 |
| Taxes .. .. .. .. .. .. | 94,438.960 |
| General expense .. .. .. .. .. | 352,275.873 |
| Total .. .. .. .. .. | Y. 640,974.662 |
| Net profit for the six months .. | ..Y.1,568,630.590 |

### Dividend Record

Dividends are payable June and December, and the rates since 1921 are listed as follows :

| | 1921 | 1922 |
|---|---|---|
| First half .. | 6% | 6.4% |
| Second half .. | 6.2% | |

### CONSTRUCTION COST

#### Generating Stations

| Name of Plant | Capacity K.W. | In Operation Yen. | Under Construction Yen. | Cost per K.W. Yen. |
|---|---|---|---|---|
| Shizumo ... ... | 14,700 | 5,086,077.219 | | 345.992 |
| Okuwa ... ... | 11,000 | 5,112,782.483 | | 464.798 |
| Kushihara ... | 6,000 | 3,474,663.577 | | 579.111 |
| Nishikadohara ... | 7,200 | 2,670,636.110 | | 370.922 |
| Suhara ... ... | 9,200 | 4,545,715.000 | | 494.099 |
| Yomikaki ... | 40,700 | | 13,748,069.220 | 337.790 |
| Ohi ... ... | 42,900 | | 12,243,300.000 | 285,392 |
| Momoyama ... | 23,100 | | 6,640,000.000 | 287.446 |
| Kema (Steam) ... | 12,500 | | 3,036,500.700 | 242.920 |
| Total ... | 167,300 | 20,889,874.389 | 35,667,869.920 | |
| Total Construction Cost .. .. | | | Y.56,557,744.309 | |
| Average Cost per K. W. .. .. | | | Y.338.062 | |

#### Sub-Stations

| Name of Sub-Station | Capacity K.V.A. | In Operation Yen. | Under Construction Yen. |
|---|---|---|---|
| Rokugo ... ... | 15,000 | 393,064.938 | |
| Mizuho ... ... | 9,000 | 315,941.412 | |
| Tokitsu ... ... | 1,050 | 91,013.592 | |
| Tōgō ... ... | 450 | 38,898.210 | |
| Takefu ... ... | 8,100 | 183,131.400 | |
| Osaka ... ... | 141,000 | 8,868,800.000 | |
| Rokugo No. 2 ... | 15,000 | | 433,031.830 |
| Sango ... ... | 15 000 | | 500,000.000 |
| Suhara ... ... | 50,400 | | 1,554,000.000 |
| Mizuho No. 2 ... | 9,000 | | 276,000.000 |
| Total ... ... | | 9,890,849.552 | 2,763,031.830 |
| Total Construction Cost ... | | Y.12,653,881.382 | |
| Average Cost per K.W. ... | | Y.75.636 | |

#### Transmission Lines

| Name of Line | Length Mile | In Operation Yen. | Under Construction Yen. |
|---|---|---|---|
| Shizumo to Rokugo ... | 48.2 | 1,059,571.328 | |
| Kushihara to Mizuho ... | 30.6 | 773,583.808 | |
| Kushihara to Mizunami | 16.3 | 183,615.336 | |
| Nishikadohara to Takefu | 29.7 | 350,032.620 | |
| Nagoya to Osaka ... | 88.0 | 8,078,750.000 | |
| Nojiri to Nagoya ... | 58.0 | 2,686,300.000 | |
| Suhara to Nojiri ... | 3.0 | 98,000.000 | |
| Kachikawa to Kiyosu ... | 6.4 | 326,485.000 | |
| Momoyama to Suhara... | 3.0 | | 122,475.000 |
| Kiyosu to Suhara ... | 6.7 | | 5,360,150.000 |
| Kema to Sango ... | 3.5 | | 549,000.000 |
| Sango to Furukawabashi | 1.5 | | 53,150.000 |
| Tokise to Yodaira ... | 2.5 | | 89,200.000 |
| Kushihara to Mizuho ... | 30.6 | | 181,000.000 |
| Seki to Kiyosu ... | 22.0 | | 1,562,872.000 |
| Total ... ... ... | | 13,556,338.092 | 7,917,847.000 |
| Total Construction Cost ... | | Y.21,474,185.092 | |
| Average Cost per K.W. ... | | Y.128.357 | |

The total construction cost for generating stations, sub-stations, and transmission lines in operation amounts to Y.44,337,062.042, and for the work under construction Y.46,348,748.750. The average cost per kilowatt for the whole work amounts to Y.542.055.

## Business Prospects

The prospects of the Daido Electric Power Co. with its natural resources and geographical advantages are exceptionally bright. Early in 1924 the total power developed will exceed 167,000 k.w. and the transmission system will extend more than 500 miles. A total number of eight water plants and one steam plant will be in operation. The average construction cost for generating stations, sub-stations, and transmission lines inclusive does not exceed Y.550 per kilowatt. It is expected, therefore, that within two years the Daido will be in a position to declare dividends on its shares at the rate of at least 12 per cent. per annum.

## Power Stations and Equipment

SUHARA POWER STATION.—Effective discharge, max. 1,300 cub. ft. sec., min. 390; effective head, 114.49-ft.; theoretical horse-power, 15,343; out-put in k.w., max. 9,200, min. 4,600; total length of waterway, 10,698-ft.; length of tunnel, 3,978-ft.; work began, May—1920; completed, July—1922; main turbine: single spiral, single discharge, vertical type. 2—7,500 h.p. (max.), 225 R.P.M. Maker: *Escher Wyss.* Main generator: 2—5,500 K.V.A., 80% P.F., 6,600v, 3 phase, 60 cycle. Maker: *Westinghouse.* Transformer: 4—4,500 K.V.A., 6,600/77,000v, delta-delta (1 spare). Maker: *Hidachi.* Switchboard: Type—*Bench type.* Maker: *Shibaura.*

KUSHIHARA POWER STATION.—Effective discharge, max. 393 cub. ft. sec., min. 260; effective head, 231-ft.; theoretical horse power, max. 10,252; min. 6,853; out-put in k.w., max. 6,000; min. 3,000; total length of waterway, 20,734-ft.; length of tunnel, 10,791-ft.; work began, October—1919; completed, December—1920. Main turbine: 2—5,500 h.p. (max.), 514 R.P.M. double spiral, double discharge horizontal shaft. Maker: *Hidachi.* Main generator: 2—3,750 K.V.A., 80 % P.F., 6,600v, 3 phase, 60 cycle. Maker: *Hidachi.* Transformer: 7—1,500 K.V.A., 2,300—6,600/77,000v delta-delta (1 spare). Maker: *Shibaura.* Switchboard: Type—*Panel type.* Maker: *Shibaura.*

YOMIKAKI POWER STATION.—Effective discharge, max. 1,573 cub. ft. sec., min. 963; effective head, 367-ft.; theoretical horse-power, max. 65,712, min. 40,249; out-put in k.w., max. 40,700, min. 24,954; total length of waterway, 36,346-ft.; length of tunnel, 31,880-ft.; work began, December—1921; to be completed, September—1923. Main turbine: single spiral, single discharge, vertical type. 3—22,000 h.p. (max.), 360 R.P.M. Maker: *Escher Wyss.* Main Generator: 3—17,000 K.V.A., 80% P.F., 6,600v., 3 phase, 60 cycle. Maker: *Westinghouse.* Transformer: 9—8,500 K.V.A. 6,600/89,000v, delta-star neutral ground through resistance. (3 spare). Maker: *General Electric.*

OHI POWER STATION.—Effective discharge, max. 4,424 cub. ft. sec., min. 575; effective head, 140-ft.; theoretical horse-power, max. 69,300, min. 9,125; out-put in k.w., max. 42,000; min. 5,150; max. height of dam, 182-ft.; length of pressure tunnel, 2,982-ft.; work began, January—1922; to be completed, December—1923. Main turbine: single spiral, single discharge vertical type. 4—18,000 h.p. (max.), 180 R.P.M. Maker: *Allis-Chalmer.* Main generator: 4—13,750 K.V.A. 80% P.F., 6,600v., 3 phase, 60 cycle. Maker: *General Electric.* Transformer: 9—9,200 K.V.A., 6,600/89,000v., delta-star non-grounded (3 spare). Maker: *Westinghouse.* Switchboard: Type: *Bench type.* Maker: *Westinghouse.*

OKUWA POWER STATION.—Effective discharge, max. 1,300 cub. ft. sec., min. 639; effective head, 127-ft.; theoretical horse-power, max. 18,600; min. 9,300; out-put in k.w., max. 11,000; min. 5,600; total length of waterway, 13,821-ft.; length of tunnel, 7,772-ft.; work began, October—1919; completed, July—1920. Main turbine: 3—5,800 h.p. (max.), 277 R.P.M., single spiral, single discharge vertical. Maker: *Allis-Chalmer.* Main generator: 3—5,000 K.V.A., 80% P.F., 6,600v, 3 phase, 60 cycle. Maker: *Westinghouse.* Transformer: 4-5,000 K.V.A. 6,600/77,000v., delta-delta (1 spare). Maker: *Westinghouse.* Switchboard: Type: *Bench type.* Maker: *Shibaura.*

SHIZUMO POWER STATION.—Effective discharge, max. 1,475 cub. ft. sec., min. 885; effective head, 163-ft; theoretical horse-power, max. 25,519; min. 15,284; out-put in k.w., max. 14,700, min. 8,400; total length of waterway, 15,969-ft.; length of tunnel, 14,630-ft.; work began, October—1918; completed, October—1919. Main turbine: 3—7,500 h.p. (max.) 360 R.P.M. Twin spiral, single discharge, horizontal shaft. Maker: *Boving.* 1—3,850 h.p. (max.) 514 R.P.M. Single spiral, single discharge, vertical shaft. Maker: *Okumura.* Main generator: 3—5,250 K.V.A., 80% P.F., 360 R.P.M. 6,600v. 3 phase, 60 cycle. Maker: *General Electric.* 1—3,000 K.V.A., 80% P.F., 514 R.P.M. 6,600v. 3 phase, 60 cycle. Maker: *Okumura.* transformer: 7—2,630 K.V.A., 6,600/77,000v. delta-delta. Maker: *Westinghouse.* 1—3,000 K.V.A., 3 phase, 6,600/77,000v, delta-delta. Maker: *Okumura.* Switchboard: Type: *Panel type.* Maker: *Shibaura.*

ROKUGO SUB-STATION (30,000 K.V.A.).—Main transformer: 15—2,500 K.V.A., 60; P. 72,500v/70,000v/67,500v.; S. 11,000v. (3 spare). Maker: *Westinghouse.* Switchboard: Type: *Panel type.* Maker: *Shibaura.*

MOMOYAMA POWER STATION.—Effective discharge, max. 1,300 cub. ft. sec., min. 639; effective head, 262-ft.; theoretical horse-power, max. 38,000; min. 19,000; out-put in k.w., max. 23,100, min. 11,650; total length of waterway, 13,974-ft.; length of tunnel, 13,974-ft.; work began, December—1921; to be completed, December—1923. Main turbine: Single spiral, single discharge, vertical type. 2—20,000 h.p. (max.), 300 R.P.M. or 250 R.P.M. Maker: *Escher Wyss.* Main generator: 2—15,000 K.V.A., 80% P.F. 6,600v, 3 phase, 60 cycle and 50 cycle. Maker: *Westinghouse.* Transformers: 7—5,000 K.V.A., 6,600/77,000v. delta-delta (1 spare). Maker: *Siemens.* Switchboard: Type: *Bench type.* Maker: *Westinghouse.*

TOKITSU SUB-STATION (1,050 K.V.A.).—Main transformer: 3—350 K.V.A. 60, single phase; P. 75,000/72,500/70,000.; S. 3,500/3,300. Maker: *Hitachi.* Switchboard: Type: *Panel.* Maker: *Hitachi.*

TOGO SUB-STATION (450 K.V.A.).—Main transformer: 3—150 K.V.A. 60, single phase; P. 64,000/63,000/62,000; S. 3,300. Maker. *Shibaura*: Switchboard: Type: *Panel.* Maker. *Shibaura.*

TAKEFU SUB-STATION (8,100 K.V.A.).—Main transformer: 4—2,700 K.V.A. 60, single phase; P. 64,000/63,000/62,000; S. 3,300 (1 spare); Maker; *Shibaura.* Switchboard: Type: *Panel.* Maker: *Shibaura.*

NISHIKADOHARA POWER STATION.—Effective discharge, max. 934 cub. ft. sec., min. 471; effective head, 124-ft.; theoretical horse-power, max. 13,181, min. 6,660; out-put in k.w., 7,200; total length of waterway, 9,067-ft.; length of tunnel, 9,067-ft.; work began, Oct.—1918; work completed, June—1919. Main turbine: 3—3,700 h.p. (max.) 514 r.p.m., twin frontal, Francis turbine. (1 spare). Maker: *Dengyosha.* Main generator: 3—2,820 k.v.a., 85% P.F., 6,600v., 3 phase, 60 cycle, 514 R.P.M. (1 spare). Maker: *Shibaura.* Transformers: 4—3,000 K.V.A., 6,700v, 6,600v, 6,500v,/66,000v., single phase, delta-delta (1 spare). Maker: *Shibaura.* Switchboard: Type: *Panel type.* Maker: *Shibaura.*

MIDZUHO SUB-STATION (18,000 K.V.A.).—Main transformer: 7—3,000 K.V.A. 60, single-phase; P. 72,500v./70,000v/67,500v.; S. 11,000v. (1 spare). Maker: *Shibaura (Indoor type). Mitsubishi (Outdoor type).* Switchboard: Type: *Panel type.* Maker: *Shibaura.*

OSAKA SUB-STATION (141,000 K.V.A.).—Main transformer: 18—9,400 K.V.A.; P. 80,800v. S. 31,800v. T. 11,000v., single phase (3 spare). Maker: *Westinghouse.* Switchboard: Type: *Bench type.* Maker: *Westinghouse.* Synchronous condensers: 6 15,000 K.V.A. 11,000v. Maker: 3. *G. E. Co.*; 3. *Westinghouse.*

SUHARA SUB-STATION (50,000 K.V.A.) (under construction).—Main transformer: 9—8,400 K.V.A. 60, single phase. P. 77,000; S. 154,000. (1 spare). Maker: *Westinghouse.* Switchboard: Type: *Bench board.* Maker: *Westinghouse.*

SANGO SUB-STATION (15,000 K.V.A.) (under construction).—Main transformer: 4—5,000K.V.A., single phase; T. 55,000v/53,000v; S. 22,000v/11,000v (1 spare). Maker: *Mitsubishi.* Switchboard: Type: *Panel type.* Maker: *Inouye.*

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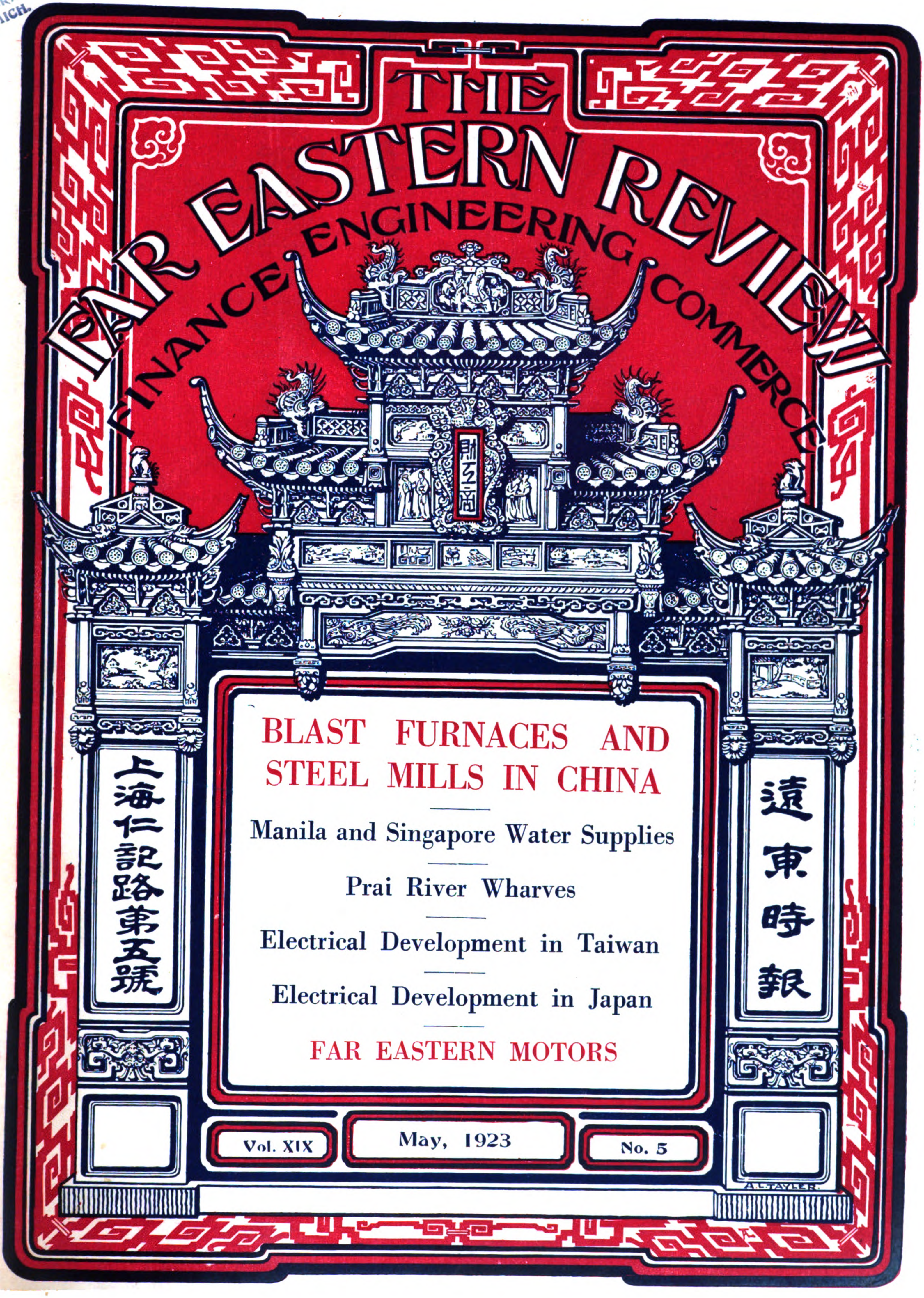

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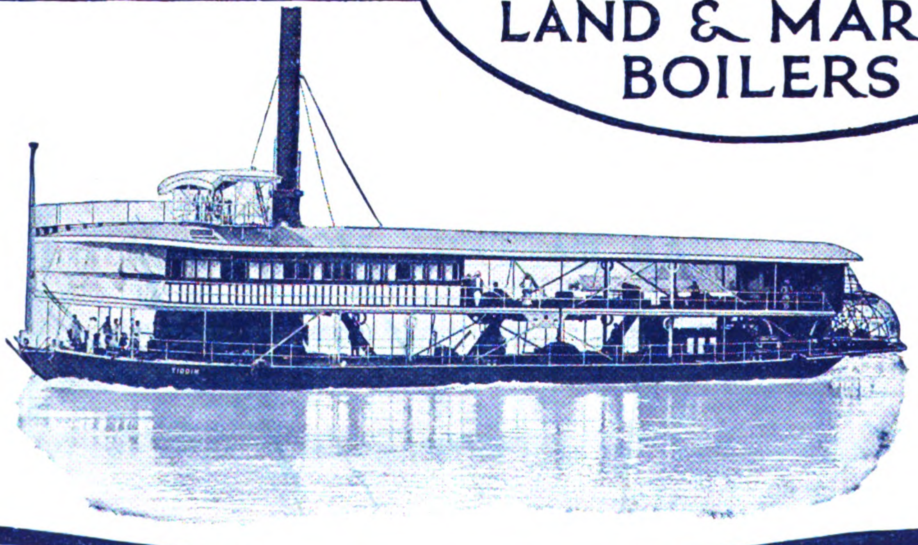

# DR. SUN'S MESSAGE TO THE WORLD

"The present lawless and chaotic condition of China is traceable to the encouragement and support extended by the liberal powers to the hirelings of the military oligarchy posing as a government at Peking. If the powers are sincerely desirous of assisting China to regain her feet, they should refuse to pay over the surplus salt and customs revenues to the Peking faction, employing these funds to liquidate outstanding unsecured indebtedness, and holding the surplus in trust for a unified government of China. These salt and customs revenues now doled out to the Peking government are transmitted to its dictator at Loyang, and employed by him to carry forward his determined campaign to unify the country by the sword and destroy representative government. China can never be unified by force of arms or will the people of the south ever again submit to the autocratic rule of a military despot maintained in power at Peking by the recognition and financial support of outside nations. The great powers fought to make the west safe for democracy; let them practice what they preach in China and if they cannot openly support the liberal movement, let them at least extend sympathy to their own ideals and stand aside in strict neutrality by withholding financial support to Peking while the Chinese settle their own problems in their own way."

**Dr. SUN YET-SEN,**

First President of the Chinese Republic and Leader of the Chinese Liberal Movement.

*Sketched for "The Far Eastern Review" at his home in Shanghai, by Juel Madsen, the Danish artist.*

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, MAY, 1923 No. 5

# The End of the Road

IN 1917, the American people entered the world war to help defeat a theory of government directed by military overloads having no sense of responsibility towards their own people and with no respect for the rights of other nations—they sent their divisions, their fleets and their air forces to stand by the side of the armies of France, of Britain, of Belgium and of Italy, so that government of the people, by the people and for the people should not perish; that the world should be made safe for democracy.

In answer to the invitation of President Wilson calling upon the neutral nations to join with America in severing relations with Germany, the American minister at Peking at the head of a little group (known to history as the " Flying Wedge ") brought pressure to bear upon the president of China to follow the example of the United States. The liberal leaders of China loudly protested against a step which they knew from sad experience would consolidate the power of the northern militarists and retard the establishment of parliamentary government. They were overruled. China entered the world war under the leadership of the Peiyang military group which used its advantage to uproot by force of arms the growth of democracy in this country. The allies fought in Europe to overthrow a predatory military autocracy which had become a menace to world peace and security, while in Asia, they fastened upon the helpless masses of China the yoke of the same damnable system which has now become not only a barrier to unification but a menace to the peace of the Far East.

The support of the allies and the continued recognition of the liberal powers to the military despots of Peking has encouraged the latter to defy the principles for whose preservation the world was drenched in blood, and to embark upon a campaign within their own country to consolidate their rule at the point of the bayonet and crush the movement for the establishment of representative government. They know, and their advocates know, that once liberalism is established in China, once the machinery of self-government is working, their days are numbered. They are fighting against this, prepared to invite foreign intervention and risk even partition ; to carry death and desolation to the futhermost confines of this great country, rather than surrender their present powers. To accomplish these unholy ends, they have plundered, sacked, violated and ravished the country. There is no law, no government, no respect for treaties or international obligations. The government is bankrupt ; loans are repudiated and defaulted; salaries of civil officials are months and over a year in arrears ; foreign debts remain unpaid; important foreign firms are failing with others on the brink of disaster; armies of bandits scourge the provinces, pirate fleets sweep the rivers, the canals and estuaries ; life, property, honor and all that is held dearest by the people are sacrificed, without a move being made by the military overlords to restore order.

The great liberal powers of the west continue to recognize the puppets of these overlords as the government of China. They go even further and hand over the surplus salt and customs revenues which permit them to preserve the fiction of government. When Mexico was ravished and laid waste by hordes of bandits, when foreign life and property were no longer secure, the powers withdrew recognition to the government which held the capital city. Recognition has been withheld from Russia, because of these same conditions ; yet for reasons best known to themselves, the powers continue to recognize and make possible the continuance of similar conditions in China.

The powers brought the full weight of world opinion to bear against military despotism in Europe and destroyed it : they focussed world attention upon the militarists of Japan and compelled the people of that country to swing into line with the other liberal nations of the world. They now give the lie to their words of political propaganda and bolster up and make possible the perpetuation of the same system in China.

What is the difference between a European military autocracy with no responsibilty to the people of its country and its Asiatic counterpart, which in the days of Li Hung-chang, could enter into a secret alliance and plunge two nations into the greatest war of history to that date, and keep its own people and the world in profound ignorance of the facts for twenty-five years ? What is the difference between a military autocracy which determines to subjugate Europe and the world to its rule, and one which boldly declares that it will enforce its rule in China at the point of the bayonet ? Who is to guarantee that this huge fighting machine, the greatest in the world to-day, will stop when it has conquered China ? The subjugation of all the provinces by any military overlord, means a huge standing army of occupation to enforce his rule, a continual drain upon the Chinese people and international finance which will foot the bill in some way or other. Who will guarantee, that this great standing army will not be employed in further conquests, that an opportunity will not be sought to try conclusions with Japan, with Russia, or with France over Indo-China ? Militarism in China is the same as its counterpart in Europe or elsewhere, it is doubly obnoxious at this time, because its proclaimed program is to throttle democracy and perpetuate the autocratic rule of a military dictator, and, if present tendencies at Loyang can be accepted as a sign of the times, it may mean the restoration of the Manchu emperor.

The day is past when the advance of liberal ideas can be checked by force. China will never be unified by the armies of Wu Pei-fu or any other military dictator. Yuan Shih-kai with all his prestige at home and abroad, with the backing of huge loans and immense internal revenues, with a powerful and efficient army and his henchmen filling all important posts, could not turn back the tide. What Yuan could not do in the hey-day of his power, cannot be accomplished by Wu Pei-fu or any other swashbuckling sword rattler. Wu may defeat the forces of Sun Yat-sen in Kwantung, he may consolidate his rule and bring Fukien, Chekiang, Szechuan and Yunnan under his banner for a time : he may induce the foreign powers to again advance a huge loan for reorganization purposes, but his rule will not endure. Sooner or later the fight will start all over again and the country plunged into another chaos of years. Sun Yat-sen may die, he may be assassinated, he may fall with his troops, but the cause of good government will carry

on. His place will be taken by another and the principles he stands for continue to guide his colleagues and followers. Peace for the Far East and the triumph of the same ideals that brought peace to Europe, can only be attained by the recognition of those same principles in China. The victory of Wu Pei-fu means the victory of a Hindenburg, the triumph of evil over good, the maintenance of a standing army of such proportions that within a few more years, it will be called upon to justify its existence by throwing down the gauntlet to Japan or some other power. With the best of intentions, the powers, in their blind support to the creatures of this boasting satrap, are inviting the catastrophe. The road to hell is paved with just such intentions. China is headed straight for the end of the road.

G. B. R.

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Events follow fast in China. To the long list of outrages upon foreigners is now added the wrecking of the Tientsin-Pukow express train by a band of 1,000 bandits who carried off the 300 Chinese and 27 foreign passengers and are holding them for ransom. Several well-known Shanghai residents are among the prisoners. We have exhausted our vocabulary in past denunciations of a policy which permits one military overlord to impose his will upon Peking and blackmail the legations into extending recognition to his puppets. There is nothing more to add. China long ago reached the conditions which existed in Mexico, but where, because of the policy of the American government, the operation of the Monroe doctrine and other factors, there could be no thought of European intervention. America, through her moral leadership, has extended her doctrine to China, where intervention on the part of any one power for the protection of its nationals would be looked upon as act of aggression. The American government failed to live up to its full demands in the Coltman case, fearful of hurting the susceptibilities of the Chinese, and we have the answer almost immediately in the outrage on the Tientsin-Pukow express. The territory, in which the outrage occurred, lies within the jurisdiction of Tsao Kun and Wu Pei-fu, who, with all their armies and vaunted military ability, could not put a stop to bandit depredations within their own province or own districts. This last challenge of the bandit leaders is the direct answer to the supine attitude of the powers which declines to take any positive action in defense of their interests in China. It is no secret that Shanghai and its vicinity may soon be drawn into the vortex of the internal warfare in China, and with crimes against foreigners in all other parts of the country permitted to pass without satisfactory indemnities and apologies, the immediate future is far from rosy for their safety in this treaty port. Events will soon demand decisive action. Who will take the lead ? If America or Britain cannot or dare not, let them step aside, and permit others to assume a leadership that will ensure at least respect for foreign interests in China. We are fast approaching the climax, the "show-down" which will determine whether the concert of powers will continue to play in harmony to the tune which extols the present *regimé* in Peking or take such action as will terminate an intolerable situation. Let us be plain. International jealousies and rivalries in China operate to obstruct concerted action to restore order in China. The situation in Peking is simply a reflex of the old anti-Japanese policies of Americans and Britons co-operating to oust the Anfu and pro-Japanese cabinets and elevate Wu Pei-fu and his underlings. In order to make certain that no pro-Japanese cabinet will control Peking, Anglo-American sentiment would continue to support Wu Pei-fu and see Chinese and foreign interests utterly destroyed, rather than withdraw recognition and support to their favorite. The Wu Pei-fuites are dragging China to ruin and endangering the lives and properties of every foreigner in the country by their blind allegiance to a man who is incapable of imposing law and order in the districts overrun by his armies.

Where will it all end ? Only when the gunboats rush to succor and save the lives of foreigners in the larger treaty ports will the deluded diplomats in Peking awake from their dream. Then, it will too late. The responsibility for the Tientsin-Pukow outrage, as well as the inevitable outrages that will follow, will go straight up to those powers whose misplaced sympathies have permitted the present lawlessness to reach that stage where the end of the road is in sight.

# The Handwriting on the Wall

## Facing Disaster

"TO the next fellow who growls about paying his corporation income tax, you can use the perfectly mild and proper expression, 'Go to China !', where he can form a China trade corporation and become rich in no time." This is the latest slogan in the United States to induce American capital to erect factories in this country, an echo of the previous campaign to bring American firms into China in order to capture the trade by sheer weight of numbers. To such talk may be added the mass of China trade propaganda spread broadcast in the United States and England by official boosters and enthusiastic journalists." More than once THE FAR EASTERN REVIEW has protested against this campaign at a time when China is bankrupt and the country split asunder by civil strife. Over 300 American firms answered the call of three years ago and swarmed into Shanghai, where through their inexperience in conducting Chinese business, they precipitated the financial catastrophe which wiped them out and carried other conservative concerns to the brink of disaster.

Is it not about time that the established hongs in China protested against the continuance of a campaign which can only result in further embarrassment during a period when the most extreme conservatism is required to tide over one of the worst depressions that business in China has ever experienced ? These thoughts occur to us as we read of the reorganization plan of Andersen, Meyer & Company which permits this representative American concern to carry on, the news of the liquidation of the old established British firm of Reiss Brothers, Ltd., and the wiping out of the capital of another pioneer British hong, Probst, Hanbury & Company. There are other firms in China who are skimming along on thin ice, carried by the banks and slowly recuperating from the blow of 1920.

The American firm of Andersen, Meyer & Company has been continued as a going concern through its engineering agencies alone. The efforts to save this company from going under with the Pacific Development Corporation has attracted considerable attention in New York financial circles for the past six months. To such an extent was the parent organization hit that its shares of $50 par went below fifty cents not three months ago. According to the *Wall Street Journal* its stock on March 7th

"was worth considerably less than nothing on the basis of current values. The assets, however, have a potential value which only time can establish.

Its largest asset, a $5,500,000 loan to the Chinese government, is in default of both principal and interest since June, 1922.

"The 1922 balance sheet of the corporation will not be issued until late in the year. As of December 31, 1921, after writing off losses and bringing asset values to a basis of cost, the net worth of the corporation was $2.95 a share for the 321,900 shares outstanding. Included were Pacific Commercial Corporation at $803,073, Andersen, Meyer & Co., Ltd., at $522,030 and other investments at $2,818,031. In current accounts there was an excess of liabilities above $3,000,000.

"The banks saw the futility of liquidating the bankrupt concern, because of the possible future value of the company's assets as well as the goodwill of its subsidiaries, and the alternative was to devise some method of financing until the frozen accounts could be freed. Two finance corporations with $2,000,000 capital each were formed, one for the Pacific Commercial Co., the other for Andersen, Meyer & Co. The stockholders of Pacific Development Corporation subscribed to the offering of $1,000,000 of pacific commercial finance corporation stock at $100 a share, but the Andersen-Meyer plan is in abeyance.

"It is expected that manufacturers interested in selling American machinery in China will subscribe $1,000,000 to a proposed issue of préferred to carry on the business.

"Under the original plan it was proposed to grant options to the finance corporations exercisable in two years at $70 a share for the Pacific Commercial stock and $500,000 for Andersen, Meyer & Co., Ltd. If exercised, the return to Pacific Development Corporation stockholders would be $1,583,810. The benefits of any rehabilitation of either of the subsidiaries would accrue only to subscribers of finance corporation stock and not to holders of Pacific Development Corporation. Their position may be set forth as follows:

"Assuming that the Chinese loan is collectable at face value and that other investments and assets could be liquidated at book value as of December 31, 1921, the assets of the corporation would amount to:

| | |
|---|---|
| Chinese government loan ... ... ... | $5,500,000 |
| Investments ... ... ... ... ... ... | 2,818,031 |
| Pacific Commercial ... ... ... ... | 1,083,810 |
| Andersen, Meyer & Co., Ltd. ... ... ... | 500,000 |
| Current accounts ... ... ... ... ... | 4,304,459 |
| Total ... ... ... ... | $14,206,300 |

As liabilities are $12,504,125, there remains a potential equity for Pacific Development stock of $1,702,175, or $5.28 a share."

The original plan to create a special finance corporation to take over Andersen, Meyer & Company was abandoned in favor of the machinery manufacturers subscribing to an issue of $1,000,000 of new stock at par fully paid up to provide working capital. It is no secret that the embarrassment of this concern was caused by the inability of the Chinese government to meet its obligations both in the matter of the Pacific Development loan and for materials supplied.

Under the reorganization plan, the position of Andersen, Meyer & Company is materially strengthened by entirely severing its connection with the Pacific Development Corporation and standing on its own bottom with no affiliations other than its own subsidiaries. The new board of directors indicates that its character as the premier American engineering company in China will be maintained. The board is composed of the following officers :—

A. W. Burchard, president of the International General Electric Co., New York, chairman of the Board; C. P. Coleman, president of the Worthington Pump Co., New York; R. F. Herrick, Jr., general manager of Saco-Lowell Shops, Boston, Mass; W. E. Kugeman, vice-president of the American Radiator Company of Chicago; Wm. De Krafft, first vice-president and treasurer of the Baldwin Locomotive Co., Philadelphia: J. W. Doty, president of the Foundation Co., New York; Loyal Victor, law firm of Sullivan & Cromwell, New York; Richard Hoyt, partner of Hayden, Stone & Co., bankers of Boston & New York; A. S. Cobb, vice-president of the Bankers Trust Co., New York; V. Meyer, president and general manager of Andersen, Meyer & Co., Ltd., Shanghai.

The result of this combination makes the manufacturers partners in the firm and indicates that its future energies will be devoted specially to the sale of machinery and engineering supplies, industrial development and construction work. In this case, the engineering business of the firm has saved it from being carried under with the parent corporation.

Somewhat different is the report in *The Times* of March 17 which gives the details concerning the difficulties of Probst, Hanbury & Company, Ltd.

"The report of Messrs. Probst, Hanbury & Company for 1921 states that further losses on stocks and trading amounting to £166,020 bring the total deficit up to £306,578 for the two years of depression. All efforts to induce the authorities to make a refund of E.P.D. to the extent of £217,363 have failed, and consequently the paid-up capital of £300,000 has been practically all lost. The profits for 1922 are estimated at £38,000, from which there is to be deducted some £14,000 further loss on the machinery department which has just been wound up. During 1922 a profit of taels 200,000 (equivalent to £33,490 at exchange 3s. 4 5/8d.) has been realized on that part of the property sold, and a revaluation of the remainder gives an increase of value over that standing in the balance-sheet of taels 14,750 (£19,215). The position at December 31, 1922, is that after providing for losses on investments and writing-off trade marks and premium of the lease of the London office and the preliminary expenses amounting in all to £31,611, and including £24,000 as the net trading profits of the year, the company will be left with a capital of £48,517, exclusive of goodwill, valued at £57,642. It has been decided that a reorganization of capital is the only practicable course, but a scheme, now under consideration, cannot be formulated until the accounts for 1922 are to hand from Shanghai, which, it hoped, will not be later than June. With the prevision of £50,000 additional working capital, the directors consider a profitable business could be continued on present lines."

Here we have a hong established for about seventy-five years which failed to recuperate from the disaster of 1920, and has had to wind up its machinery business. The addition of working capital will enable it to carry on and surmount its difficulties. Coincident with the above news comes the report from London that another of Shanghai's foremost hongs has gone into liquidation. The telegraphic report states :

"Messrs. Reiss Brothers, Ld., of Manchester, trading with China, principally in cotton goods, have announced that an official receiver has been appointed liquidator pending the hearing of a petition for the compulsory winding up of the company. The position is attributed entirely to the fall in value of goods lying on the Chinese markets at the time of the 1920 slump."

This disaster involves one of the largest engineering agencies in China as the concern act as agents for over thirty of the most important British machinery manufacturers. From the above statements it would appear that the British failures can be attributed to the violent slump in piece-goods prices of 1920, and our only reason for commenting at all upon the situation is to invite attention to the hazards incidental to the engineering departments of such concerns, which operated on their own bottom, might have pulled through. These disasters, while deplorable in every way for general business, are especially depressing when considered from the engineering viewpoint. It leads us to express the opinion that as far as possible the engineering departments of general import and export hongs should stand squarely upon their own feet and not be subjected to the fluctuations of general business. Andersen, Meyer & Company comes through a reorganization financed largely by its machinery manufacturers and it will be recalled that only two months ago the engineering department of the great Ewo hong was separated from the parent concern and launched as an independent corporation, in order, amongst other good reasons, that its business would not conflict with the many other activities of the firm. In this wise move, the Jardine Engineering Corporation like Andersen, Meyer & Company faces the future development of China prepared to battle for the business without being hampered by affiliations with other departments whose profits and losses are determined by varying conditions which do not obtain in purely engineering and industrial development.

The situation we face to-day in China could be readily foreseen. In our last September number, commenting upon the financial condition of the Chinese government and its inability to pay for materials supplied, we expressed the opinion that "*unless these unsecured debts are paid within a reasonable time, foreign firms in China can prepare for another catastrophe before which the crash of 1920 will appear insignificant. The market has never recovered from that break and another blow at this time may precipitate the failure of firms who have gallantly weathered the storm relying upon the traditional honor of the Chinese to pay their accounts in full.*" Since writing the above, the three disasters noted have been chronicled. We do not mention the serious condition of Japanese banks staggering under the burden imposed by China's repudiation of her just debts, or the losses incidental to Japanese commercial concerns through continual boycotts and other agitation. That is a different story. The simple truth is that chaos in China is driving many important foreign firms into liquidation and bankruptcy. Yet the powers sits idly by supporting a militarist crew which has sucked the marrow from the bones of China, and refuses to pay their legitimate obligations, while the foremost foreign trading hongs are forced to the wall.

The handwriting is upon the wall for all to read. We quote from the Peking correspondence of *The Times*:

"The evil of militarism is responsible for the evil conditions of the finances. Each condition reacts on the other, so that steadily things are becoming worse and worse. The situation of government employees in Peking is tragic. Many modern-style banks which have arisen of late years will shortly collapse if government indebtedness is not liquidated. Many valuable educational institutions must soon cease functioning if provision is not made for them. Every kind of public work is neglected. Enterprise is everywhere paralysed. Economic development is arrested. The situation of the railways was exposed in an article which appeared in *The Times* last month. Everything indicates that the splendid foreign trade which has persisted in spite of the internal chaos of the past ten years will in the end be seriously affected. Huge foreign interests are dependent upon the foreign commerce. The funded foreign debt of China is dependent on the maintenance of the foreign trade. The whole existence of the state is based upon its commerce, and if the foundation decays what becomes of the state?"

The bankruptcy of the state carries bankruptcy down the line to the foreign merchants and in the end the loss is shouldered by the firms at home. The time has arrived for the powers to take action that will avert more serious disasters.

# Wanted: A Leader

"TOO many cooks spoil the broth." Too many powers, too many propagandists, too many high advisers, too many divergent international interests allied with too many factions now struggling for supremacy is one of the many reasons why China is unable to set her house in order. No one foreign power has the courage to make a move that might lead to internal peace and unification. France now claims the undivided interest of the world; Great Britain is busy watching developments on the Ruhr; America has both ears glued to radio receivers listening-in on Lausanne and other centres of European oratory; nobody cares a tinker's damn what becomes of China. As long as self-styled experts could sit around conference's tables and declaim over principles, everybody knew exactly what should be done and how to do it (where Japan was concerned) but like all recipes for political puddings it was easy enough to lay down a formula but somewhat difficult to mix the ingredients in the right proportions and bake it to a proper turn for serving. What China needs is a real *chef*; a number-one cook who will tell the number twos and "learn-pidgens" what to do and how to do it. Someone must assume the leadership.

The American government seems hopeless when it comes to offering a working program for carrying out theories. So long as principles alone are concerned America can be depended upon to exercise moral leadership, but in practical application, we have a tendency to wait for the British to declare their position and join in with a very meek, "Me Too"! This is exactly the American position on China to-day. Ideals and principles which should influence our attitude toward the internal struggle in China have been surrendered; we have joined forces with the select clique in Peking who are frankly and openly out to make Wu Pei-fu the strong man of China.

Japan is still smarting under the rebuke administered by world opinion for her past activities. Her vital interests, however, remain unchanged; she stands or falls with her huge neighbor; yet in the face of China's certain dissolution her statesmen hesitate to initiate any move or propose any solution that might be misconstrued as a revival of discarded policies. For the present, the only solution advanced comes from Wu Pei-fu's foreign friends. *The Times*' correspondent at Peking, puts forward the same old appeal for a foreign loan that will enable this high-minded patriot to cement his position by force of arms. There is no principle involved, it simply follows the precedent of 1913 in furnishing funds to create a strong central government directed by the strongest military satrap. It is an open secret that Wu is violently anti-Japanese and bitterly opposed to the principles of liberal government as represented by Sun Yat-sen. So the solution of *The Times*' correspondent reduces itself to a political expedient in order that the strong man of the Peking president-makers may be firmly seated in power. There is, nor can there be, any guarantee that Wu can consolidate his rule except by the application of force, which means a constant and wholly unnecessary drain on the central treasury and foreign investors for the maintenance of huge armies, a return to the old Manchu system of subordinating the civil authority to the Tartar general, subjugating and holding the provinces by a northern army of occupation; in no wise differing from the Manchu bannermen who battened on tribute levied upon a conquered people. The success of Wu Pei-fu would simply repeat history and pave the way for the restoration of the monarchy, in fact, we are informed by his adviser through the columns of a contemporary, that public opinion throughout the north is swinging around in favor of this solution. Further news corroborates this testimony. The same men who surrounded Yuan Shih-kai, surround the new military overlord; if he should triumph and occupy all the provinces with his victorious armies, then indeed, would the path to the dragon throne be cleared of all obstacles. It might mean the return of Hsuan Tung supported by the bayonets of Wu or the ascension of the latter by the acclaim of his battalions. At any rate, Wu's success would sound the death-knell to democracy in China, and turn back the wheels of political progress a quarter century. A loan to Peking at this time, means a loan to Wu, the betrayal of liberal ideals by those who talked so loudly not a few years back about making the world safe for democracy.

After reviewing the problem from the financial standpoint, *The Times* says that "the real question for the powers is whether it is wiser for them to relieve the present necessities of China at the manifest risk of prompt relapse into extravagance, or to face the risks and the losses inseparable from her rapidly approaching bankruptcy." *The Times*, in effect, inclines to the belief that it is better to bolster up the present government after a commission has pointed the way, by advancing fresh loans to save actual investments. The British undoubtedly have the most to lose in any general bankruptcy of China and their solution must command the respectful consideration of others who have no great financial stake in the country.

On the other hand, we have the argument of Sun Yat-sen, representing the liberal element, that the country can never be unified by the force of arms; that even if Wu and his northern hordes do succeed in subjugating the south, his victory would be only temporary, or until such time as the southern provinces could renew the fight. Sun further says that if the foreign powers desire to hasten unification let them practice strict neutrality in the internal affairs of China by withholding from Wu Pei-fu the surplus salt and customs revenues which alone keeps his puppets in power at Peking. Sun bases his case on its abstract justice and by appeal to a principle the liberal powers will find difficult to ignore.

British support to Wu Pei-fu is counterbalanced by the attitude of Hongkong in recognizing that its interests will be best served by remaining on good terms with the neighboring city of Canton and the southern provinces which constitute the source of such

raw materials as will permit the growth and industrial development of the colony.

With America disinclined to take any initiative that will convert her moral leadership into a practical force for the solution of China's troubles : with the British in China divided between allegiance to Wu Pei-fu and the recognition that Hongkong's future development depends largely upon harmonious relations with Canton : with France engrossed in her adventure beyond the Rhine, Japan alone remains to propose a program for the restoration of order and good government in China.

Here we are met at the outset by the fact that the Anglo-American combination in Peking backing Wu Pei-fu to win, are almost to a man, bitterly anti-Japanese. In fact, it may be said that their enthusiasm for Wu arises largely from the belief that he is the only leader who can be relied upon to resist Japanese influence. This element is intensely hostile to Chang Tso-lin the overlord of Manchuria and Tuan Chi-jui the Anfu leader, because of their friendliness towards Japan. To the unbiassed observer the civil warfare now devastating China while outwardly appearing to be a struggle for power between rival *tuchuns*, in reality is a bitter fight to prevent Japanese influence from regaining ascendency at Peking. For this reason no compromise short of Wu Pei-fu's triumph by force of arms, can be considered. Foreign support to the King-Han war-lord is the logical aftermath to the long period of international intrigues to checkmate Japan during and after the great war, the prolongation of the campaign to circumscribe her activities and destroy her prestige in China.

Principles and ideals so dear to the heart of the Anglo-Saxon are completely ignored by Wu's supporters or subordinated to a determination to resist at all hazards any attempt on the part of Japan to regain her influence at Peking. As long as this anti-Japanese foreign element continues to exert pressure upon the Chinese authorities, there can be little hope for a peaceful settlement of China's problems by any unification scheme that will bring Sun Yat-sen or the liberal party into power.

Nevertheless, the situation in China is commanding more and more attention in Japan and signs are not lacking that unless the other powers take the initiative and live up to their ideals, Japan may be urged to assume her natural rôle of leadership and demand the adoption of a program that will terminate a most dangerous situation. The powers agreed upon the abstract principles to be applied in China at the Washington conference, in which Japan was induced to surrender many of her favored positions and reverse her old policy. Japan has swung from the extreme of militarism to the extreme of moderation in her dealing with China and with the exception of the Kwantung lease and some of the Nishihara loans there are no serious questions outstanding between the two nations. The cancellation of the Lansign-Ishii agreement and the floating of a Japanese government guaranteed loan in New York for development in Korea and Manchuria indicates that America has faith in her good intentions. Once Japan's good faith is established and the other powers are satisfied that she harbors no ulterior designs upon the integrity of China, the way will be clear for her to assume her natural rôle in Eastern Asia.

The Japanese press reports that the policy of the government is now being rewritten into what may be called for want of a better word, a new interpretation of a Japanese Monroe doctrine, based on a loyal acceptance of the spirit of the open door and respect for the territorial integrity of China, a doctrine that will bring the two nations into the closest harmony for mutual economic development. The program is essentially liberal and rejects any further interference of the Japanese military party in diplomatic affairs and looks forward to persuading China to disband her armies and enter the ranks of liberal nations. Japan will follow the precedent of the United States in declaring the doctrine and assume a special position which makes it essential that the two nations shall stand together for the preservation of their common independence. The program calls for the amicable settlement of all outstanding questions between the two countries and for such assistance to China as will hasten the unification, peace and happiness of the country.

These are merely the barest outlines of a policy which, if adopted, and acted on without undue delay, will restore to Japan a paramount position in Eastern Asia and permit her to assume a leadership which the other powers are showing themselves incapable of exercising. Standing on the platform of John Hay, prepared to guarantee the future integrity of China, and demanding of the world that it recognize her right to such a leadership, there is little doubt of what the answer will be.

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# The Nishihara Loans

## An Appeal from Kobe

OUR attention has been invited to the following quotation from MacMurray's "Treaties With and Concerning China" which appeared in an article on the Nishihara Loans in our February issue :

Commenting on the Sino-Japanese military and naval agreements of 1918 MacMurray says in his introductory note : "It need scarcely be said that both agreements contain no such stipulations whatever as will go towards disturbing the peace of China or encroaching upon her sovereignty, as has been understood to be the case in a section of the Chinese public. It must be clear from the agreements that they have been made entirely for the purpose of China and Japan participating in the allied operations, of facilitating defensive measures against the enemy, and of taking the steps to meet the urgent exigencies of the situation. There is nothing clearer or more impartial then the evidence of this eminent authority."

The above introductory note was, in effect, a translation of the official statement made by the Japanese government on the occasion of its publication of the military and naval agreements of May 1918, more familiarly known as the war participation pact. It is not an expression of opinion on the part of the compiler.

While relieving the chief of the far eastern bureau of the state department from any responsibility for expressing such an opinion, this correction does not weaken the statement that the war participation pact between Japan and China entered into three months before the American government dispatched its troops to Siberia for the identic reasons set forth in the pact, was of incalculable benefit to the allied cause. Whether the statement is that of the Japanese government or the opinion of an American official does not alter the fact that the agreements were entered into for the reasons set forth in the introductory note. Upon the legitimacy of this agreement hinges the validity of the loan advanced by Japan to China for the purpose of enabling the latter to carry out her obligations under its provisions as an ally in the great war and automatically involves the arms contracts which followed as a matter of course.

These and other loans were advanced in good faith by the three semi-official Japanese banking institutions at the request of their government, and they have since staggered under the burden of paying the interest to the bondholders in order to preserve China's credit. They now face the prospect of repudiation of both principal and interest. We believe that certain of these so-called Nishihara loans were eminently proper and that any propaganda in defense of their repudiation can only result in encouraging China to extend the principle to other loans and bring further hardships on foreign creditors. Amongst the Nishihara series of loans are other deals which cannot be readily defended but even here there is no call for actual repudiation. The Chinese government officials received the funds and appropriated them into their own pockets, and the

present authorities dare not prosecute them. We believe, with many sensible Chinese with whom we have discussed this subject, that when the proper time arrives a suitable compromise can be effected with the Japanese lenders. They might be settled by the repayment of the net amount received, plus a fair rate of interest and the surrender of the rights given as security.

We are fully aware that many of these loans have aroused considerable antagonism throughout China; we also know that the foreign leaders of the anti-Japanese movement have lost no opportunity to use these loans as an argument for the furtherance of their own campaign, but we fail to see how any honest end can be served by advocating their repudiation at a time when the Peking authorities are seeking reasons to justify the default of payments on other admittedly legitimate obligations, which, on analysis, are on a par with some of the much abused Nishihara transactions. If the latter are illegal then several foreign loans other than Japanese, fall into the same category and the agitation simply provides an excuse for the Chinese to repudiate these also.

It is difficult to understand just what is behind the continued agitation to discredit all the Japanese loans to China during the war period, for, to our certain knowledge, the campaign is not encouraged by many of the most prominent Chinese officials, whose main desire has been to obtain an extension of time in which to repay them. Chinese opinion is divided on the question of the repayment of these loans. A large number of highly placed officials recognize them as a just obligation but ask for an indefinite postponement of payment or a renewal of the agreements which will cover the unpaid interest. Others, even amongst the southern leaders, admit that certain of these loans are legal and must be paid, but they balk at the others and advocate repayment of the net sum received, not the nominal amount of the loan. Few Chinese officials of prominence can be found who will openly advocate repudiation of all the Nishihara loans. The agitation for repudiation is traceable to sources inspired more by an unreasoning hatred of Japan than by any overzealous regard for China's interests.

This fact is borne home to us by an editorial appearing in the *Baltimore Sun* of February 23 entitled "What is the Truth About This"? It refers to a letter to the editor from John Brailsford of Kobe, in which the correspondent evidently had some very trite things to say about the American government sanctioning the inclusion of the Nishihara loans in any consolidated debt scheme secured on the prospective increase in customs revenues. The editorial says:

"John Brailsford, whose letter from Kobe, Japan, was published on the editorial page of *The Sun* yesterday, is a correspondent of distinguished ability and recognized standing. He is not a sensationalist and has a conscience as well as a brain. . . . Such a letter as that of yesterday demands a straightforward answer from the state department. It demands that sort of answer for two reasons: First, because it seems to reflect on the honor and humanity of the government of the United States if Mr. Brailsford has got his facts straight. And second, because it appears to furnish evidence of our curiously dark and devious foreign policy.

"According to Mr. Brailsford, the diplomatic representatives of the United States at Peking have combined with the diplomatic representatives of Great Britain, France and Japan in attempting to force the Chinese government to apply to the payment of a questionable debt part of its expected increase in revenue from the higher tariffs allowed at the Washington conference. The debt which the ministers of these powers ask to be given a special position of advantage includes what Mr. Brailsford describes as 'the notorious Nishihara loans, foisted upon China through corrupt politicians —men who were glad to pawn anything they could pawn to the Japanese lenders in order to get a rich share of the loan moneys for their own use.' In other words, the United States is charged with lending itself to the promotion of a deal that is largely in the interest of a cold-blooded game of international graft. And it is alleged to be using the apparent liberality of the Washington conference for the benefit of the loan grafters. . . . The state department owes it to the country to prove that we are not engaged in such an unmerciful and suspicious transaction. The country has the right to know whether it is being used as a catspaw for the benefit of unscrupulous international usurers, who have been sucking the life blood from a helpless country in whose rescue and reconstruction we have been affecting the greatest interest and sympathy."

We can understand why the Peking camarilla who backed Wu Pei-fu for the purpose of turning out the Anfu officials and destroying Japanese influence in China, made the welkin ring over the Nishihara loans. They, at least, had a well defined motive. We cannot understand, however, why a correspondent writing from Japan should take upon himself the task of denouncing any plan approved by the powers for the liquidation of unsecured debts among which are included the legitimate loans of the three Japanese official banks. It is safe to wager that the distinguished Kobe correspondent very carefully omitted to send to *The Times* or other prominent British newspapers, a similar letter accusing the British government of being engaged in a cold-blooded game of international graft, and calling upon the secretary of state for foreign affairs to explain.

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# The Looters

## The Other Side of the Story

SINCE writing the above, the Chinese newspapers of Peking have given prominence to the result of an investigation concerning the wealth of the super-*tuchuns*, ordinary *tuchuns*, simple governors and statesmen and every day grafters in high position, disclosing that 71 such embezzlers are worth over a million dollars, the total of their wealth coming to the huge sum of 631,000,000 dollars. Some GRAFT! Tammany or Russia in their palmiest days could sit at the feet of these sleek mandarins and learn much wisdom. According to the report, the properties of these leading boodlers, if confiscated by the government because they have been secured through corruption, embezzlement, graft and oppression of the people, will be more than sufficient for the repayment of all of China's foreign indebtedness and still have enough left over to pay for the disbandment of the rabble armies which perpetuate the system.

In commenting upon the Chinese financial situation, the papers frankly admit that the present *tuchun* government at Peking only enriches the militarists and their immediate *entourages*, while all classes of civil servants, employees, diplomats, students as well as the merchants and farmers are suffering from the exactions of the tax gatherer. They also admit that China will become bankrupt unless the people rise up as one man against the militarists who are fighting for personal interests in various parts of the country, while the "*Shih Pao*" says that in pursuance to the Washington treaties, the powers should render friendly assistance to the Chinese people in their efforts to get rid of the dangerous, corrupt and disorganized militarists and their mercenary armed coolies, otherwise foreigners and natives cannot enjoy peace and order or pursue their legitimate commercial occupations in this country for many, many, years to come.

From this, it begins to look after all that the Chinese people may start that counter movement inside the country and apply the boycott methods to the boodlers and demand to know, "Where did you get it"?

Here is where the money of China has gone to; deep down into the pockets of the officials, who have invested it in property in the foreign settlements, in shares of foreign companies or have it safely deposited and drawing interest in the foreign banks, all outside the jurisdiction of the Chinese government. This is why it would be a crime at this time to lend further sums to the puppets of Wu Pei-fu at Peking, or to any other cabinet appointed by a military overlord. And this is why, in protection of their own interests, the powers should listen to the advice of Dr. Sun Yat-sen and withhold any further payments of the salt and customs revenues to the present Peking government. If their own interests are not sufficient to move them to take such a step, then the interests and welfare of the masses of China, the furtherance of liberal ideals, and the prospect of restoring trade and confidence should influence them to take a step that will convey to the military dictator of the

Kin-Han and others of his ilk, that the foreign governments will no longer be a party to or an accomplice in the jolly old game of beggaring the country.

The Kobe conscience alluded to in the previous article would imply that the "blood-sucking usurers of international finance" were standing together to rob the Chinese people, but the evidence from Peking shows where the money goes and where it will continue to go just so long as foreigners can be blackmailed into advancing further funds to keep the freebooters in power. With actual bankruptcy confronting the government ; with all classes of civil servants without pay : with foreign loans repudiated and defaulted : with foreign firms failing and on the brink of financial collapse, the powers sit idly by in Peking doleing out the money that permits the leeches to cling to the victim, and enables a military oligarchy to mock and make sport of principles that the flower of western manhood cheerfully laid down their lives not five years ago to maintain. The Chinese people are responsible for their own government, but the powers are responsible to their ideals for continued recognition to a system which puts to blush the Villa *regimé* in Mexico and stands on a par with the Soviet in its treatment of the people. The powers refuse to extend the hand of fellowship to Moscow, but they continue to recognize, bolster up and maintain in power a group of military despots whose exploits put Moscow to the blush.

# American Co-operation in China

## A Plea for the Overworked, Underpaid Wheel Horses of the American Foreign Service

THERE is a bill pending in congress designed to place the American diplomatic and consular service on a higher plane of ability and usefulness. If the bill becomes a law the larger investment will certainly make for greater efficiency and the employment of a higher grade of officials. With salaries cast on a decent scale, with better assurance of longer tenure of office in dignified capacities and with a more sensible system of rewarding merit, the foreign service of the United States should improve rapidly. Speaking for the service in China it would seem that a reduction in the general administrative expenses to carry on the American government in this country and a return to a one department organization under the secretary of state would somewhat lessen the burden of taxation at home and make for greater efficiency by eliminating duplication of energies, especially on the part of officials of other departments who rely to a large extent upon the consular service for their ability to operate. It is not generally understood that in order to keep abreast of other nations the American government has embarked on a program of peaceful penetration in China which calls for an administrative system as elaborate as any required for the supervision of its insular affairs. With a total of 412 firms and 8,000 individuals registered in this country, we find every department of the federal government with the exception of the interior, represented by officials on the ground. Americans in China are enjoying to the full all the benefits of extraterritoriality with the added advantage of being exempt from taxation if they register under the China trade act. These truths were brought home to us while listening to the speech on "Co-operation" delivered by Judge Charles Sumner Lobinger at the dinner recently tendered by the American community of Shanghai to Consul-General Cunningham on the occasion of his completion of 25 years of public service.

It came somewhat as a surprise to learn how deeply the American administrative system had penetrated into China, that the only one of the federal departments which has not at some time been represented, is the interior department, and we gathered the impression that only the difficulty to find a suitable excuse was all that prevented it from being here. In order to bring out how closely the various department officials had always co-operated for the advancement of national interests in China, Judge Lobinger reviewed the development of American official representation in this country. He told how the navy department had furnished several of the early commissioners and how in later years the various admirals of the China squadron and the Yangtze patrol had protected national interests by cordial co-operation with the consulates ; he told how the state department for many years exercised almost unlimited judicial powers through the consular service and how these prerogatives were subsequently taken over by the supreme court for China ; how the postmaster-general's department so efficiently operated for many years the post office at Shanghai; how the department of commerce entered the field with a commercial attaché and then with trade commissioners which took over the economic work of the consulates, and then appointed a registrar of companies to supervise the China trade act corporations ; he enlightened us as to the existence of the representatives of the departments of justice, labor, treasury, shipping board and other special bureaus, and the presence of a military force which has recently been organized into a separate command. He emphasized how each and all of these various officials had always been inspired by the most cordial spirit of co-operation in their endeavors to advance the interests of the nation.

To those who have insinuated that co-operation amongst Americans could not exist, Judge Lobinger pointed to the splendid harmony characterizing the relations between the various federal officials in China, and although it was not stressed, the audience could gather some idea of that sympathetic understanding which binds together the court and the consulate and the splendid team-work between the consulates and commerce departments, all of which refutes the insinuation that Americans cannot co-operate. In summing up, the judge pleaded for still greater co-operation between American officials and their nationals ; a wonderful address, one which should have been delivered in the halls of congress, where its full import could have been digested.

As the applause which followed his words swept over the banquet hall, our eyes turned to the honored guest of the evening and beheld the familiar type of the traditional American official grown old and grey in the service of his country, and as we followed his quarter century wanderings from Bergen to Durban, thence to Bombay, Singapore, Hankow and Shanghai, we suddenly realized that this tried and true public servant had reached the zenith of his career, the top of the consular ladder, in charge of the most important consulate-general in the American service. Twenty-five years of earnest endeavor, adherance to duty and advancement of his country's welfare abroad, had brought its great reward, a salary of $8,000 per year (last year cut to $6,000): a public dinner to commemorate his survival and the prospect of having his photograph adorn the dusty walls of the consulate when he is relegated to private life or passes on ; not even a pension to look forward to when the inevitable day of retirement arrives.

Our eyes wandered back to the face of the last speaker, the popular judge who only a few months since was similarly honored by his compatriots on the occasion of his vindication from charges preferred against him by a local attorney. We saw here another public servant who after twenty-five years of service on the bench

is worth just $8,000 a year to his government. He, however, is consoled by the fact that when the axe falls or the day of retirement can no longer be staved off, he has a valuable legal experience to fall back upon. He can live and remain active. He operates with a full staff; prosecuting attorney, court clerk and officials, stenographer, marshal, jailer, etc , with an adequate appropriation and an official organ for carrying on the work of justice: a little supreme court for Americans in China complete in every detail, except—the jury.

We remembered that he was a great and good judge who had been personally honored by his president, and as we pondered, our eyes caught sight of a young consular official drawing the magnificent salary of $3,300 a year, and at another table sat another young man worth just $2,500 a year to his government. We recalled that these two unassuming, retiring, yet highly efficient assistants to the consul-general were Chinese scholars, who act as judges in the local mixed court—assessors they are officially called—who daily pass judgement on cases ranging from the misdemeanor of kicking a rickshaw coolie to homicide; from passing a simple jail sentence to condemning a man to be shot; from petty larceny charges to civil suits involving millions. We recalled that these two modest young Americans whose names are hardly known outside the consulate, had attended 745 mixed court hearings during 1922, that two-fifths of the immense judicial work of the settlement devolved upon them, and we marvelled at a system that could pay one dispenser of justice $8,000 a year and expenses with a complete working machine to try Americans without a jury, and permit its junior consular officers to do the same, if not more important work, for $2,500 a year, the salary of a ward heeler doing duty as police court doorkeeper at home. From the decision of the judge of the supreme court of the United States for China, the dissatisfied can appeal; from the decision of the two young $2,500 a year officials in whom the integrity and honor of America is typified for the great masses of China, there is no appeal. Charges may be brought before the authorities at home if the American judge is remiss in his duty, but as far as we know, there have been no complaints on the part of the Chinese that our consular officials have failed in their duty to dispense justice with equity. Such a record is worthy of the highest praise, one that should not be overlooked in summing up the development of our federal official system in China. Surely here was a phase of co-operation and co-ordination that the good judge might have dwelt upon had he not been a federal officer himself.

Had the speaker been a private citizen, he might have advocated that the consular officials detailed to dispense justice in the mixed court be selected with as great care as the judge appointed by the president of the United States to the bench of the supreme court at Shanghai; that these men should form a separate corps in the China service, picked for their efficiency in the Chinese language and legal attainments, and, paid accordingly. They try cases as important at times, and at other times of greater importance, than those which come before the federal judge. Why should a jurist of prominence on the American bench be sent to China with a salary of $8,000 a year, with a complete staff and ample appropriations to try cases under the American law, and a junior consular official just graduated from the student interpreter class, be expected to dispense the same justice to Chinese at a salary of $2,500 a year ? This is not justice either to the Chinese or the young men expected to uphold the honor and integrity of the nation under such trying conditions.

Still thinking over these matters, our eyes lit upon another young man representing the department of commerce, a specialist in his line, whose stipend was equal to that of the consul-general; we turned and saw a young lady recently elevated to the rank of trade commissioner, drawing a salary of $5,000 a year: we recalled that somewhere at home we had a commercial attaché who is paid a salary of $8,000 a year with mileage and other incidentals for his contribution to the advancement of American trade interests in China. He has a special office at Peking and a branch at Shanghai and we learn that the system is to be extended. Yet, we do not detract from his rare ability, when we state that a large part of his brilliant success is due to that wonderful spirit of co-operation extolled by the learned judge which makes of the consular officials throughout China a part of his staff. The consulates unearth the information, keep the commerce department informed of new developments in their territory, while the department of commerce gets the credit, the glory, the appropriation and the large salaries. During the year 1922, the $6,000 a year consul-general at Shanghai and his staff held 108 interviews with representatives of American business houses in connection with the extension of trade, forwarded 351 replies to trade inquiries, compiled 95 voluntary trade reports and answered 46 special requests for trade information, all of which are at the disposal of the commerce department. When the record for work accomplished by the other consulates in China is taken into consideration, throwing the lime light on that splendid system of co-operation extolled by Judge Lobinger, it is no wonder that he brought tears to the eyes of those consular officials cognizant of these pathetic truths.

We looked around the grand banquet hall for another face. It was absent. We recalled that this $6,000 a year consul-general with twenty-five years of service behind him, in addition to his many other duties of making out invoices, passports, clearances and looking after American seamen and destitute citizens, with notarial duties and the avalanche of paper work and red tape which forms the daily grind of his office; omitting altogether his arduous executive labors on the consular body which directs the affairs of the international settlement; the calls upon his time to represent in a fitting manner his government at all kinds of international functions and to act as guide, host, and general entertainer to other first-class American officials who from time to time honor the port with a visit; is also the registrar of American property in Shanghai and its consular district. Over $30,000,000 worth of American property is registered in his office and during 1922 there were 92 deeds executed and 149 titles transferred, or the work of a good sized municipality at home.

Thinking of registration of property led us naturally to the recently created office of registrar of China trade act corporations for which the department of commerce has appropriated $29,000 a year to provide for the expected rush to take advantage of this legislation. We recalled that the registrar appointed to reside in China receives a salary of $7,500 a year in addition to travel expenses and the necessary staff. We also recalled that to date just two companies had registered under the new law. We also recalled that there are 461 companies registered under the Hongkong ordinances and we are informed that the extra cost of this registration to the British consular service is exactly $3,000 (Hongkong dollars), or the salary of a Chinese clerk and his assistants who handle the papers. Under the British system, the consul or consul-general acts as registrar, his duties being equivalent to those exercised by his American colleague in the registration of property. Recalling this feature of the day's work in the $6.000 a year consulate, it seemed to us that if the American government was really anxious to practice economy and bring down the burden of taxation, that one Chinese clerk or an American stenographer added to the consular staff might conceivably be sufficient to take care of the rush to register the new China trade act corporations.

We realized how difficult it would be for any federal official to invite attention in a public speech to these inconsistencies in the government service and our sympathies went out to a body of men upon whose whole-hearted co-operation depends to such a large extent the efficiency record of other departments but whose tongues are tied by the traditions of a service schooled to express most diplomatically their opinions on these matters. Co-operation, co-ordination and cohesion in all branches of the federal service are essential to the full attainment of our national aspirations in China, but frankly, we fail to see how it can be cheerfully given when the wheel-horses of the united services have their meager salaries pared down to where it is a struggle for them to exist decently,

while other departments more fortunate in securing appropriations, create high salaried sinecures and posts which not only duplicate the work of the consular officials but rely to a large extent upon them for assistance and success.

Public sentiment at home is crystallizing in favor of a sounder and more suitable recognition of the talent required to represent the nation adequately in foreign fields. If the United States is to be represented in consonance with its greatness, it must pay its representatives in other lands such salaries as will attract men of the desired capabilities and permit them to live befitting their station. Our diplomatic service has been filled in large part by men of wealth who were willing to pay out of their own pockets for the privilege of serving and were compensated by the prestige and social standing their positions gave them. The system shut out abler men from the service, and handed it over to social climbers whose principal ambition was to shine at some European court. As for the consular service, the door has also been closed to promotion above the $8,000 a year limit. It has been virtually out of the question for a man in the consular service however able he might be, to step into a highly responsible diplomatic post, or any other kind for that matter, unless he has the good fortune to get transferred into the more active and better paid service of the department of commerce, where he stands a chance of keeping himself before the public and working up a reputation that will land him in a big salaried job with some of the many great industrial and export concerns seeking heads of departments with a knowledge of foreign markets and merchandising. Rarely does the consular official ever get the opportunity of expressing his views freely before the business-men of the country. He stands, however, as the backbone of the entire system, even here in China, where only the interior department is unrepresented, and should receive consideration due to the importance of his work. It was highly gratifying to listen to a great American judge so eloquently plead for a greater measure of co-operation between the federal officials in China, but in the last analysis, this means a further load of work shouldered on to the consular officials, further co-operation on their part, to enable the other department officials to get greater publicity, increased appropriations and larger salaries. This is not co-operation; it is a rotten imposition upon men who see their salaries diminishing from year to year, while new sinecures and jobs are created to duplicate their work and serve as an excuse for wasting the public moneys. Under these conditions, or until the consular service is recognized and adequately remunerated, co-operation between American federal officials in the China service will be all one-sided. In discussing the bill for the diplomatic and consular service now before it, congress should give some thought to these truths and the arguments of Secretary Hughes to better the condition of the real representatives of the American government in foreign lands. Provide proper salaries, allowances and living quarters for the consular service, place them on a par with at least some of the more newly created office holders who duplicate their efforts, and then let us appeal for cooperation that will work both ways. This is our humble opinion about real American co-operation between federal officials in China.

G. B. R.

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# Asiatic Machinery Markets

*By W. H. Rastall*

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NOTWITHSTANDING the fact Japan, the best of the Asiatic markets for American machinery ranks only fourth among the markets of the world, it should be emphasized that the Asiatic group shows signs of rapidly increasing importance and deserves more attention than the present volume of business might suggest. All five of the leading Asiatic markets rank better than 13 among American machinery markets. Of total machinery exports the Asiatic markets took 7.4 per cent. in 1910, 6.8 per cent. in 1913, 22.9 per cent. in 1919, 18 5 per cent. in 1920, and 26.1 per cent. in 1921. In other words, the comparative importance of the Asiatic group, as expressed in percentages, expanded about three and one-half times in the last decade, and the value of American machinery absorbed by Asia rose from $3,800,000 in 1910 to $64,400,000 in 1921.

As contrasted with the markets of Europe which are contracting, the markets of Asia are showing most satisfactory expansion, and it would appear constructive sales effort would yield the best returns when applied to expanding markets. Most of the countries of Asia are densely populated and show indications of being capable of marked industrial development, as contrasted with markets in other parts of the world in territories that have developed more recently, where there is a lack of adequate population. South America, Australia, and other sections have their immigration problems, but with Asia it is more a matter of raising the standard of living and rapid progress is being made in this direction.

It is a mistake to think of Asia as the "unchanging East." Railways are being developed, shipping increases rapidly from year to year, mines are being opened, industries are being established, highways are being constructed, automobiles and trucks are being placed in service, and in a great many other ways the entire continent is showing sings of absorbing an everincreasing volume of mechanical equipment of great variety. In mapping out a sales program for the current year the foreign-sales manager should make amply allowance for these and many other factors.

Japan ranked 4, 4, 8, 10 among the world markets for American machinery in 1921, 1919, 1913 and 1910, repectively. For many years Japan has surprised the world by its industrial development. There is something remarkably consistent about the way in which Japan has developed, and the increase in the volume of machinery absorbed, whether measured in dollars or in the relative importance of this market. Japan is being industrialized. The standard of living for its people has risen rapidly during the last several decades. Thirty years ago it was a cheap country in which to live; it has become one of the most expensive in the world.

### Country on Gold Basis

The country is on a gold basis and the exchange situation has not become a problem. On July 30, 1914, the exchange value of the yen was $0.499; on July 31, 1920, it was $0.515; and on December 1, 1922, it was $0.485. Probably the exchange will not get far from the par value, which is $0.4985.

American machinery rapidly is increasing in popularity in this market. In 1910 the United States supplied 20.1 per cent. of the machinery absorbed by Japan. In 1919 the share of the United States had increased to 75.4 per cent. but conditions then were abnormal. In 1921 our participation was 52.9 per cent. These figures seem to indicate that more business awaits the American manufacturer in this market if he will take the steps necessary to secure it. Even with this lower participation in the trade, the total volume has been so large as to represent a very remarkable increase in the American share, which has expanded from about $1,700,000 in 1910 to nearly $21,000,000 in 1921.

China in 1921, 1919, 1913, 1910 ranked 5, 7, 28, 15, respectively, among our machinery markets the volume having increased from about $642,000 in 1910 to more than $18,000,000 in 1921. It would be difficult to find a better record for expansion in both volume and rank. Chinese exchange always fluctuates very rapidly and widely, as the currency is practically on a strive basis and follows the silver-bullion market. The Shanghai tael on July 30, 1914, was worth $0.60; on July 31, 1920, it was worth $1.065; and on December 1, 1922, $0.713. In the face of disturbed political conditions, unsatisfactory currency systems, inadequate transportation, and a number of other disturbing factors, trade in China expands rapidly in many directions and industrial activity shows rapid

development. Moreover, American equipment is becoming increasingly popular in China. Our share of the total machinery trade of that country was 5.8 per cent. in 1911, 8.3 per cent. in 1914, 30.4 per cent. in 1918, and 54.1 per cent. in 1920.

British India ranked 8, 15, 22, 19 among our machinery markets in 1921, 1919, 1913 and 1910, the volume of American machinery absorbed having increased from $500,000 in 1910 to $10,700,000 in 1921. Exchange in India has been fluctuating widely. On July 30, 1914, the value of the rupee was about 32 cents ; on July 31, 1920, it was 37.25 cents ; and on December 1, 1922, it was 30.03 cents. The currency fast is approaching stability.

The industrialization of India has become the avowed policy of both the government and the public. The imports of machinery are expanding rapidly, and during recent years the American participation in this trade has shown a marked increase. During the fiscal year 1913-14 the total imports of machinery into India were valued at £6,000,000, of which the United States furnished 1.8 per cent. During the war imports fell off, but American participation increased rapidly. During the year 1919-20, when the forces of reconstruction had begun to operate, the imports were £8,600,000, of which the American share was 29.3 per cent. During the year 1920-21 the machinery imports were £25,300,000, and although the volume from the United States increased, the percentage fell to 13.7 per cent.

India may be expected to show rapid development along all industrial lines that its population and resources can support. In spite of the fact that there is a large volume of native capital available, it should be noted that British capital flowing into the country at an ever-increasing rate, and the markets ot India may be expected to absorb increasing volumes of industrial machinery from now on. Unfortunately the machinery users of India have a very inadequate knowledge of the types of machinery produced in the United States and the uses to which they may be put. India is a large market that deserves careful sales work of a character suited to its development.

Among the markets for American machinery the Philippines ranked 11, 8, 11, 18, respectively, in 1921, 1919, 1913, and 1910, and the value of American machinery absorbed increased from $500,000 in 1910 to $5,500,000 in 1921. This represented most of the machinery taken by the archipelago, the American share of the total vahing expanded from 73.1 per cent. in 1915 to 97.3 per cent. in 1920. In fact, American influence in this territory is so strong as to make it almost part of the domestic field.

The exchange situation is independent of that of Europe. On July 30, 1914, the Philippine peso was worth 49.9 censs ; on July 31, 1920, 47.25 cents ; and on December 1, 1922, 48.2 cents. Currency has reached reasonable stability.

The sales manager's problem in this territory is one of development, which has been rapid since American occupation. In this market one will find endless problems, not the least of which is the comparative scarcity of labor. But, on the other hand, the sugar industry has been expanding rapidly and in the years to come will probably show further development. In many other directions this market shows great possibilities.

In 1921, 1919, 1913, and 1910, respectively the Netherlands East Indies ranked 13, 17, 25, 27 among our machinery markets, value of American machinery exports expanding from $84,000 in 1910 to $5,000,000 in 1921. This has been due largely to the fact American machinery has become better known in the country since the beginning of the European war. Circumstances connected with the war served to introduce our equipment there, and since then American machinery has been popular. Satisfactory development of this market, however, depends upon careful sales work.

Excluding machinery for sugar factories, America's share in this trade was less than 2 per cent. up to 1914. At that time, however, important progress began and by 1919 (the last year for which data are available), American participation was 34.5 per cent. Of the machinery for sugar factories the United States supplied less than 1 per cent. up to 1915, but its share increased to 36.8 per cent. by 1918, after which it fell off rapidly to 4.1 per cent. in 1920.

This market offers a difficult sales problem, but inasmuch as it absorbs more than $5,000,000 worth of our machinery a year, and as conditions indicate a larger participation might be developed, it would appear the trade deserves the necessary attention. Conditions in this market are obviously related to those in the Netherlands, and the two territories should be considered jointly. Exchange is on a reasonably satisfactory basis. On July 30, 1914, the guilder was worth 40.9 cents ; on July 31, 1920, it was worth 34.4 cents ; and on December 1, 1922, it was worth 39.6 cents.

Business in this market has been confronted with serious problems during recent years. Sugar is one of the most important products, and the reaction of the sugar market has been felt seriously, but as the price of tdis commodity now approximates 4 cents, it would appear the industry is again on a profitable basis. The fluctuations in the rubber market have also seriously affected this archipelago, but in this respect, also conditions have improved greatly. Java is one of the garden spots of the world, and it would appear that reconstruction has now advanced to such a point that important development may be expected as rapidly on the present favorable business conditions enable these interests to overcome the difficulties resulting from the recent experiences.

Conditions in the smaller Asiatic markets, such as the Federated Malay States, Ceylon, Siam, and Indo-China, are to a greater or less extent reflected by those indicated above, and it will be noted that the conditions in the entire territory encourage the expection of important developments in the near future. No general rule can be laid down that will apply to the marketing of all kinds of machinery, and obviously it would be folly to expect these markets to employ the more specialized types that have been developed for use in the United States. On the other hand, there is a definite opportunity to expand the sales of those other types that are suitable for use in these countries.

The machinery markets of Asia are so important and the extension of American participation there during recent years has been so great that a special report on this subject has been prepared by this bureau and will be ready for distribution in the near future. The subject has been treated rather exhaustively, the report totaling 332 pages, well supplied with illustrations, charts, diagrams, and several maps that have been specially prepared to indicate the size and importance of these markets. The volume of the trade of each country, the kinds of machinery absorbed, the nature of industrial development needed, and the methods by which the business should be secured and handled have been treated with very great care. This report is entitled "Asiatic Markets for Industrial Machinery" and can be secured from the superintendent of documents, government printing office, Washington.

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# The Development of Engineering in China

## Industrial *versus* Civil Engineering

### *By Lawrence Impey, Assoc. M. Inst., Municipal and County Engineers*

DURING the last decade the development of engineering in China has made remarkable progress, as was almost inevitable in a country but newly opened to Western ideas and still struggling against the reactionary impulses of the older generation of its citizens. There is always a danger, however, that a people suddenly awakened to development along fresh lines may adopt a program impulsively and without due reflection as to whither it is leading them, until they find themselves committed to a course which at first was far from their thoughts or desires.

As an illustration, we cannot do better than regard the situation in Europe during and after the war. The first causes of the

cataclysm may be traced back to the early years of the nineteenth century, when England, from being an agricultural population, became to a large extent industrialised, and transferred large masses of her labor from the land to the workshop and the factory. This industrial productivity was imitated on the continent, by France and Germany in particular, with the result that an immense competition for world markets for their goods soon developed. This was due to the fact that none of these countries was content to manufacture for consumption only, but drew more and more of its agricultural population to the cities in the struggle for export trade.

The dearth of labor for food production was not noticeable to any great extent in France and Germany until the latter years of the nineteenth century, but in England it proved to be a different matter altogether, though the full danger was not realized until the closing years of the great war. From year to year the government returns showed a steady increase in the export of manufactured goods, and a corresponding increase in imported food supplies, as the transfer of labor from the farm to the slum rendered Great Britain increasingly unable to cope with her own demand for agricultural produce. In no country in Europe was the danger realized, and the system of national credits was extended again and again under the pressure of industrial necessity.

Paper currency was brought into existence and negotiated in larger and larger quantities in order to meet various emergencies, without any pause for reflection that while gold was always good at par, a paper money had no real value beyond the fact that it was a ' promise to pay ' on behalf of some bank or nation, and was only financially stable up to the point at which the faith of the world market in the said ' promise ' began to waver. The over productivity of the three or four great manufacturing countries of the world led them to go further and further afield in search of fresh markets which would consume their goods, and this was the first cause of the opening up of China and Japan, and their subsequent invasion by merchants and missionaries.

The competition for export trade, which grew more keen year by year as the United States of America began to absorb her share, which proved to be an increasingly large one, culminated in the world war of 1914, a war which the congestion of the world markets and the growing unrest amongst the laboring population had rendered almost inevitable.

The outbreak of the war quickly forced upon the British a realization of the fact that they were no longer a self-supporting nation, and that in these days of modern warfare it was more particularly dangerous for an island population to be dependant upon exterior sources for its food supply. The end of the war taught them the fresh lesson that national credits may prove to be but a broken reed in times of stress, for it slowly came to be realized that the various debtor nations had nothing in which to pay their debts but paper ' promises to pay,' which were of very doubtful value, or goods from their factories, with which the market was already overstocked.

It is true that practically all countries have some export of either raw or manufactured stuffs which is a necessity to some other people in the world, but this is, of course, but a minor item in the development of their trade under the present system. It seems conceivable, however, that this financial and commercial collapse in Europe, which may not improbably spread to the United States of America, will force upon the nations of the occident the choice between a return to agricultural production and industries which are chiefly for home consumption, or a relapse into the barbarism which has engulfed so many civilizations in the past.

Japan has already begun to industrialise her population, whether wisely or not, time alone will show, and the trend of events seem to be urging China along a similar course. It is this possible development in China which it is the purpose of this article to consider, in the hope that some of the attendant dangers may thereby come to be realized and avoided. China in the past was undoubtedly self-supporting, and its population chiefly agricultural, though it had a number of industries developing at the same time in various distinct centres, so that sweated industrialism, as in Europe and America, was entirely unknown. The chief ills which have befallen China in historic times have been due not to lack of industries, but rather to warfare and famines, of which she would appear to have had more than her share.

The curse of warfare has been due chiefly to the provincial spirit as opposed to the feeling of nationality, which has existed for centuries, and led to endless strife between military despots in the various provinces of China, and which even now is strikingly exemplified by the internecine warfare of north and south, and the rivalries of Sun Yat-sen, Wu Pei-fu, Chang Tso-lin, and many others.

In England, in Italy, in Germany, intercommunication proved the remedy for similar ills, by bringing the people of the various districts together and enabling them to realize their national unity and that the existence of the corporate whole depended on the successful co-operation of the areas comprising it. This mutual understanding is needed in the China of to-day, and the key to it lies in the improvement of means of communication, which at the same time will prove to be the solution of the ever present danger of famine, which in the past has so often devastated the country. Floods or drought have been the cause of most famines in the East, and these can be dealt with in a variety of ways by the science of engineering.

River conservancy, which besides straightening and deepening the river channels to ensure a clear flow, also includes the construction of the necessary dykes to act as retaining walls in the event of unusual flood water, is but one of its branches. The construction of dams and reservoirs in the mountainous districts in order to ensure a sufficient supply of water in the dry season, together with the designing of schemes of irrigation to remedy the drought on the plains below, is another, and one which is particularly applicable to northern China and the provinces of the interior. Afforestation, which is badly needed in certain provinces, has a decided effect on the rainfall and therefore on the crops, while it also has an almost unlimited commercial value, though until recent years the necessity of replanting forests has hardly been appreciated even in the countries of the west, where it has been of the most vital urgency.

Roads and railways, perhaps the most noticeable product of the engineer, will serve a purpose in famine prevention in China which has hardly yet been realized, for it is an undoubted fact that a famine in this country is usually confined to some portion of a province, while provinces to the north or south of the afflicted area may have an abundance of food stuffs, which they are unable to supply owing to lack of transportation and intercommunication.

Finally we come to the problem of sanitation, a problem which has been more or less successfully solved in other countries by scientific drainage and sewage work, and which in China has not yet received the slightest consideration, except in a few of the foreign concession in the larger treaty ports. As opposed to these constructive branches of engineering, which are an end in themselves, we have engineering as applied to the development of industrialism, and which we have studied in its results in other countries. Engineering in all its branches is a science which should be applied to the benefit of humanity, and it is only when it is devoted to the construction of war machines bringing devastation and death, or the over development of industrial production, with its concomitants of slums, sweating, and eventual national paralysis, that it may be said to have been perverted and misused.

The Chinese have been an agricultural people in the past, and they would be well advised to remember that fact, for though they possess vast natural resources which would enable them to enter into industrial competition with the nations of the west, it would seem doubtful whether it would be in their best interests to do so.

At present they do not produce a large amount of foodstuffs beyond their own needs, and if they decide to devote a large proportion of their population to manufacturing industries, their food supplies are certain to be penalised. There is a vast field open to them in improving their internal conditions, and in stimulating

those industries which will supply articles for home consumption, and betore going beyond these and entering into a competition with other nations for a world market for those manufactures which are already handled abroad, the Chinese ot the rising generation would do well to devote some thought to the economic situation.

Most of the countries of the world are becoming producer countries from the manufacturing point of view, and it is becoming increasingly difficult to find a market for goods in huge quantities under the present financial conditions, while there is no indication that this difficulty will lessen very materially in the future. Therefore it would seem that the development of engineering in China should take the constructive line which has been suggested above, and which will lead to increased prosperity on normal lines, rather than aid in the expanding of a policy of industrialism, which if developed too far, cannot but threaten to bring disaster in its train.

* * *

# Electrical Development in China

### By E. L. Clark

WITH over 300,000 k.w. of installed capacity in China, electrical development can be said to have passed the experimental stage and entered on the stage where refinement in design, more accurate calculations for transmission and setter adaptation of machinery for the purpose for which it is designed, has been ushered in. We find in China a tremendous contrast between the 100,000 k.w. generator station of the Shanghai municipal council which operates under as favorable conditions as almost any city power plant in the world, which carries a loadfactor of around 45 per cent. and which has generating units of 22,000 KVA—with the little power station in central China which has perhaps 300 k.w. so sadly overloaded by the demand for modern power, that the operator frankly admits the voltage regulation is as poor as 30 pei cent. This plant would fail half of its customers if anything were to happen to one of the units.

The growth in demand foi electricity has been very rapid in the last few years, the demand now reaching many of the small cities and villages in China. Up to 1915 perhaps one to five plants were added per year, 1916 nine to ten plants were added while in 1921 a conservative estimate would indicate that twenty or twenty-five new plants were developed exclusive of small units less than 100 k.w. operated by gas or steam. Paralled with this electrical development or perhaps causing it, has come the market for electrical goods in the industries. With a population of 400,000,000 people using practically no cloth but cotton, but even now importing less than 5 per cent. of the probable demand for thread, the demand for modern production and the opportunity tor profits in modern mills has more than any other industry, attracted both Chinese and foreign capital. Even as late as 1900 only fifteen or twenty modern mills were in operation, the increase was gradual up to 1918, when perhaps forty-five mills had a combined installation of 1,200,000 spindles. Taking advantage of the exchange situation during the last two years, the Chinese have thrown capital into this industry so that at the beginning of 1922 there had been over two and a half million spindles.

The demand for such power has thrown tremendous problems on to the central station plants and even such an efficient and huge plant as the Shanghai municipal council has had very great difficulty in keeping up with the demand.

An analysis of the power stations in China makes three problems stand out most strikingly: (1) Adequate capital investment, (2) proper operating conditions in the generation plant, and (3) satisfactory distribution to the customers.

The question of capital involves the interest of men of means in this type of industry. It has been hard for the business man of any particular city to grasp the requirements of the power plant demand for power, but also reserve for the rapid growth which would soon follow. Consequently there have been many failures and many more plants put up which are so inadequately supplied with equipment or generating capacity as to be of little real service to the community aside perhaps from merely lighting the house and streets.

The engineer, of course, depends on capital of efficient work but for the purpose of this paper, we would prefer to consider the technical engineering problems rather than problems of finance.

Considering then the equipment actually in use in China in the power stations, an analysis of the stations bring out the second problem, namely, that many of the smaller plants are working with veiy inadequate equipment.

In the following analysis we have committed altogether the Shanghai municipal council and the French power plant in Shanghai, Canton, Hongkong, Tientsin and the principal cities in Manchuria are included. Japanese controlled cities excepted.

The record, taken from as many sources as possible, covers 205 stations on many of which the reports are of course inadequate or old. The figures are only those of actual record. As a matter of fact there may be in China from 10 to 20 per cent. mcre power than the summary shows.

Of the 205 stations 84 are under 100 k.w., 81 are from 100 to 1.000 and 41 are over 1,000. The total capacity of these stations is 165,000 k.w. which, if the Shanghai power of 120,000 k.w. be added, gives a total of 286,000 k.w. for China. By far the largest part of the power goes into lighting with the result that the lamps per k.w. varies from 40, the larger in the smaller towns to 20 in the industrial centres. An estimate for all China, including Shanghai, would be 4,500,000 sockets.

In the 205 stations machinery from all parts of the world has been installed with the result that a good many different voltages and frequencies have been used. 75 cycles, even, existed for a time in the south but has now been superceded 50 cycles has the preference if Shanghai is included. Exclusive of Shanghai the following table gives the results:—

| *Frequency.* | *Number.* | *k.w.* |
|---|---|---|
| 50-cycles | 32 | 81.750 |
| 60-cycles | 54 | 65.090 |
| Direct current | 25 | 4.000 |
| Ooc. frequency | 2 | 10.000 |
| Misc. frequency | — | —— |
| Unknown | 92 | 15.000 |
| | 205 | 165.840 |

Of the 92 plants in the last class an estimate may give 3/1 to 50 cycle, 3/1 to 60 cycle and 3/1 to D.C. many being gas engine sets used in small towns back in the country.

The variety of equipment is shown even more strikingly in the voltages at which power is generated. There are 350,240 plants generating at between 2,200 and 2,300 volts, 80,210 plants have generating voltages of 3,000 to 3,500 volts. There are also one or two plants each at 6,000 volts, 5,200 volts and 4,400 volts, besides a large number of small plants which generate the distribution voltages of 440,220 or even 110. The common distribution voltages are 110-v. and 220-v. A few of the cities copy Shanghai in having 350/200 volts. There are, however, any number of 000 voltages, such as, 32-volts, 100-volts, 380-volts, 440-volts, etc. On the D.C. lines 110/220 have preference. In some of the industrial plants, however, the distribution is at 220/440 volts.

However, the station voltage rating of equipment means very little. The important point is the voltage regulation. Proper regulation is the most serious problems which power users experience, as may be shown later in the effect on motors, lamps, etc. As already mentioned one man considered himself lucky if he got 30 per cent. voltage regulation. As a matter of fact, consumers have to face voltage anywhere from normal down to 60 per cent. of rated voltage.

The best regulation reported is 30 per cent. Out of 25 reports received, 8 reported better than 10 per cent. four from 10 per cent. to 15 per cent. and five no better than 20 per cent.

No general conclusions can be drawn in regard to types of transformers used, although, of course, most primary transformers are 3 phase and, as the majority of power goes for lighting, almost all the secondary transformers are the pole type. Lighting arresters are conspicuous by their absence. Outside of the large plants about the only arresters used are the multicap on compressed chamber type. One of the big contributions which the association could make would be to study the conditions in China in regard to electrical storms so as to be able to advise what the power stations in different localities should be prepared to meet.

Except in the large cities, street lighting is more a matter of impression than utility as the average size of lamp used is 16 to 25-c.p. the lamp are usually strung at rather long intervals with only tin reflectors if any reflectors at all.

Three-fourth of the plants report 150 to 160-lbs. steam pressure, one reports 200 and one as high as 250-lbs., there are a great number who report under 100-lbs. pressure. With plants of this type, approximately one-half the condensers are of the jet type and one-half of the water tube type. The result is that only a few read 28-in. vacuum, the majority acknowledge 27-in. or less. This question of maintaining high steam pressure and low vacuum depends a great deal on the type of operators which the plants can employ and on the care with which the equipment is maintained. A spendid service could be rendered by issuing Chinese instructions corresponding to the standardization rules showing how power plants can be tested and what conditions are necessary for efficient operation. Only a small additional attention in regard to use of measuring instruments, handling of coal and care of the boiler, fires, etc., would be necessary to make a difference between success and failure on the part of a good many plants.

Inadequate equipment and poor regulation affects both the power plant and the consumer in a serious way—from the viewpoint of the power plant, in serious loss of revenue, if the voltage drop is even a small percentage of the rated value. The following figures have been taken from experience with actual operating plants:—

If there are 10,000 lamps connected, the anticipated revenue per year would be $48,000, the loss in revenue for the conditions mentioned below would be $1,440. These figures are based on using 40-watt lamps two hours a day for 300 days a year and the voltage impressed across the terminals is normal for half the time and 4 per cent. below normal for the remainder of the time. The cost of power consumed was 20 cents Mex. per k.w. hour.

Looking at it from the viewpoint of the consumer, merely a 5 per cent. drop in voltage means a big loss in power received and efficiency of lamps. For example on 110 volts theoretical circuit supplied with 110 volt lamps, the voltage is allowed to drop to 105 volts the candle power from the lamp will drop to 85 per cent. of normal. The wattage for candle power will be nearly 10 per cent. higher, on the other hand, the lamps will last almost twice as long. No wonder one of the salesmen reported from a certain city that the lamp business had decreased because the voltage was low, the city regulations required that 110 volt lamps be supplied. His comment was "lamps no burn out quick." When it is common to fine 10 per cent. drop in voltage not 5 per cent., the seriousness of the situation cannot be overemphasized from the viewpoint of actual loss in cash value to the power stations and the consumers.

That the above rate of twenty cents Mex. per k.w. hour is fairly representative may be shown by the average charges for power in China. The rate for lighting is quite uniform throughout the country, it being based on a charge per month per candle power. The average is $1.20 for 16 c.p. or 20 watt lamps. The average varies from $0.90 for 16 c.p., to $1.30. The power rate varies over very wide limits, the minimum being five cents per k.w. hour, the average is approximately 25 cents per k.w. hour.

The effect on lamps has been emphasized because outside of the larger cities, most of the power goes for lighting. The effect on other electrical equipment, however, is not less serious as the heating effect varies the square of the current. The motor which is carrying full load on normal voltage will very rapidly overheat and burn out if the voltage is allowed to drop below normal. A 10 per cent. drop in voltage means roughly a 10 per cent. increase in current with a resultant 20 per cent. increase in heating. If than the motor is required to carry full load at a voltage 15 per cent. below normal the temperature rise may be enough to cause serious trouble if not a burn out. Many of the complaints for failure of machinery are due to no other cause than bad voltage regulation, and yet, unless the operator appreciates the situation, the blame falls back on the manufacturer. The result is economic loss to all parties for the following reasons:—

The manufacturer to protect himself must give a motor of larger capacity than is actually required with resultant increase of price to the customer. The customer is running a motor at one-half to three-quarters load instead of normal load most of the time resulting in lower efficiency and the use of more power. These remarks apply to any type of motor. The situation is even more serious with induction motors, because a drop in voltage on an induction motor means much lower factor. A lower power factor results in increase of current, heating effect, loss of power, even worse regulation and difficulty in handling the generator equipment. A drop in voltage at the consumer's terminal, therefore, means a loss all the way back to the power plant (1) in the light and motors, due to increased current or poor power factor, (2) in the transmission and transformers due to the additional current which must be carried, and (3) in the generating station due not only to the additional current but to the difficult problem of voltage regulation when the power factor is bad. The loss increases approximately as the square of the current.

In looking over the field, there is great encouragement in the demand which is being made for electricity in China and the rapid growth in the number of power plants. On the other hand, this growth brings serious problems, the principal ones being (1) adequate capacity of the plants, (2) suitable equipment and design of the plants and (3) proper supply to the customers. If any one point should be most strongly emphasized during this stage, it would be that the power plant operators and customers must insist on good voltage regulation, as this is the most important element and the key to successful and efficient power plant operation. If the facts could only be presented showing the actual economic loss due to even a 5 per cent. drop in voltage, we are sure that much more attention would be paid this important phase of power plant operation.

The detailed methods of maintaining voltage through voltage regulators, properly designed distribution system, intelligent station operating, etc., from a separate problem in each case.

The association of Chinese and American engineers can conr tribute much by (1) emphasizing the need of this study and (2- supplying information to or actually assisting in testing powe) plants which face this situation.

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# Construction Costs in China

**A Review of "The Chinese Railway System" by H. Stringer, B.A., Cantab., A.M.I.C.E., Resident Engineer, Peking-Mukden Railway. Published by Kelly & Walsh, Limited.**

LIKE most technical writers, the author is not always accurate in explaining the political side of Chinese railway contracts and concessions but is more interesting in his handling of administrative, operating and construction data. In this respect the book is a welcome addition to technical literature and of immense value to engineers in estimating costs in China. The book gives a general résume of the history of the railways, their statistics and a list of railway loans, etc., but it is in the chapters on the case for machinery on railway construction in China, the

use of reinforced concrete and construction data that its real value rests.

There is some exceedingly interesting information in the chapter devoted to the economics of Chinese railways which treats of native transport, roads, and average costs of transportation. For instance, the following data is given on the costs of the various modes of transport which varies in a country where labor increases in cost from north to south (wages in the Yangtze region being about 50 per cent. and in Canton 100 per cent. higher than in North China).

| Type | Cost per mile | Remarks |
|---|---|---|
| Cart ... ... ... | 10 to 20 cts. (2d. to 4d.) per ton mile. | Max. load 1½ ton. English cart 25 cwt. cost 7½d. per ton mile. |
| Water ... ... | ½ cent to 1 cent (0.1d. to 0.2d.) per ton mile | Sailing boats up to 200 tons. An extra of 4d. per ton for loading is charged. |
| Wheel-Barrow... | 10 cts. to 30 cts. (2d. to 6d.) | Max. load 800-lbs. |
| Mule ... ... ... | 15 cents (3d.) | Max. load 200 to 270-lbs. |
| Railway ... ... | 1 cent (0.2d.) | Cost to government. |

Costs per mile of metalled and unmetalled roads, cost of railway construction, motor traction, and other interesting data on traffic costs and charges are given. In the chapter on machinery on railway construction are found estimates of costs to run excavating, pile driving, stone breaking and quarrying, concrete mixing and minor contractor's machinery. The chapter on reinforced concrete also gives useful cost data and estimates for Chinese railway work and the memorandum on earthwork is also of exceptional value to contractors in preparing estimates. This data makes the book a contractor's manual for Chinese construction work. As it was printed by order of the board of communications of the Chinese government, it may be taken as an official presentation of data that should be in the hands of every financier and engineer interested in the management, operation and construction of railways in China.

* * *

# Travels of a Consular Officer in Eastern Tibet

**A History of the Relations Between China, Tibet and India by Eric Teichman, C.I.E., B.A. (Cantab.) of His Brittanic Majesty's Consular Service in China, Author of "Travels of a Consular Officer in N.W. China," Published by the Cambridge University Prsss, London. 25s. net**

UNDOUBTEDLY one of the most valuable contributions to knowledge about this remote part of China. Although the highly illustrated book is devoted largely to descriptions of the places visited by the author on an official tour beginning at Tachienlu and covering the Eastern Tibetan country as far as Chamdo on the west, its main value lies in the few chapters giving the political history of Tibet during the past two decades. Much that has been obscure to even the intelligent observer in China is clarified by the presentation of the facts surrounding Chinese, British and Tibetan policies in this mysterious land.

The questions at issue are comparatively simple to state, if they are not easy of solution. Briefly, Tibet seeks, if not complete independence, autonomy and freedom from interference in her internal affairs on the part of China, India, or other power, and would extend her boundaries to embrace all those parts of high Asia inhabited by peoples of Tibetan race. The Tibetans base their claim to manage their own affairs without Chinese interference on the history of their country as an autonomous state from the earliest days, and further argue that on the disappearance of their nominal overlords, the Manchu emperors, at the time of the Chinese revolution in 1911, they became, either entirely independent, or equal partners in the new commonwealth with the Chinese themselves and other constituent elements of the former Manchu empire.

This book has no official imprimatur of any kind. No secrets are made public, nor, so far as the writer is aware, are there any to divulge. All that has been done is to piece the various items of information together to make a consecutive story, which will, it is hoped, do something towards dispelling the fog of suspeicion and misunderstanding which is apt to enshroud the Tibetan question.

The writer lived too long in China not to be imbued with regard for the Chinese and admiration of their many outstanding qualities. At the same time he cannot avoid strong feelings of sympathy with the Tibetans in their gallant struggle for autonomy and regret that the Chinese should in this case have placed themselves so much in the wrong.

The book gives the inside facts surrounding a war for the subjugation of a free and independent people waged with great ferocity by China during the progress of the greater world conflict in Europe, a war that was only terminated in 1918 by the mediation of the British consular agent stationed in western China. The truce was only just effected in time to prevent the Tibetan advance towards Tachienlu from where it would have been difficult to dislodge them. Between the lines we get a glimpse of British activities in the far off mysterious corners of Asia where one white man braved the dangers of travel amongst wild, lawless tribes in order to bring about a peaceful solution to problems, which, if left to solve themselves in the traditional Chinese way, would once more involve Great Britain in another military expedition into Tibet in order to preserve the peace and security of India. As a record of service, the book is of greater value than the record of places visited.

# The Bolsheviki in China

**From "The Balance Sheet of Sovietism" by Boris L. Brasol. Published by Duffield & Co.**

THE following extract from one of the recent books on the Soviet machine should be most interesting to Shanghai readers:—

"When Urin, *alias* Dzevaltvosky, proceeded to China in the rôle ot Soviet ambassador, he carried in his luggage a bag containing 3 poods and 22 pounds of gems and precious stones, which were later exchanged for Chinese dollars and spent for propaganda.

"The Bolshevist scheme of the Red East is an adroit plan in which even minor details of the work have been discussed at length and scrupulously weighed. Its general outline, however, is based upon the plain fact of the discontent among the masses inhabitating the Asiatic continent. This is the great premise from which the deduction is drawn that subconscious fermentation among the Eastern peoples must be used *ad majorem Marxi gloriam*. To this end, all means are acceptable, all methods should be tried, all destructive forces set in motion.

"As a typical example of Soviet 'achievements,' the Far Eastern communist organization may be mentioned. Chita, the capital of the transbaikal region, was made the general headquarters for the Eastern Asiatic zone, comprising China, Japan, Korea, and Eastern Siberia. China is subdivided into four belts, with Peking, Tientsin, Canton and Shanghai, serving as communicating centres. Each of them has business ramifications of its own, subordinate to the local Soviet chiefs. Thus, the Shanghai organization, which probably is the strongest among the Chinese groups, works through the following subsidiaries :—

(*a*) The Chinese labor party, Çun-Dan-Koui, which disposes of considerable funds. Its members are conducting propaganda mainly among the army units. It also is engaged in buying munitions and supplies for rebel soldiers. This party publishes in Shanghai two newspapers and one underground organ, *Jan-Bao*.

(*b*) The Chinese Students' Federation

(*c*) The Chinese Labor Union

(*d*) The Korean National Organization

(*e*) The Zionist Group

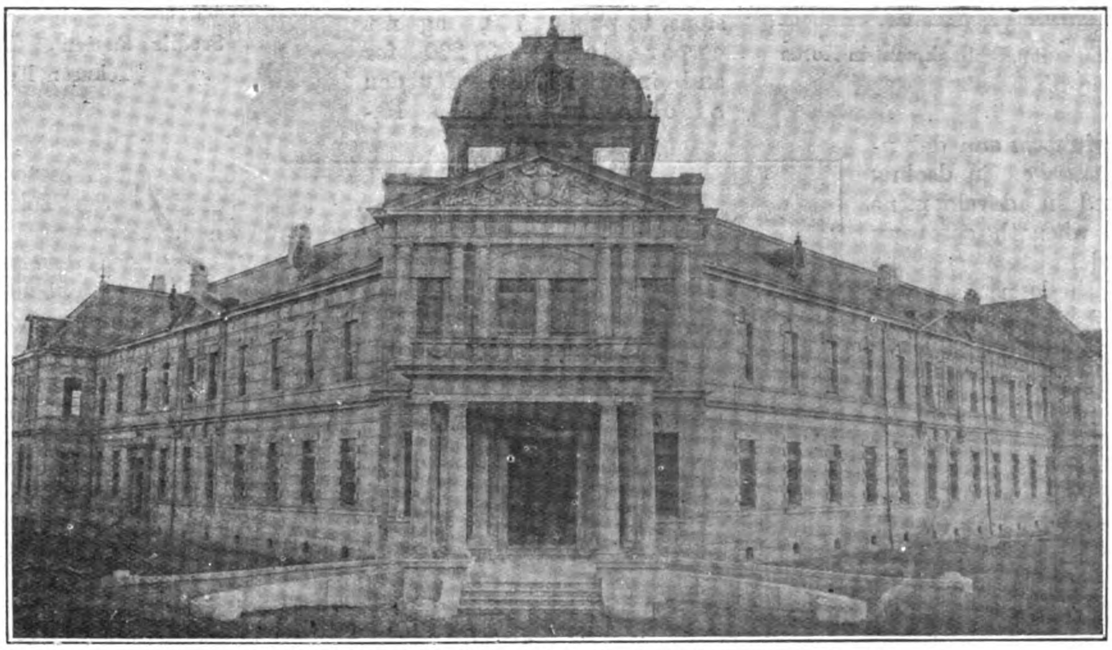
(*f*) The Esperanto

(*g*) A special committee which prints *The Shanghai Life*.

"Propaganda, purchase of munitions, and espionage, are the three main lines of work in which the Shanghai communist centre is engaged."

# The Oriental Development Loan

A TWENTY million dollar loan for the development of Korea guaranteed by the imperial Japanese government has been floated in the United States. Thus ends the campaign to obstruct Japanese-American co-operation for the development of enterprises in Korea and Manchuria, a step which, if followed up, will do more to preserve the peace of the Far East and assure the integrity of China than all the conventions, gentleman's understandings and discussions over the open door principle that clutter the reports of proceedings of international conferences. The mere fact that American capital is co-operating with Japan for the development of industries, mines, and agriculture in Korea, is a sign that an end has come to the long-drawn-out attempt on the part of Korean independence leaders to involve the United States in their cause, it also indicates that whatever may be the government's attitude, our bankers are willing to take a chance with Japan in developing the resources of Manchuria.


Office Building of the Oriental Development Company at Seoul

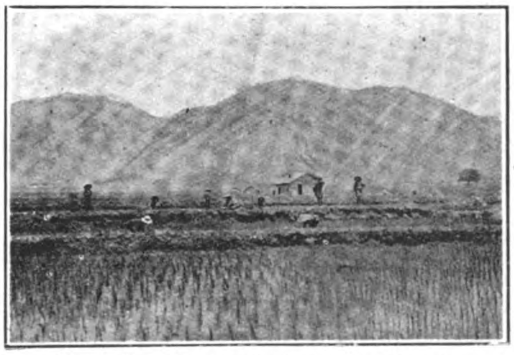
The keenest competition existed amongst international bankers for handling this loan, which was finally placed on the New York market on March 26 by the National City Bank. The bonds are debentures of the Oriental Development Company, Ltd., bearing six per cent., sold at 92 and maturing in 1953. Both interest and principal are guaranteed by the Japanese government and the proceeds of the loan are to be employed for agricultural development in Korea, though some of the money will be used in Japan and Manchuria.

It is now easy to read between the lines and understand more clearly the motives behind the recent cancellation of the Lansing-Ishii agreement, when it is understood that simultaneous with this, the Oriental Development Company, guaranteed by its government, was carrying on negotiations in New York for a large loan which might be employed in part for the development of Manchuria. With the acknowledgement on the part of Japan that she holds no special interests in Manchuria which conflict with the doctrine of the open door, there was no longer any legitimate reason why American financiers should decline to co-operate with Japan in the development of its resources. Although the Chinese may declaim against this loan as being inimical to their interests, common sense will tell us that the mere fact that American capital is co-operating with a Japanese company, is the surest guarantee that Chinese sovereignty will be upheld and the only guarantee for many years to come that American capital invested in that region will be adequately protected.

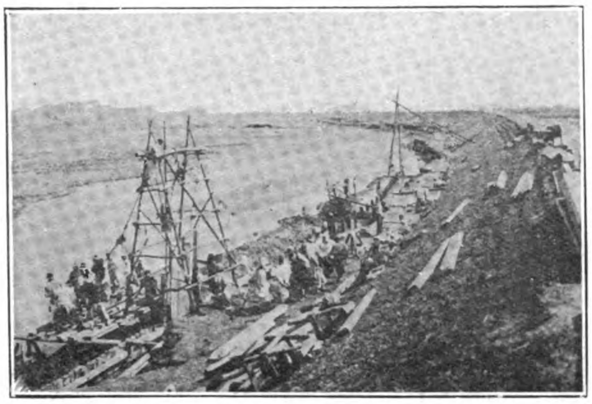
The Oriental Development Company, Ltd., is what its name indicates, an institution originally created for general development work in Korea, subsequently extending its scope of operations to other countries. When Japan undertook the task of developing Korea its government followed the precedent created by Great Britain and organized a semi-official chartered company to carry out the work. The Oriental Development Company, Ltd., was established in December, 1908, with a capital of Y.10,000,000, of which Y.3,000,000 was taken up by the government, its statutes providing rigid official supervision over its operation. The government furthermore furnished a subsidy of Y.300,000 for each of the first eight years, which is to be repaid out of excess profits when dividends exceed ten per cent.

The company started work early in 1909, not long before the formal incorporation of Korea in the Japanese empire, an event which doubtless accelerated the company's progress. The program of the undertaking was largely that of a bank making advances to settlers, to groups of farmers and on produce on the way to market.

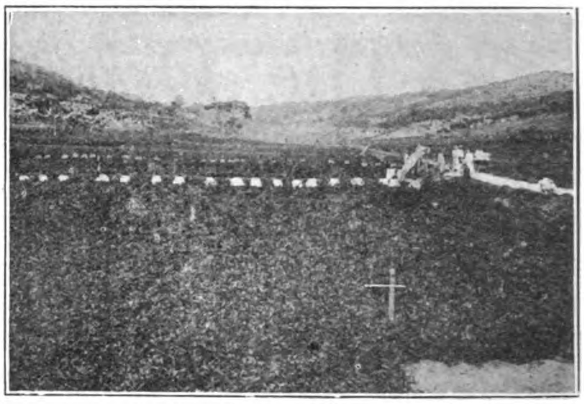
Ploughing by Native Farmers on Lands of the O.D.C.


Rice Cultivation by Japanese Immigrants introduced by the O.D.C,

School Maintained by the O.D.C,



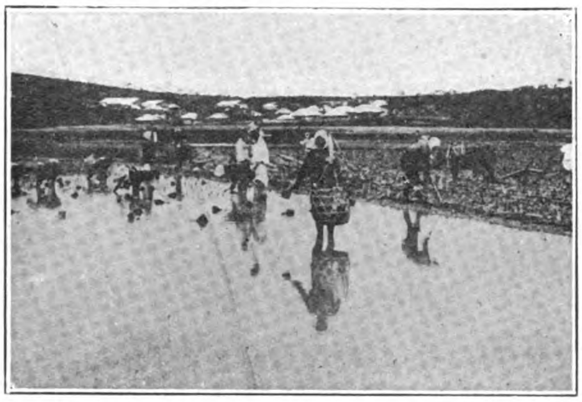
Building Flood Protection Embankment in Korea by the O.D.C.



Seedling Station of the O.D.C. at Tokuson, Korea

All such loans were repayable by instalments extending over various terms of years—in the case of produce within one year. Loans could also be made on real property, railways and mining concessions, to public corporations and industrial associations, and on the security of shares and debentures of companies engaged in dealing with emigrants, and in development work. Up to 1916, when the company confined its operations to Korea, the average amount of the loans made was small, and, indeed, had a declining tendency, the average falling from Y.5,835 in 1921 to Y.2,803 four years later.

Then came a revolutionary change in the scope of the Oriental Development Company, for in 1917 the statutes were revised to permit operations in foreign countries. Branches were opened at Mukden and Dairen in that year; in 1919 Kharbin and Tsingtao (formerly German) saw branches established.



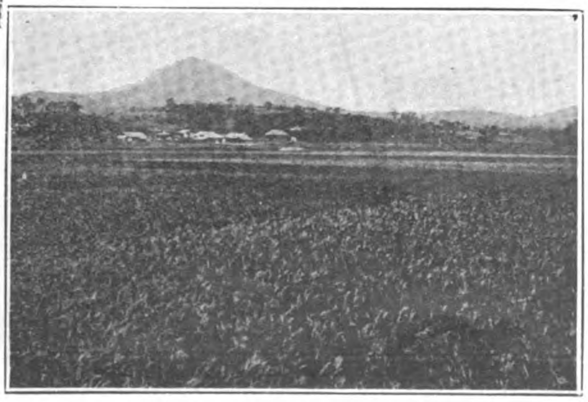
Japanese Immigrants Planting Rice

The company contemplates, if it has not already done so, the establishment of branches in some of the South Sea islands and in New York. The Philippines, Sumatra, Java, Borneo and even New Guinea are included in its potential sphere of operations. A curious fact emerges from a record of the company's achievements published in English at Tokyo. Under the influence of war demand or products the average of loans in Korea expanded, but still was modest in comparison with those made in the more distant spheres of operations. In 1917 four-fifths of the loans were made in Korea with an average per loan of Y.4,000, but the Mukden branch had an average of 18,300 and the Dalny (Port Arthur) branch one of Y.8,860. By 1918 the aggregate of loans in Korea had fallen to 56 per cent. of the total advances, and their average was just under Y.5,000, against Y.26,600 for Mukden and Y.8,700 for Dalny.

Horticulture Introduced by the O.D.C. at Tokuson

Koreans Using Improved Rice Separating Machine Furnished by the O.D.C.

By 1919 the operations had so far changed their character that of Y.70,257,000 advanced only Y.32,595,500 were lent in Korea, where the average loan had declined to Y.4,700, against Y.37,200 for the Mukden branch, 15,500 for Dalny, 54,500 for Kharbin and 52,600 for Tsingtao. Nine loans attributed to the Tokyo head office give an average of Y.336,800 per loan. Agricultural development still claimed the largest proportion of the 1919 loans, though mining and industries begin to bulk more largely, and transport and communications account for a rapidly expanding sum. It may be presumed that the substantial amount of Y.19,806,200, described as for "streets laying," relates to roads, otherwise it would appear that an organization designed for rural development was paying too much attention to urban facilities. In any case it is evident that the company originally intended to fulfil the duty of assisting production in Korea has increasingly become an instrument for developments in Manchuria, Mongolia and China, which since Europe went to war have had to depend more and more on Japanese capital and enterprise for their advancement.



A Rice Field Maintained by a Japanese Immigrant

The extent of lands now in possession of the company which is regarded as constituting its most important asset is 252,273 acres and upwards. It consists of paddy fields, upland farms, forests, residential and lands unclassified. The actual value of all these lands is not less than Y.100,000,000. The company has also acquired lands and buildings to a considerable extent in China. To give the principal instances, it purchased lands and buildings worth Y.1,700,000 in Tsingtao which had been in the possession of Germans under the control of the Chinese government. With these new acquirements the company started an

industrial concern. In Tientsin it purchased similar real estate to the value of Y.700,000 and upwards and opened a sister company therewith. In the same place, the company also purchased other lands and buildings amounting to Y.800,000, approximately.

**Keisan Grain Warehouse of the O.D.C. near Taiko**

Under its agreement with the Japanese government the company undertakes the following :—

First, supply funds for development ; second, develop agricultural and water power resources and acquire, manage and dispose of lands ; third, recruit and dispose of settlers necessary for development ; fourth, construct, purchase, sell, lease and rent buildings necessary for settlers ; fifth, furnish settlers and farmers with the necessities of development and dispose of articles produced by them ; sixth, manage and take charge of lands in trust ; seventh, receive fixed deposits, and carry on other enterprises.

In general the Oriental Development Company is engaged in the work of banking, fostering the growth of agriculture and industry and giving facilities to settlers.

With the annexation of Korea as an integral part of the Japanese empire, the program of the company naturally underwent some changes. In one of its principal aims, that of inviting Japanese farmers to the peninsula, the company was not very successful. Now that every Korean is a Japanese subject, there is little use in introducing Japanese, save that their presence among the Korean farmers might lead to improvement in their condition by the example set them of better farming. The result of this particular venture is seen in the following table :—

**Farm Operated by O.D.C. Tenants**

| Year | | Applicants | Accepted | Number of Successful Settlers | | Lands Appropriated | Funds Advanced |
|---|---|---|---|---|---|---|---|
| | | Families | Families | Families | Members | Acres | Yen |
| 1910 | .. | 1,253 | 160 | 118 | 531 | 532 | 13,034 |
| 1911 | .. | 1,714 | 720 | 337 | 1,516 | 1,448 | 33,410 |
| 1912 | .. | 2,086 | 1,167 | 640 | 2,880 | 2,914 | 60,963 |
| 1913 | .. | 3,465 | 1,316 | 568 | 2,556 | 2,563 | 40,874 |
| 1914 | .. | 1,964 | 1,108 | 432 | 1,944 | 1,946 | 20,899 |
| 1915 | .. | 1,284 | 774 | 293 | 1,318 | 1,434 | 13,520 |
| 1916 | .. | 1,101 | 542 | 250 | 1,125 | 1,103 | 14,030 |
| 1917 | .. | 1,552 | 650 | 340 | 1,530 | 1,875 | 13,830 |
| 1918 | .. | 1,528 | 598 | 479 | 2,155 | 3,926 | — |
| Total | .. | 15,929 | 7,035 | 3,457 | 15,555 | 17,741 | 20,360 |

The great difference between the number of applicants and that of those accepted shows the care exercised by the company in the selection of immigrants in order to secure the best.

In other respects, the company has generally done very well. Especially successful has it been in the work of irrigation and reclamation. Many a stretch of waste land hitherto lying idle on account of lack of irrigation has been converted into the best of farm land, and rented to Korean farmers or Japanese settlers. Its horticultural farm in Tuksum is perhaps only next to the government horticultural garden in the same place in size as well as in perfection of equipment. In afforestation the company has obtained a lease from the Government of an area of no less than 75,187 acres, part of which has already been afforested and part is under way. As the supplier of agricultural funds it has also achieved signal success and rendered valuable service to agricultural development in general. Since its head office was removed from Seoul to Tokyo, and the scope both of the nature of its undertakings and its fields of activity greatly widened, it has come to partake of the nature of an underwriting company, and has already an active interest in quite a number of industrial companies in Chosen, Manchuria, and Japan. As in the case of the Bank of Chosen, Manchuria was for a time its principal field of investment.

## Advances

Forms of advances and their term made by the company are as follows :

(1) Advancing loans to immigrants on the terms of annual redemption within a period not exceeding 25 years or redemption at a fixed date within a period not exceeding five years.

(2) Advancing loans (by means of discounting bills) to producers on security of their products on the terms of redemption within a year.

(3) Advancing loans on security of real estate, railways, mining rights and rights established on real estate on the terms of annual redemption within a period not exceeding 30 years or redemption at a fixed date within a period not exceeding five years.

(4) Advancing loans to industrial associations founded in accordance with special law without security on the terms of annual redemption within a period not exceeding 30 years or redemption at a fixed date within a period not exceeding five years.

(5) Advancing loans without security to a party of agriculturalists not less than 20 in number taking upon themselves joint responsibility for their obligations on the terms of redemption at a fixed date within a period not exceeding five years.

(6) Taking up shares or debentures of companies having for their object the immigration or colonization business.

(7) Advancing loans on deposit of shares or debentures issued by companies engaged in immigration or colonization on the terms of redemption at a fixed date within a period not exceeding five years.

(8) Advancing loans on security of financial associations founded in accordance with law or of other trustworthy things on the terms of annual redemption within a period not exceeding 30 years or redemption at a fixed date within a period not exceeding five years.

## Purpose of Present Loan

The proceeds of the present issue will be used to redeem Y.15,000,000 ($7,500,000) of debentures of the company now outstanding, to retire Y.10,000,000 ($5,000,000) of bank loans, and the balance to aid in the development of the company's business in Japan and its colonies, principally Korea, for economically productive purposes.

## Assets

Among the assets, the land owned by the company, amounting to 253,272 acres, together with improvements, excluding buildings, represented an investment March 31, 1922, of $9,996,363, and a present estimated value of approximately $50,000,000. This with improvements, including buildings, is carried in the balance sheet, as of February 22, 1923, at only $15,814,694.

## Capitalization

The capital stock and funded debt of the company outstanding February 22, 1923, adjusted to include the present financing, was as follows :

| | | |
|---|---|---|
| Capital stock, fully paid .. .. | $10,000,000 | |
| Capital stock, 50% paid .. .. | 7,500,000 | |
| Total paid up capital .. .. .. .. | | $17,500,000 |
| 6% debenture loan of 1923 (this issue) .. .. | | 19,900,000 |
| 5% debenture loan of 1913 (French issue Fcs. 33,026,000) .. .. .. .. .. | | 6,375,675 |
| Internal debenture loans .. .. .. .. .. | | 57,087,800 |
| Total capitalization .. .. .. .. | | $100,863,475 |

The only loan of the company to be presently outstanding, which will bear the guarantee of the imperial Japanese government, other than this 6 per cent issue of 1923—purchased by you, is a French 5 per cent. loan originally issued for Fcs. 50,000,000 ($9,625,-500) and outstanding February 22, 1923 to the amount of Fcs. 33,026,000 ($6,375,675). The internal debenture loans are not guaranteed. The French loan was issued in Paris in 1913 on a 5.22 per cent. basis and has sold at average prices to December 31, 1922 to show an average annual yield of 5.85 per cent. The bonds were quoted in Paris February 22, 1923 to yield 5.21 per cent.

## Balance Sheet

The condensed balance sheet of the company as of February 22, 1923 was :

*Assets—*

| | |
|---|---|
| Land owned, with improvements, including buildings | $15,814,694 |
| Loans due from municipalities, corporations, farmers and others, payable at fixed dates or in installments.. .. .. .. .. .. .. .. | 60,400,148 |
| Shares and debentures owned .. .. .. .. | 11,712,567 |
| Cash on hand and in bank .. .. .. .. | 15,504,332 |
| Other miscellaneous assets .. .. .. .. | 3,254,445 |
| Total assets .. .. .. .. .. | $106,686,186 |

*Liabilities—*

| | | |
|---|---|---|
| Capital stock authorized and subscribed, par value Y.50 ($25) .. .. .. .. | $25,000,000 | |
| Capital stock subject to call .. .. | 7,500,000 | |
| Capital stock paid in .. .. .. .. .. | | $17,500,000 |
| Bonds outstanding .. .. .. .. .. | | 70,978,331 |
| Bank loans, deposits and other current liabilities .. | | 12,338,049 |
| Miscellaneous liabilities .. .. .. .. | | 1,374,570 |
| Surplus and reserves .. .. .. .. .. | | 4,495,236 |
| Total liabilities.. .. .. .. .. | | $106,686,186 |

The above balance sheet does not include the $19,000,000 6 per cent. bonds of the present issue.

## Earnings

Net earnings of the company during the ten years ending March 31, 1922 have amounted to more than 1.93 times interest requirements. The following table shows earnings of the company for this ten-year period :—

| Year Ending March 31 | Gross Earnings | Operating Expenses | Net Earnings | Interest Payments | Available for Sinking Fund. Reserves, Dividends & Surplus |
|---|---|---|---|---|---|
| 1913 .. | $1,032,265 | $511,341 | $520,923 | $234,590 | $286,333 |
| 1914 .. | 1,519,635 | 596,700 | 922,936 | 488,759 | 434,177 |
| 1915 .. | 1,431,119 | 522,366 | 908,752 | 495,255 | 413,498 |
| 1916 .. | 1,390,318 | 451,953 | 938,366 | 436,568 | 401,798 |
| 1917 .. | 1,465,403 | 518,038 | 947,365 | 422,014 | 525,450 |
| 1918 .. | 2,223,716 | 1,045,261 | 1,178,455 | 553,621 | 624,834 |
| 1919 .. | 4,113,500 | 1,278,508 | 2,834,992 | 1,261,091 | 1,573,901 |
| 1920 .. | 5,921,592 | 2,539,008 | 3,382,584 | 1,917,274 | 1,465,310 |
| 1921 .. | 6,679,865 | 2,323,318 | 4,356,547 | 2,127,961 | 2,228,586 |
| 1922 .. | 8,916,949 | 2,288,244 | 6,628,705 | 3,778,706 | 2,849,999 |
| Total .. | 34,694,362 | 12,074,737 | 22,619,625 | 11,715,839 | 10,903,786 |
| 1923 (estimated). | 9,549,778 | 2,191,359 | 7,358,419 | 4,469,631 | 2,888,788 |

The capital stock of the company outstanding in the hands of the public has received dividends regularly since the organization of the company in 1908 at rates ranging from 6 per cent. to the present rate of 10 per cent. per annum. The stock sold on the Tokyo Stock Exchange on March 19, 1923 at 112 per cent., which indicates a stock equity of $19,600,000 junior to the total funded debt of the company.

The American loan to the Oriental Development Company will come as much needed assistance for the development of many legitimate enterprises in Korea where, to date, the Japanese have provided 85 per cent. of the capital for the 1,500 factories already established there. Many private and industrial railways and other enterprises have been held up these past two years for the lack of capital and it goes without saying that if foreign capital participates in this development, a market will be opened in Korea for manufactured articles that will expand rapidly under Japanese management.

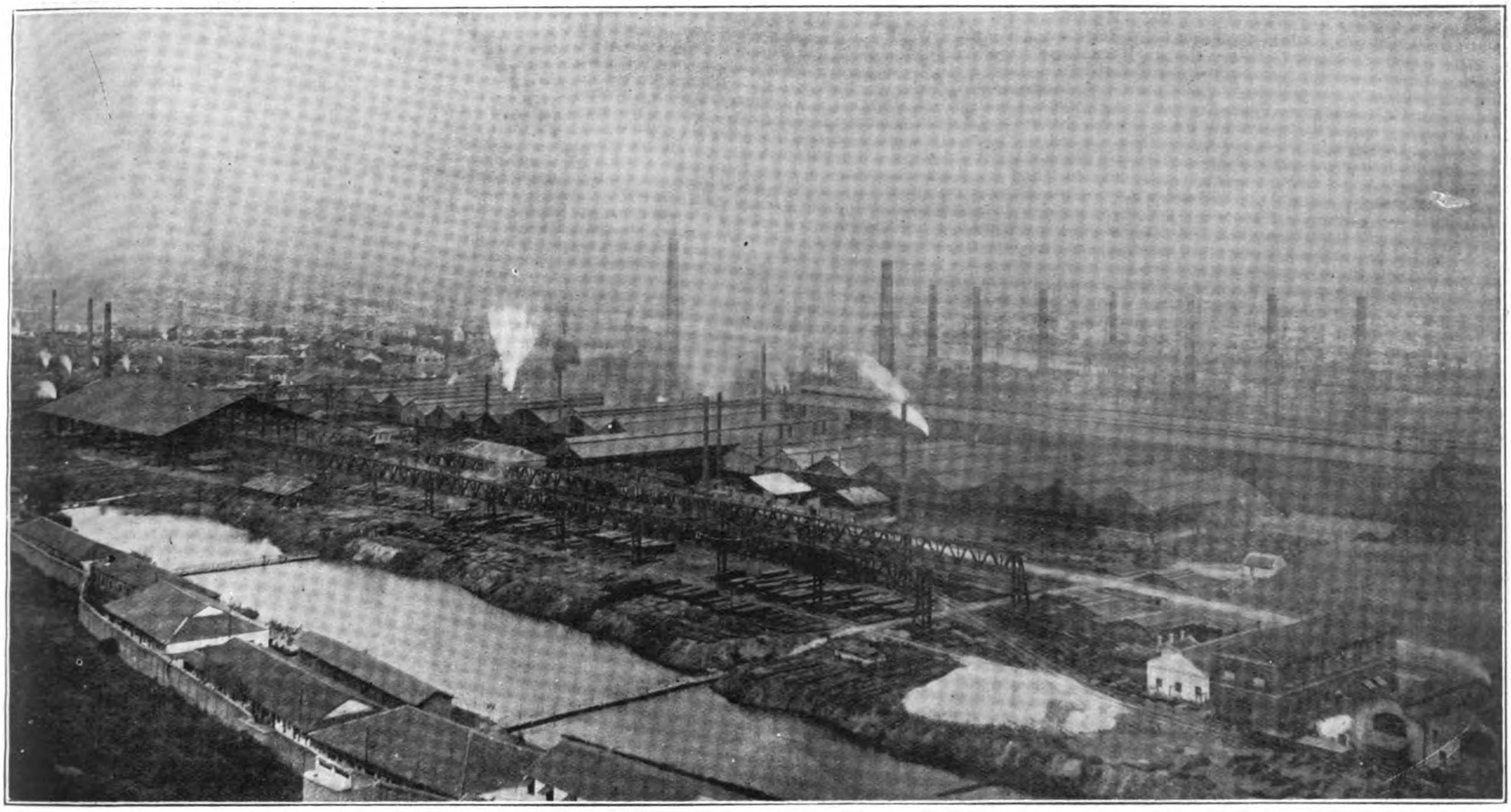
## Hammering the Loan

It was to be expected that the anti-Japanese clique in China would initiate some move to discredit the Oriental Development loan.

This element has again seen fit to question the wisdom of Washington and Wall Street and through *The Weekly Review* we learn that "*it has produced condemnatory resolutions on the part of both Chinese and foreign chamners of commerce. The apprehension is due to the fear in China that this loan is the beginning of a financial policy on the part of certain American banking group to lend money to Japan for the purpose of furthering Japanese imperialistic projects on the continent of Asia. Considerable apprehension has also been aroused in American commercial circles for fear that this policy might be detrimental to American commercial interests in China.*"

We are informed that the American chamber of commerce of China at Shanghai has passed no such condemnatory resolutions.

*(Continued on Page 320)*



Hanyang Iron and Steel Works at Hanyang: General View of Steel Works Department from Tortoise Hill

# Blast Furnaces and Steel Mills in China

## A Comprehensive Survey of China's Steel Industry

*By Lansing W. Hoyt*

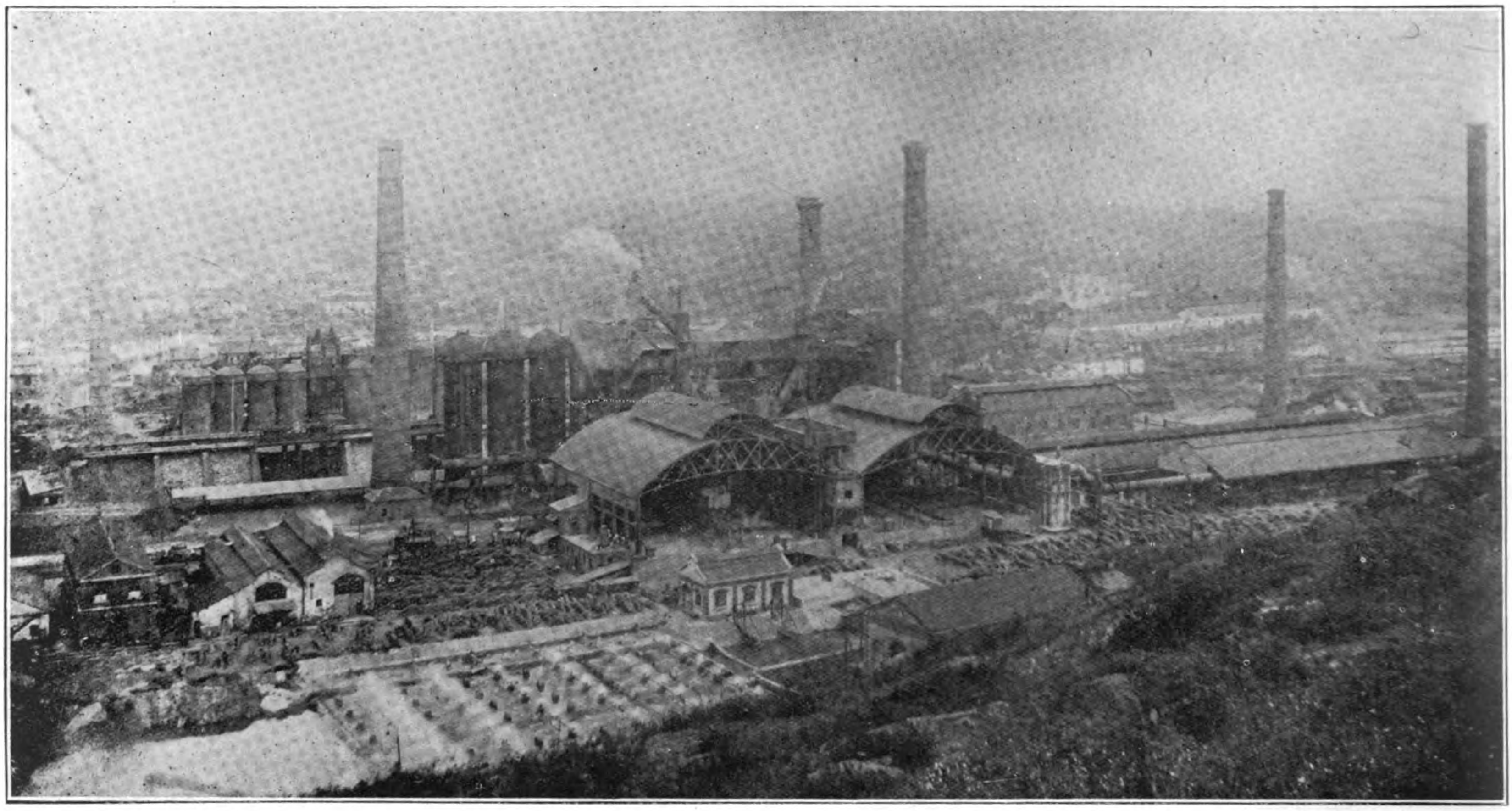
IT is not the purpose of this article to enter into an academic discussion of China's iron resources. A great deal has been written by geologists on this subject, and it would be a waste of time to recapitulate. This is an attempt, however, to place before Americans interested, certain phases of the iron and steel situation now prevailing in China from an operation standpoint. In doing this, of course, the iron ore and coal properties furnishing raw materials to the iron and steel companies will be described.

There is not a great deal of information available in America covering blast furnace and mill practice in China and Manchuria. That available is to a large extent too partial to China. Considerable publicity has been wrongly given the wonderful resources supposed to be at the disposal of Japan in Manchuria and other parts of China through the enterprise of her iron and steel engineers.

From a blast furnace operation standpoint Manchurian ore acts very unsatisfactorily. It is too low in iron content (30 per cent.) and will have to be concentrated before successful furnace practice is possible. This concentration is practicable, but the additional cost may prove too excessive. Manchurian coke is high in ash (16 per cent.) and moisture (10 per cent.) and none too good for the work in hand. It will be many years before blast furnace practice in China and Manchuria even approaches the efficiency so common and necessary in the United States.

> The author of these reports is the American trade commissioner at Shanghai, who, before entering the government service, was for many years connected with the United States Steel Corporation and the Tata Iron & Steel Company, Ltd., of India. Mr. Hoyt is, therefore, an authority on his subject, and was instructed by the department of commerce last year to draw up the report on China's steel industry. These reports, since released by the bureau of foreign and domestic commerce, are undoubtedly the most careful and reliable ever presented to the technical press. The reports emphasize the slow progress of steel manufacture in China due to many natural and economic causes which together make it possible for foreign material to be delivered in China and undersell the home product.

For purposes of discussion, it is convenient to separate China's iron plants into three distinct groups, namely: the Hankow district, the Peking (Chihli) district, and the Mukden, or Manchuria, district. These three groups embrace every blast furnace and mill thus far erected in China. At present there are twelve completed blast furnaces, varying in age from one year to thirty years. By this is meant the period which has elapsed since they were " blown in " for the first time. Their rated individual daily output ranges from 100 tons to 450 tons of pig.



General View of Blast Furnace Department from Tortoise Hill

*Rated Daily Output of Chinese Furnaces*

| | | | | | |
|---|---|---|---|---|---|
| | 3 | Furnaces | at | 100 | tons. |
| | 2 | ,, | ,, | 130 | ,, |
| | 2 | ,, | ,, | 200 | ,, |
| | 3 | ,, | ,, | 350 | ,, |
| | 2 | ,, | ,, | 450 | ,, |
| Total | 12 | ,, | | 2,610 | ,, Total Rated Output. |

If Chinese blast furnaces and Japanese blast furnaces in China lived up to their rated capacity, the respectable total of about 900,000 tons of pig iron would be produced yearly.

In August, 1922, however, but 500 tons of pig was being cast daily which gives a yearly rate of only 180,000 tons. This rate will not be exceeded, at least until 1924. This shrinkage in production is not due entirely to the present depression in business. Only four blast furnaces are out of blast owing to the 1921 drop in price of pig. These four furnaces, idle through lack of funds, have a total rated capacity of 220,000 tons per year.

Two other furnaces, with a capacity of 73,000 tons yearly, are enjoying a forced retirement owing to their obsolete design.

Adding these tonnages together, it is evident that about 300,000 tons (293,000 exact) of pig making capacity is out of business due to causes beyond the control of the management or the present economic depression.

Deducting this total from the 900,000 tons of rated capacity for the whole of China and Manchuria we find that 600,000 tons of iron should now be the annual output of the entire country. But on August 15, 1922, the yearly rate was roughly only 200,000 tons (180,000 tons exact), leaving a 400,000 tons deficit which must be chargeable to poor design, faulty construction and inefficient blast

Front of Casting Halls of Furnaces 3 and 4. Blast Furnace Department

New Elevated Track, Showing Ore and Limestone Bins

furnace practice and management. These figures are a sad commentary on the ability of interests in China to produce iron in an efficient manner.

## The Hankow District

There are two companies owning blast furnaces in this district. The leading interest is the Han-Yeh-Ping Iron and Coal Co., Ltd. This is by far the largest plant in China. This company owns six blast furnaces, a rail mill, plate mill and bar mills. The other company, the Yangtsze Engineering Co., owns but one 100-ton blast furnace, besides its engineering works, or bridge shop. The furnace is now out of blast. It shut down about January, 1922.

The Han-Yeh-Ping Co. is likewise the only company in China which has ever manufactured rolled steel products. This company derives its name from a combination of certain syllables in the names of its subsidiary organizations. These subsidiaries are: Hanyang Iron and Steel Works; Tayeh Iron Mines, Pingsiang Colliery, and the Yanghsing, Changlei and Changnien Manganese Ore Mines. The Hanyang Iron and Steel Works, founded in 1890 by a viceroy of Hupeh province, gets its iron ore from a place called Tayeh, 80 miles downstream from Hankow. In 1907 the Hanyang Works and the Tayeh Mines were amalgamated with the Pinghsiang Colliery into the present parent company.

## Hanyang Iron and Steel Works

These works are located at the confluence of the Han and Yangtze Rivers and are within a mile of Hankow proper. Hankow is the largest city in central China, having a population of 1,300,000. It is a terminus of the Peking-Hankow Railway and when the other railways are completed will be the terminal for both the Canton-Hankow Railway and the Hankow-Chungking line. Hankow is about 700 miles from the sea.

The site of the plant appears to be ideal when first seen, but even a cursory inspection soon develops the fact that the area is too cramped (110 acres) for efficient operation. The only advantage the location possesses is good water transportation, but this advantage also obtains in other areas near Hankow which would have been much more suitable to present-day furnace and mill practice. It is said that only Viceroy Chang, the founder, insisted on the plant being near enough to his palace so that he could see the furnace gases by day and the cast house flare by night. The fact that the site chosen was very low and almost marshy caused considerable trouble later on when additional plant necessitated heavier foundations. Also the ground water always present has been a constant annoyance at the open-hearth where frequently trouble is caused by damp checker chambers. On the Yangtze River front, a very modern ore bridge with two grabs of English design (Frazar and Chalmers Engineering Works) handles the Tayeh ore and limestone which is delivered close to the wharf during the high water season, but which must be unloaded from a point 130 feet further out during low water. This fall in water level necessitated the building of cantilevers capable of sustaining large grabs working at times almost 150 feet from the face of the wall. When the grabs are working on the extreme end there is an upward pull of 120 tons on the four rear columns. The overturning movement is counteracted by a 500-ton block of concrete. The unloader consists of two transporters, 50 feet between centres. Each transporter is fitted with a traveling carriage from which is suspended a crane capable of revolving 360°, while operating a grab weighing 7 tons empty and 11 tons full. The total weight of each grab and its transport is 43 tons. Owing to the bigh lift (75-ft. at times) and to the 650 feet carry to the bunkers and back, the rate of urloading is curtailed somewhat. While the bridge is rated at 100 tons an hour per grab, Chinese operators generally unload at the rate of about 70 tons for each grab. Even this rate works out much cheaper than coolie labor and ensures a steady handling of material under conditions of weather.

No arrangements, other than coolie labor, have been made to handle the coke which arrives from Wuchang in lighters on the Han River side. When operating to capacity, the Hanyang plant handles at its two wharfs about 3,000 tons of raw materials daily. All these raw materials come from the other side of the river. The ore and stone comes from Tayeh, 80 miles down stream, and the coke from Pinghsiang, 310 miles south by rail from Wuchang, the city opposite Hankow on the Yangtze. This means that all the coke must be rehandled at the river, a rather expensive proposition even with cheap labor. The ore and stone being transported by water direct from the loading wharf on the Yangtze (which point is only 15 miles from the Tayeh Mines) comes to the plant under comparatively low freight and labor charges. The ore docks at the Hanyang Works are operated under the shipping department which also controls the movements of the Company's 200 lighters and 21 tugs. The handling of the raw materials as far as the blast furnace stock house is done as well as could be expected. The coolies employed on coke handling are the only source of annoyance to an American eye from a raw material standpoint.

## Cost of Raw Material at Hanyang Works

(Costs have appreciated greatly during the last six months. Figures during Second Quarter 1922 given).

| | |
|---|---|
| Pinghsiang coke at stock house ... ... ... | G. $18.00 per ton. |
| Tayeh iron ore ,, ,, ,, ... ... ... | ,, 2.80 ,, ,, |
| Tayeh limestone ,, ,, ,, ... ... ... | ,, 2.30 ,, ,, |
| Native iron scrap at stock house (limited) ... | ,, 2.00 ,, ,, |

From the above it is readily seen that cheap pig iron is out of the question at Hanyang even if furnace operation itself were perfect. Burden sheets of Hanyang blast furnaces show that it requires on an average:

3,000-lbs. coke to make one ton of pig iron.
900 ,, limestone to make one ton of pig iron.
3,500 ,, iron ore ,, ,, ,, ,, ,, ,, ,,

Taking 100 per cent. as the cost of one ton of pig, the cost sheets show that the raw materials enter into this cost in the following proportion:—

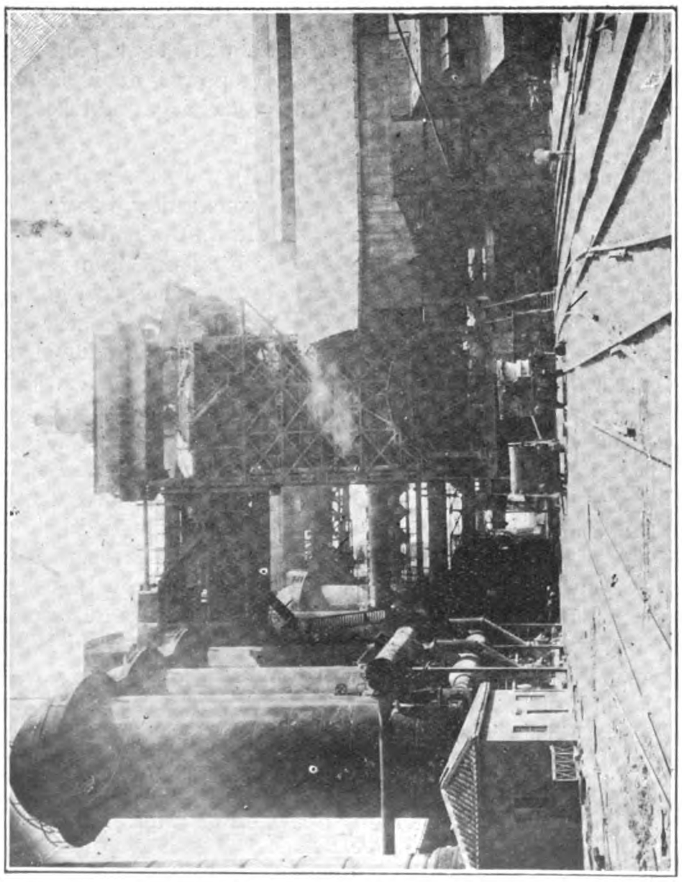
| Coke | Iron Ore | Limestone and Manganese Ore | Total | Power, Interest, Labor, Overhead, etc. |
|---|---|---|---|---|
| 55% | 13½% | 4½% | 73% | 27% |

With coke at G. $14.00 per ton and a consumption of 1⅓ tons per ton of pig made, we get a coke cost in gold dollars of 18.60. If the coke cost is 55 per cent. of the total cost of a ton of iron at the cast house, the cost of pig is therefore G. $33.90. Labor costs entering into this figure do not exceed 2 per cent. or about 67 cents gold per ton. The balance of 25 per cent. takes care of power, depreciation, interest charges and all overhead. Interest charges add $4.00 gold to the cost of pig at Hanyang.

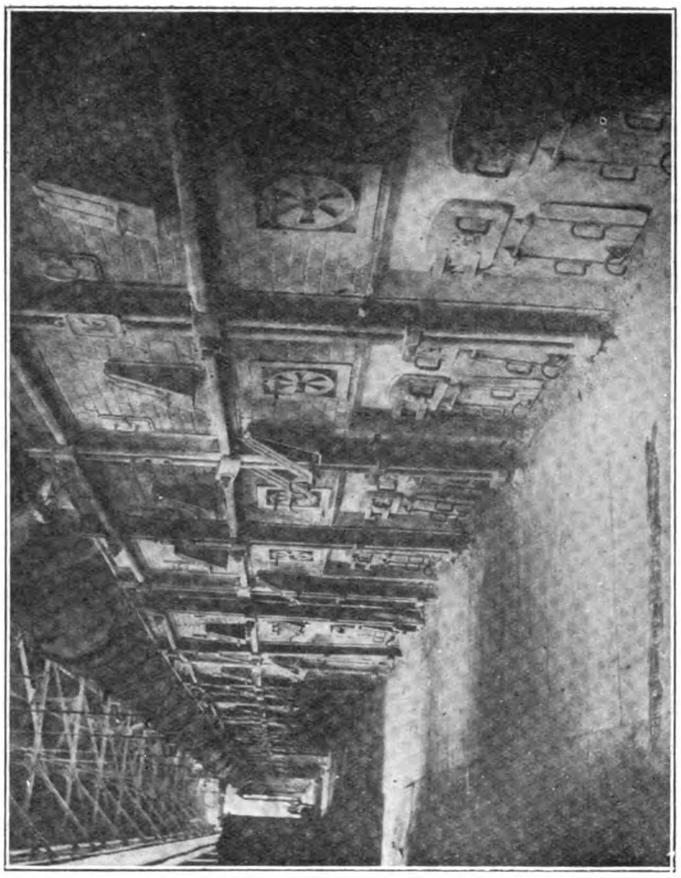
Furnaces No. 1 and No. 2 (British) were erected about 30 years ago and were each producing 100 tons a day, but they were blown out 1920. They are nearly obsolete now and it is almost certain that they will never make pig iron again. They are brick "stacks" with steel band re-inforcing around the bosh, having no metal shell. Four Cowper stoves and one gas cleaner served each furnace. The blast is supplied by one horizontal compound Cockerill blower and three vertical two cylinder Teeside blowers. Excess furnace gases fire eleven Lancashire and three B. & W. boilers.

Furnaces No. 3 blown in during 1910 and No. 4 in 1913 were built by Germans. They are of 250-ton daily capacity and from an operating standpoint work fairly well. These furnaces are hand filled, the buggies containing raw materials being loaded below and hoisted by elevators to the charging floor. Blast pressure is about 6-lbs. per square inch and is supplied by three turbo blowers, one of which is used as a spare. Two of these blowers are Parsons and the other was built by Richardson, Westgarth & Co. of England. They are capable of delivering 30,000 cu. ft. of air per minute at a pressure of 9-lbs., but under local conditions 6-lbs. is sufficient. Lancashire and B. & W. boilers, fired by excess furnace gas, furnish the steam.

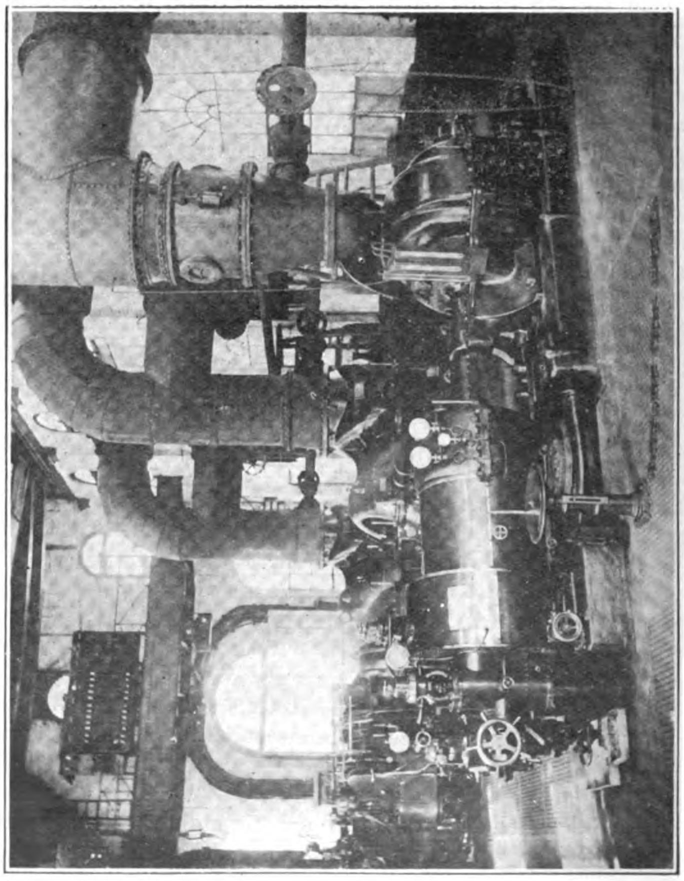
These furnaces are the only ones in blast in the entire Hankow district, but even they are being operated at a loss, all costs considered.



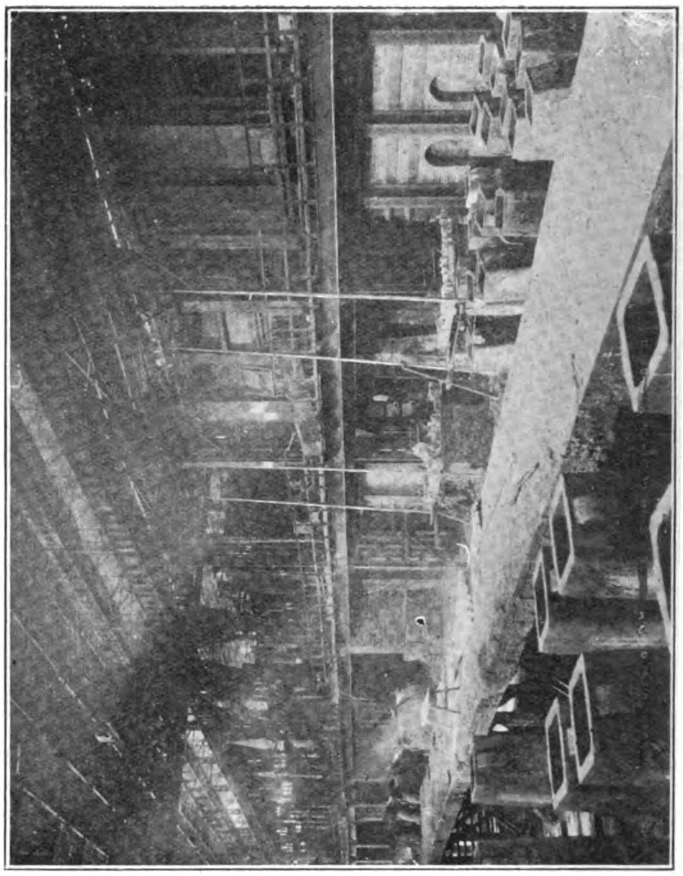
Blast Furnace No. 3



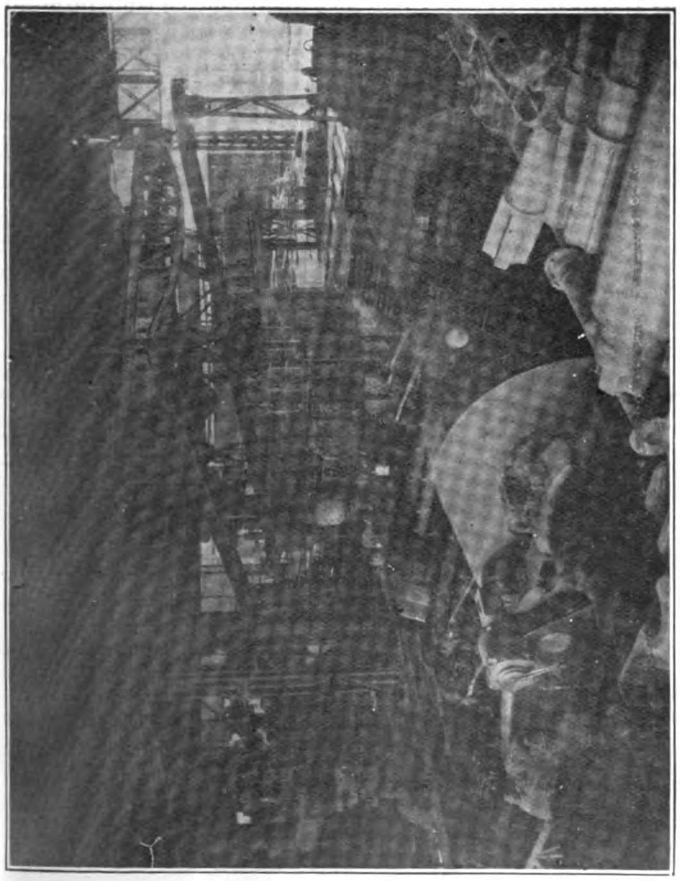
Gas Fired Boiler Battery; Blast Furnace Department



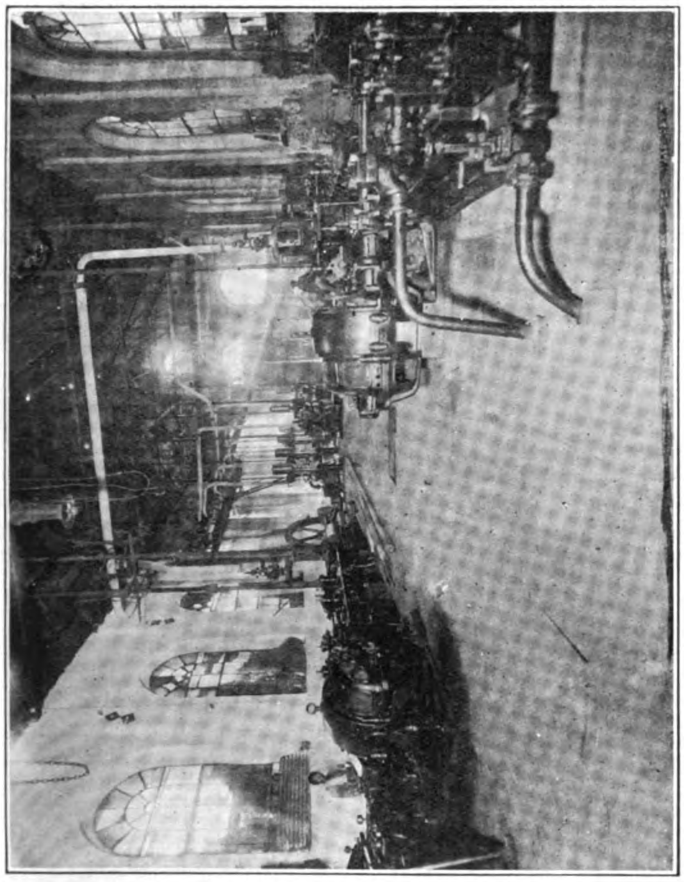
Turbo-Blower House: Blast Furnace Department



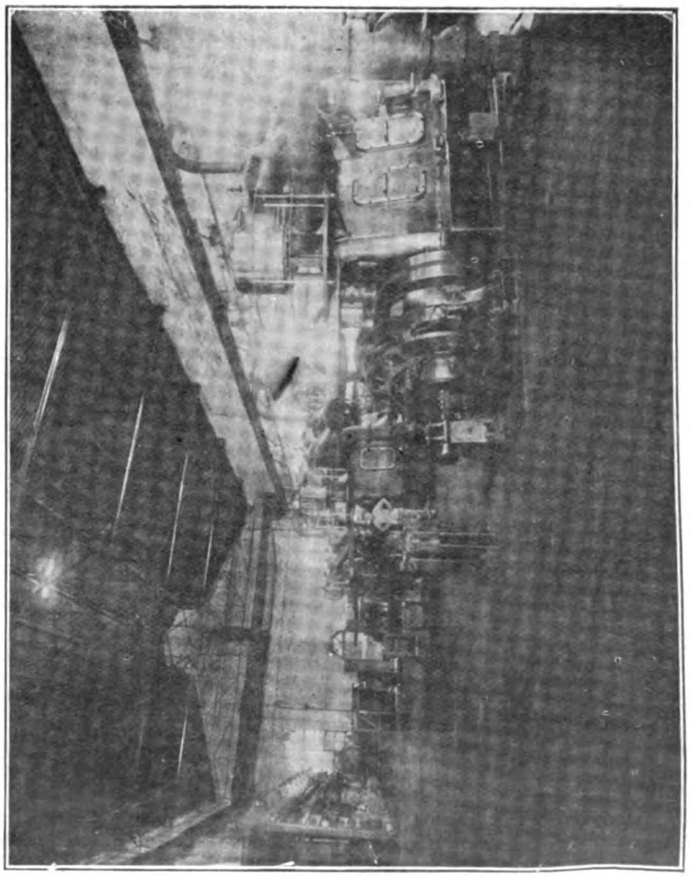
General View of Open Hearth Steel Furnace



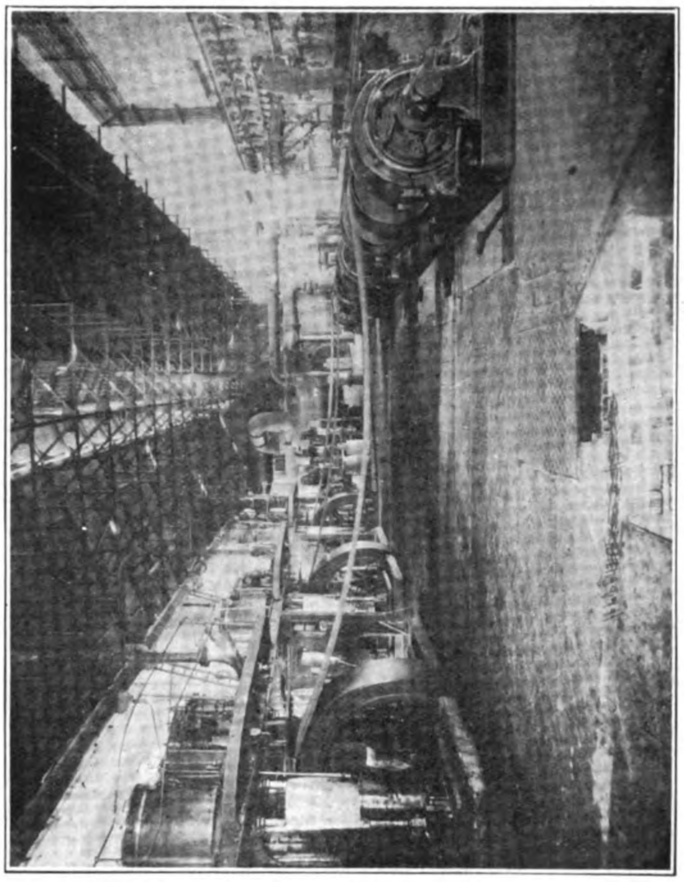
Cogging Mill and Plate Mill Engines, 8,500 H.P. each: Steel Works Department



Hydraulic Station, Showing Hydraulic and Boiler Feed Pumps: Steel Works Department



Power Station No. 1 : Mechanical Department



Power Station No. 2 : Mechanical Department

Unless assistance of some sort is arranged, it is difficult to understand how operation can be continued by the present management. The Tayeh mines are well situated and the ore contains about 60 per cent. iron. With 40,000,000 tons in sight, these mines alone are very good security. The ore is the best in China and is the equal of most ores in America.

*Analysis of Ore and Coal from which Coke is Made.*

| Ore: | | Coking Coal: | |
|---|---|---|---|
| Fe ... ... | 59.45 per cent. | Fixed carbon ... | 54.118 per cent. |
| Mn ... ... | 63 „ „ | Gaseous matter ... | 23.490 „ „ |
| S ... ... | .119 | Combined water ... | 1.392 „ „ |
| P ... ... | .109 „ „ | Ash ... ... | 21.000 „ „ |
| Al O ... ... | 1.05 „ „ | | |
| Cu ... ... | .292 „ „ | | |
| Si O ... ... | 9.16 „ „ | | |

Looking at the coal analysis, it is evident that the coke will contain considerable ash. This is the case, the average ash content being about 18 per cent. The moisture in the coke is also very high, being about 10 per cent. or even more.

With coke containing 10 per cent. moisture and 18 per cent. ash, it is readily seen why, despite a good ore, it takes 3,000-lbs. of coke to make a ton of pig. An additional drawback to efficient blast furnace practice at Hankow is the moisture in the air. Hankow is one of the wettest spots in the Far East from a humidity standpoint. This is especially so during the summer months. This highly saturated air eats up considerable coke, although no exact figures are available as to how much coke thus goes for naught.

The pig iron made at the Hanyang Works is a good product. No. 1 foundry iron has the following analysis :—

| *Si* | *Mn* | *P* | *S* |
|---|---|---|---|
| 2.75 | 0.50 | 0.150 | 0.03 |

Basic pig used at the open hearth furnaces runs about :—

| *Si* | *Mn* | *P* | *S* |
|---|---|---|---|
| 1.00 | 1.25 | 0.150 | 0.03 |

Slag from the furnaces is used for fill, but a brick making plant consumes a fair amount. Bricks made at Hanyang are sold locally for building purposes. The pump-house supplying cooling water to the bosh plates, tuyers coolers and cast house contains five Hess motor-driven turbine pumps and one steam pump driven by a Bellis and Morcum engine. This is an ample supply because under normal operation three pumps only are required.

At the present time all the foundries iron produced is cast in sand pig beds in the cast house adjoining the furnaces but basic in iron moulds. Eight casts are made per day from each furnace. The pig is hand broken by coolies and carried out of the cast house when cool to cars which transport it to the loading wharf. When the open hearth steel furnaces were operating some of the molten pig is cast into hot metal ladles, which in turn were emptied into the 150-ton mixer at the open hearth.

*Pig Iron Production at Hanyang (Furnaces Nos. 3 and 4).*

| | |
|---|---|
| 1915... ... ... ... ... ... | 136,531 tons. |
| 1916... ... ... ... ... ... | 149,929 „ |
| 1917... ... ... ... ... ... | 149,664 „ |
| 1918... ... ... ... ... ... | 139,152 „ |
| 1919... ... ... ... ... ... | 166,096 „ |
| 1920... ... ... ... ... ... | 126,305 „ |
| 1921... ... ... ... ... ... | 126,496 „ |

The above figures show that while Nos. 3 and 4 furnaces are rated at 250 tons, actual production was only about 200 tons. Time out for re-lining and " banking " reduced production. Due to good ore, fair coke, and lack of innovations in construction, these furnaces from a metallurgical standpoint operate better than most Chinese furnaces.

## Open Hearth Steel Works at Hanyang

The steel-making plant at Hanyang (this is the only one in China) consists of seven 30-ton basic open hearth furnaces and one 150-ton mixer. There is nothing unusual about the furnace layout. These furnaces were built about 15 years ago to furnish steel ingots for the blooming mill installed at the same time. They would be considered too small for efficient operation in America, but there are numerous furnaces similar to those in operation in England and Europe. The checker chambers and air and gas flues are too far underground, moisture being prevalent on this account. The slag chambers are not large enough to efficiently protect the checker-brick from slag deposits. The furnaces proper are not long enough to allow of complete combustion before the gases reach the outgoing ports. This causes the ports to wear back much quicker than would otherwise be the case, and the gas flow is more difficult to direct due to this erosion. After the furnaces have been operated awhile the gases too readily attack the roof with a consequent shortage of life for the furnace. A run of 200 heats on a roof is considered excellent. This practice adds to the cost as silica brick were very expensive in China up to the time those furnaces shut down.

*Price of Furnace Brick (Japanese Brick Used).*

| | |
|---|---|
| Silica brick... ... ... ... | 20 gold cents each. |
| Magnesite brick ... ... ... | 80 „ „ „ |
| Chrome brick ... ... ... | 40 „ „ „ |

Fire clay costs $25.00 gold per ton.

Owing to the scarcity of cheap steel scrap in China, the open hearths at Hanyang are operated on about a 80 per cent. pig basis. Except in case of emergency, practically the only scrap used is that recovered from the pit and the rolling mills. Being so highly " pigged up," the furnaces operate much slower averaging when other things are all right, about two 30-ton heats per day. Figures during the last six years show the following ingot tonnage produced:—

| | |
|---|---|
| 1916... ... ... ... ... | 43,104 tons. |
| 1917... ... ... ... ... | 60,933 „ |
| 1918... ... ... ... ... | 25,146 „ |
| 1919 (Japan took pig) ... ... | 4,850 „ |
| 1920... ... ... ... ... | 50,912 „ |
| 1921... ... ... ... ... | 46,800 „ |

*Finished Steel Tonnage (Mostly Rails).*

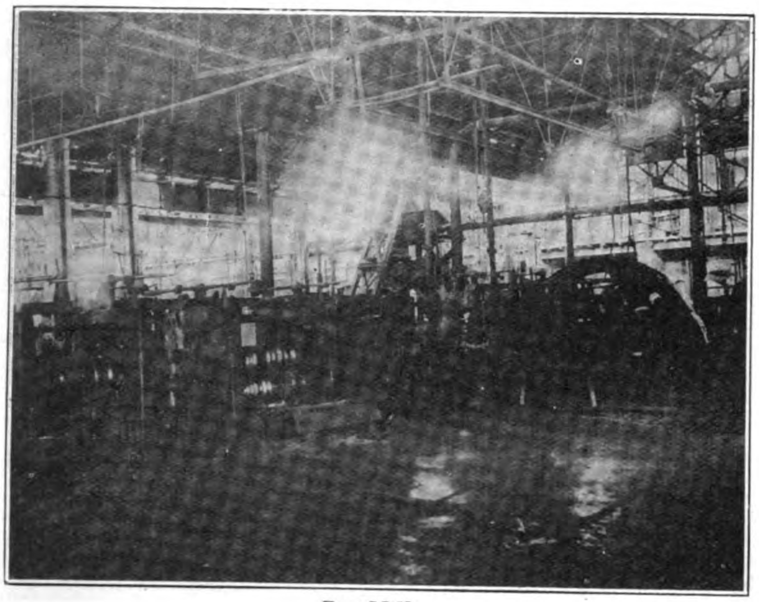
| | |
|---|---|
| 1916 (cold stock rolled) ... ... | 45,043 „ |
| 1917... ... ... ... ... | 42,651 „ |
| 1918 (cold heats charged) ... | 26,994 „ |
| 1919 (pig sent to Japan) ... ... | 3,684 „ |
| 1920... ... ... ... ... | 38,260 „ |
| 1921... ... ... ... ... | 35,100 „ |

Under prevailing operating conditions, the Hanyang plant is like a megaphone, with the blast furnaces at the big end. The furnaces provide more pig than open hearth needs (150,000 tons), the open hearth capacity is larger than the mill capacity and finally the mills produce more steel products than can be sold profitably under prevailing prices. Of course, pig iron can generally be sold to Japan at a price, but it seems poor foresight to have continued operating seven 30-ton open hearths spasmodically when two 75-ton furnaces could easily supply enough steel, allowing time for periodic relining too. This would save tons of gas coal and much labor per month, for instead of 18 gas producers, 6 modern producers would be sufficient.

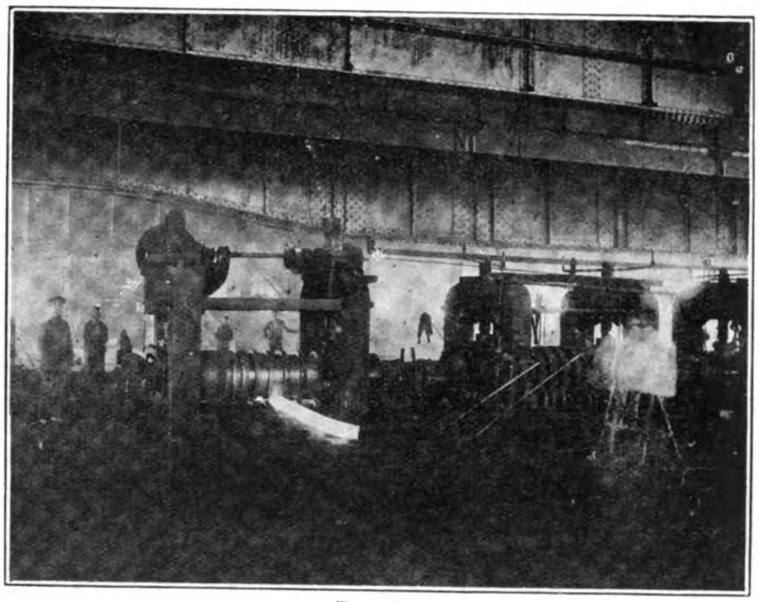
The furnace floor of the open hearth is served by two 35 ton-electric cranes and the charging boxes are handled by a Wellman charging machine. On the pit side of the building are two 50-ton ladle cranes, a poring platform and a hydraulic stripper.

The steel ingots are cast in moulds set on turtleback cars and when stripped are brought to the blooming mill soaking pits by locomotives. A charging crane (Wellman machine) places them in the heating pits. When set and reheated, the ingots are drawn and sent to the blooming mill. There is nothing unusual in the mill equipment, except that it would be considered obsolete in America, though perhaps not in Europe.

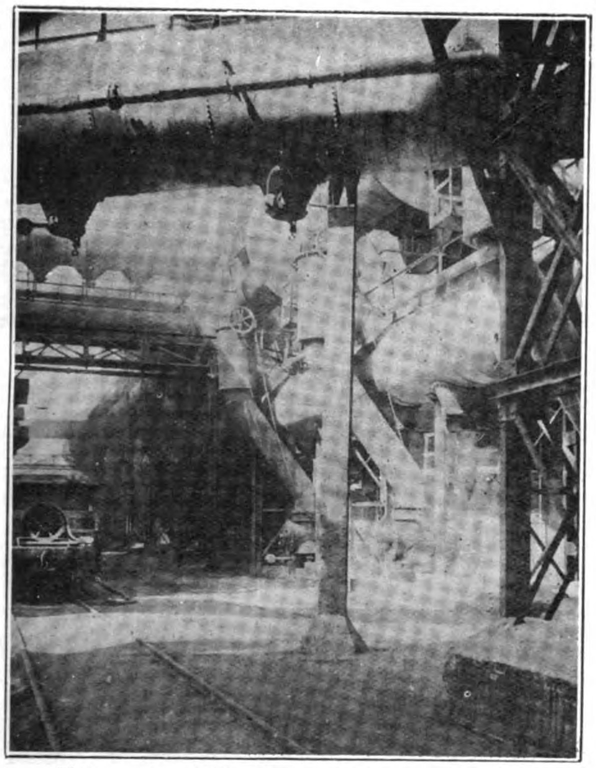
Although the 40-in. blooming mill and the 28-in. rail mill (used also as a structural mill) were only installed about 15 years ago, no one at the time seemed to have been cognizant of the continuous mill which in 1907 was quite common in the United States. The Hanyang blooming mill can "knock down" a four rail ingot into a bloom in fairly good time, but when the hydraulic shears have cut the bloom into 2 two railers, the delay is very noticeable. A four rail bloom (65-lbs. rail) is the easiest one to roll in American mills and tonnage piles up very rapidly, but in the two-high mill at the Hanyang Works, the fact that the bloom must be cut in two is a



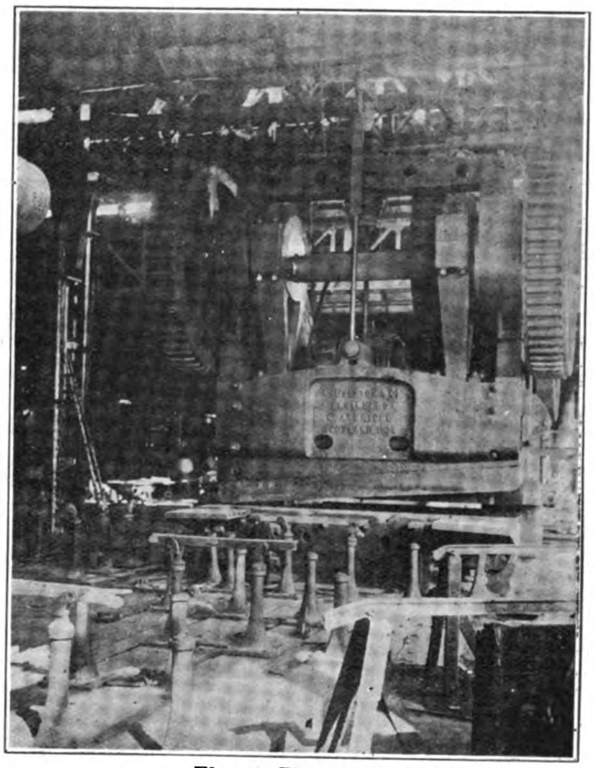
Bar Mill



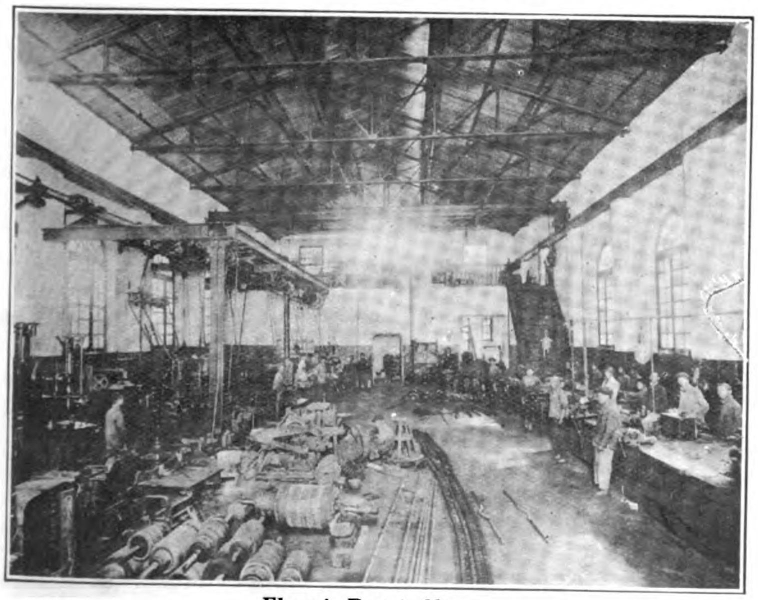
Rail Mill



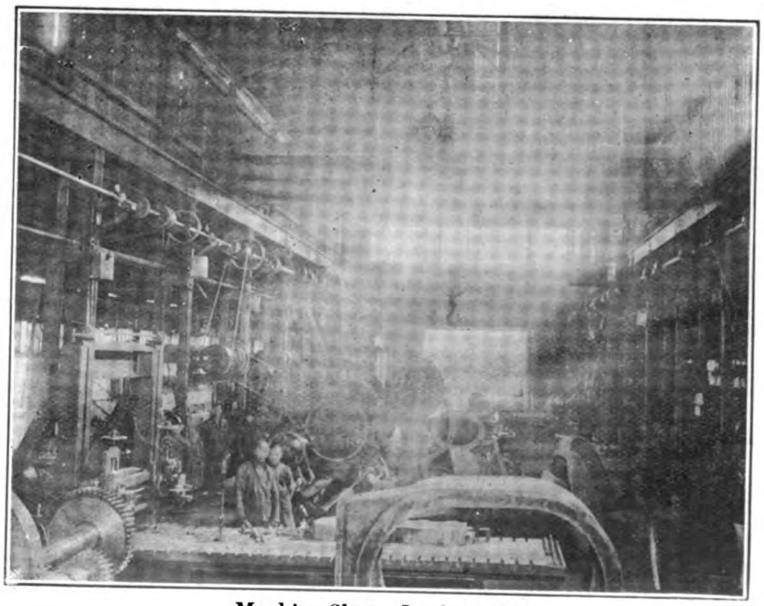
Valves, etc., of Hot Stoves of Furnaces 3 and 4



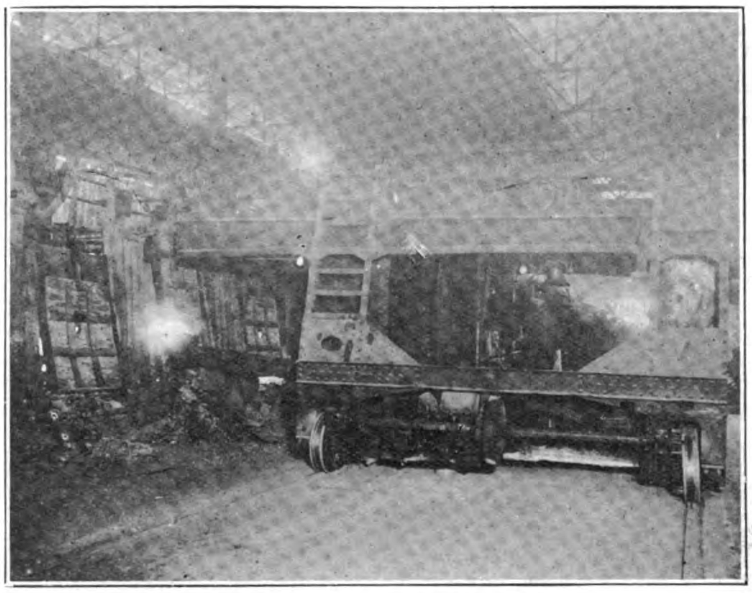
Electric Plate Shear



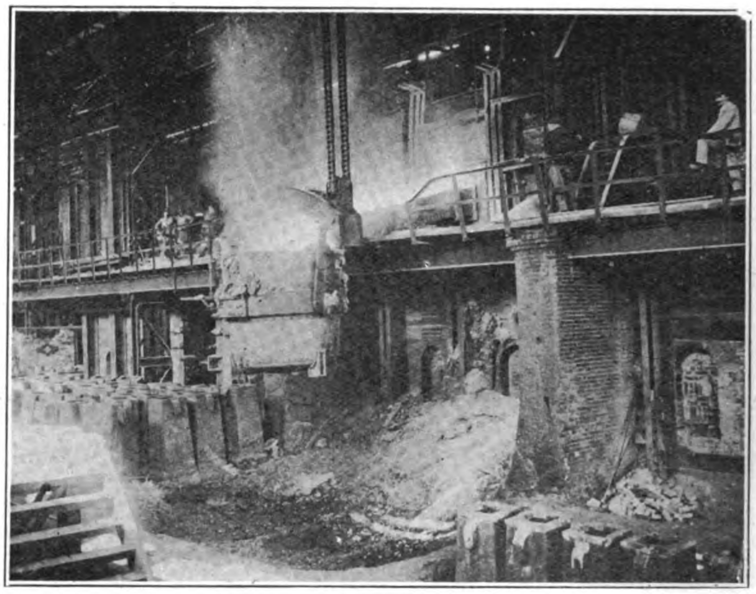
Electric Repair Shop



Machine Shop—Looking East



Charging an Open Hearth Furnace



Tapping an Open Hearth Furnace

very serious handicap. Costs start to rise at the 28-in. mill because both the first and second roughing as well as the finishing rolls are in line, i.e., in one train and naturally the second two railers cannot enter the first roughing rolls until after the first two railer enters the finishing pass. It would be slow enough even if the four rail bloom could be reeled direct from the blooming mill.

Owing to lack of room, this is impossible and all blooms are therefore cut and reheated before reaching the first roughing rolls. When working to capacity under these conditions, it is not surprising that but 120 tons of rails are rolled per day. The 28-in. mill (rail mill train) is driven by a 6,500 h.p. Davy engine. Another engine (Daniel Adamson) of 12,500 h.p. can be " hooked up " to the other end of the roll train when desired. The total weight of housings, couplings, pinions, rolls, etc., is fully as great (and the engine power too) as would be required in a continuous mill. The output is, however, but 25 per cent. of that possible in a continuous mill.

As the two railers leave the finishing pass they are rolled along to the hot saws (one electric, one steam) cut, and after going through the cambering machine reach the hot beds.

The straightening presses, drill presses and milling machines easily handle the product arriving from the hot beds.

Structural shapes up to 12-in. by 6-in. beams are also rolled on this 28-in. mill.

## Plate Mill

In line with the blooming mill is the plate mill roll train driven by a 2,500 h.p. Davy engine. A roughing and a finishing set (two high) constitute this unit. A plate straightener set is in line with the finishing mill and is motor driven. This plate mill turns out plates from 2-ft. to 7-ft. wide and from 1-in. to $\frac{1}{4}$-in. thick.

## Bar Mill and Light Rail Mill

A three high 16-in. bar mill is used for rolling fishplate, bars, etc.

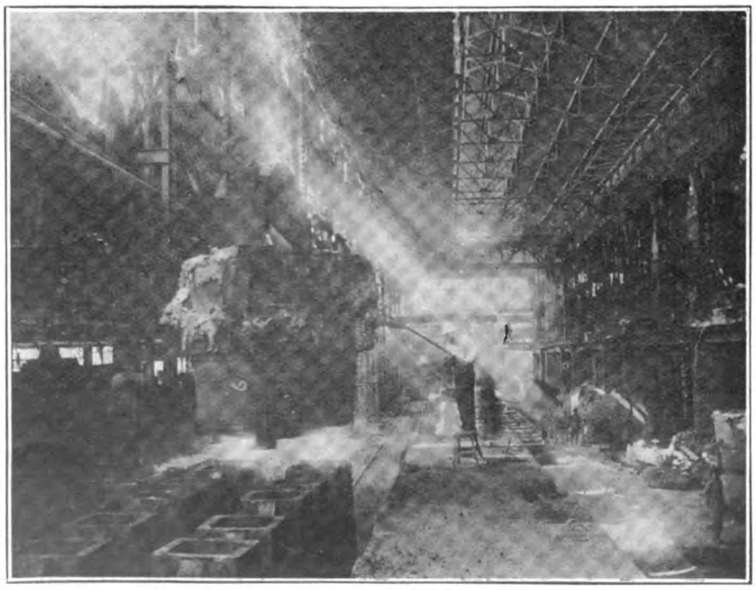
A light rail mill rolls from time to time rails under 30-lbs. per yard.

Nineteen coal fired Lancashire boilers supply steam to the big mills and eight Corinth boilers furnish power for the lighter mills.

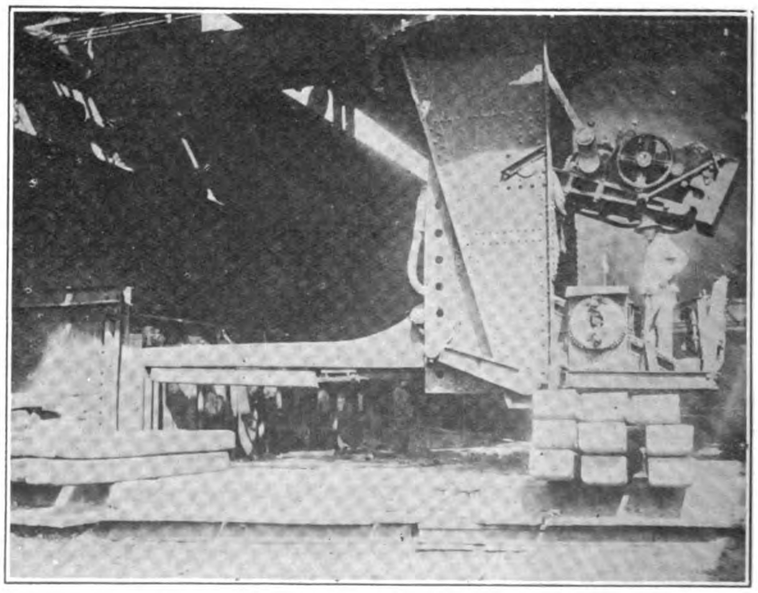
## Finished Products

The products turned out by these mills are up to British standard specifications. The rails conform to a very severe drop test, which is practically the same as the British standard rail tests.

(1st) One piece of rail 6 feet long, taken from every 50 tons of rails manufactured will be placed on iron bearings 3 feet 6 inches



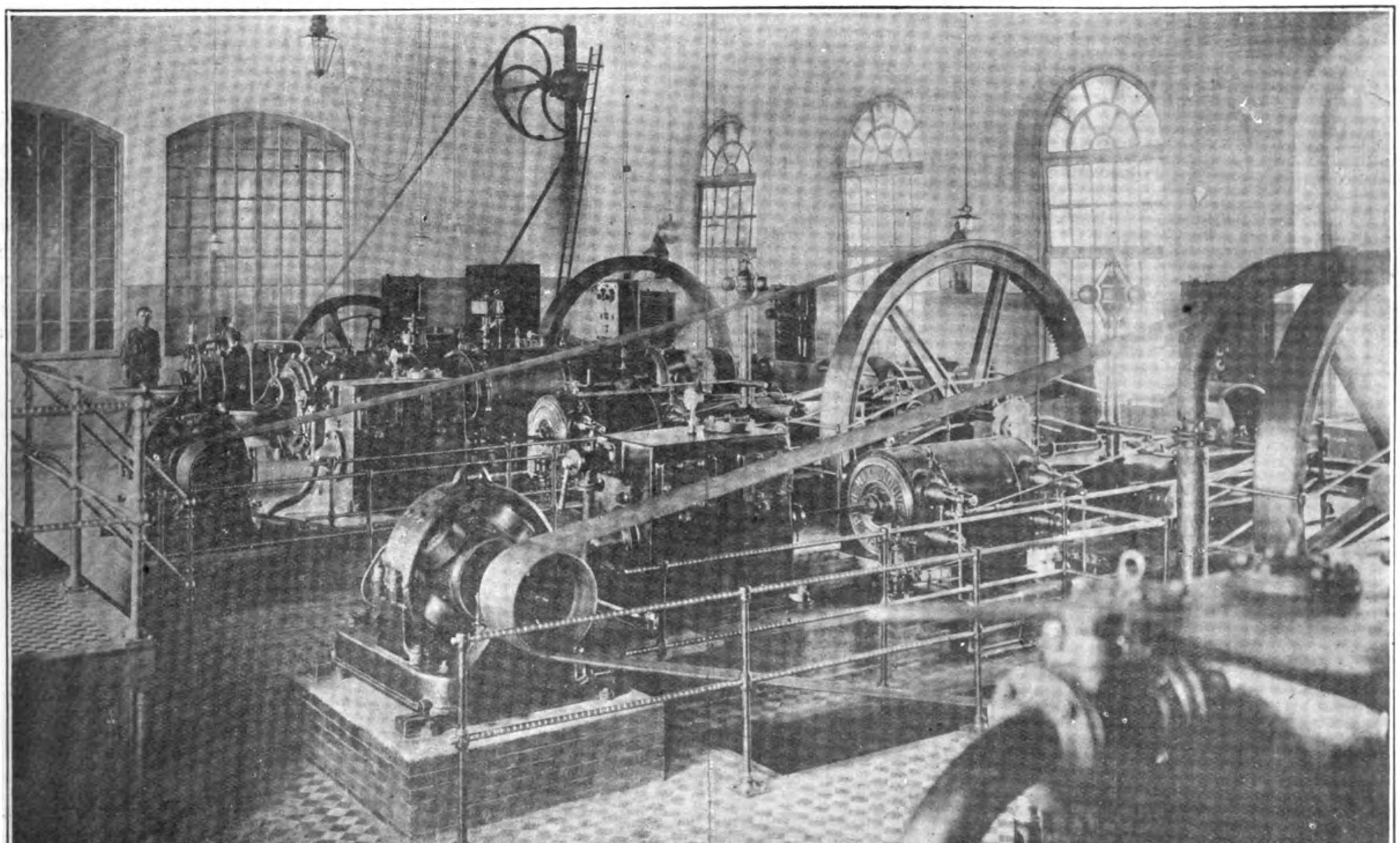
Teeming Casting Steel Ingots in Iron Moulds



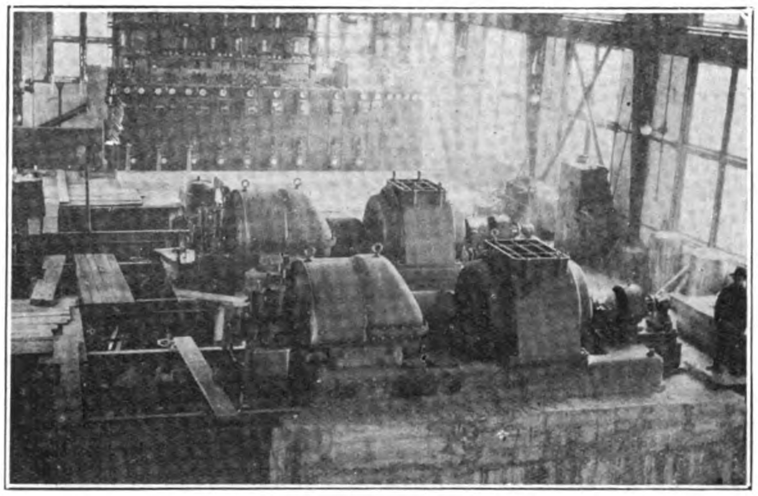
Bloom Charger

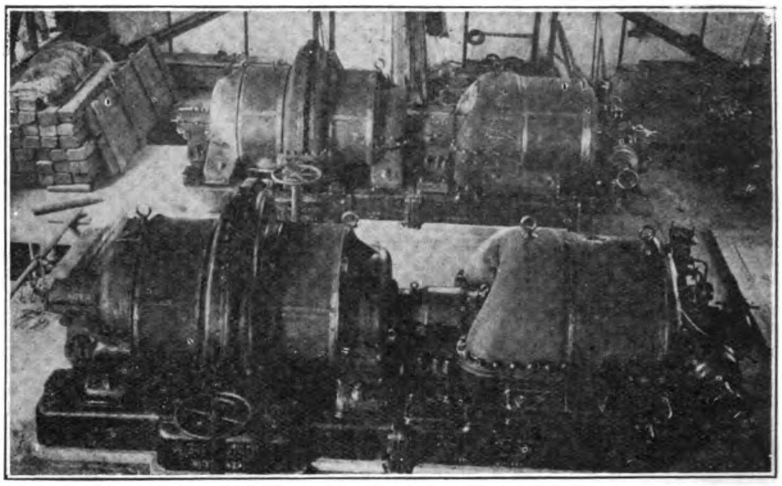
# PINGHSIANG COLLIERIES OF THE HAN-YEH-PING COAL & IRON COMPANY

General View of the Pinghsiang Collieries of the Han-Yeh-Ping Iron and Coal Company, Located at Pinghsiang, Kiangsi Province



Power Room of the Pinghsiang Colliery equipped with German Machinery





**A Fraser and Chalmers' Installation at the Tayeh Iron and Steel Works of the Han-Yeh-Ping Coal and Iron Company**

**Two Turbo-Alternators, each 1,500 k.w.** **Two Turbo-Blowers, each 1,490 b.h.p.**

apart in the clear, and equidistant from its ends, and a weight of 28 tons will be suspended from the centre of the rail. The deflection under this weight, measured on the distance between the centres of the bearings, must not exceed $\frac{5}{16}$ of an inch after the weight has been on the rail half-an-hour. No permanent set must appear after the removal of the load.

(2nd) The same piece of rail will be supported as before, and a cast iron monkey, weighing one ton, will be allowed to fall freely upon the centre of the rail from a height of 20 feet. The rail must bear two such blows without showing the least sign of fracture. Should the rail fail, then two more pieces from the same cast should be tried, and, if satisfactory, then the cast may be accepted. The permanent set caused by the first blow must not exceed 4 inches. The total deflection of the rail, measured on the distance between the centre of the bearings after both blows have been given must not exceed 8 inches. The rail is then to be broken by further blows; when it must show a perfectly sound and homogeneous fracture of such a character as shall be satisfactory to the inspector.

If any rail tested shall fail to comply with any of the above-named tests, the cast to which it belongs will be rejected, for which purpose every rail must have distinctly stamped upon it at both ends the number of the heat.

The writer has little criticism to make of the sections rolled. They conform pretty well to template. The chemical specifications are more liberal than in America, especially as regards sulphur and phosphorus. A spread of 20 points in carbon is also very liberal.

Pieces of rails must, on analysis, comply with the following:—

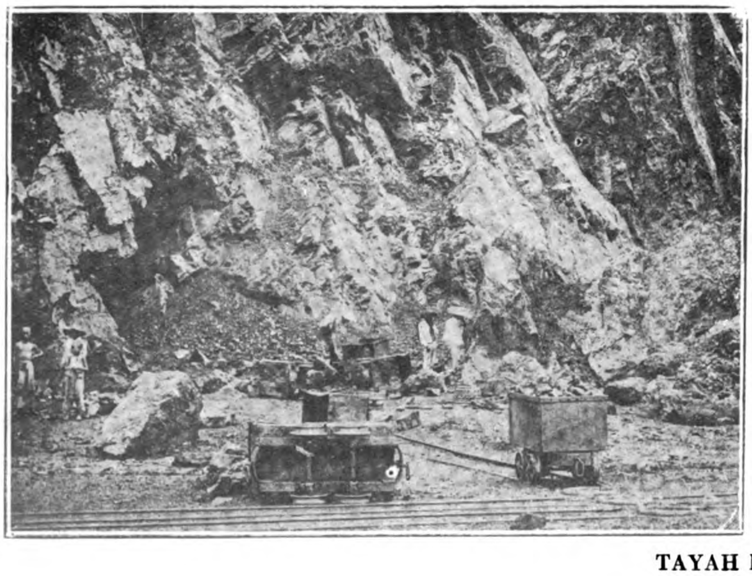
| | | | |
|---|---|---|---|
| The quantity of | carbon | must not be less than | 0.40 per cent. |
| ,, ,, ,, | ,, | ,, ,, ,, more than | 0.60 ,, ,, |
| ,, ,, ,, | Phosphorus | ,, ,, ,, ,, ,, | 0.075 ,, ,, |
| ,, ,, ,, | Sulphur | ,, ,, ,, ,, ,, | 0.06 ,, ,, |
| ,, ,, ,, | Silicon | ,, ,, ,, ,, ,, | 1.00 ,, ,, |
| ,, ,, ,, | Manganese | ,, ,, ,, ,, ,, | 0.90 ,, ,, |

Should any piece of rail analysed not comply with these conditions, the cast from which it is taken shall be rejected and fresh samples taken from the remainder.

The standard rail used on many railways in China, orders for which have been placed with the Hanyang mills, is the 85-lbs. per yard Chinese section. This rail section is practically the same as the 8,504 section of the Illinois Steel Co., South Chicago. Certain radio are different and there is slightly less weight in the flange. The height and base are identical.

## Conclusion (Hanyang Works)

The furnaces and mills described above constitute the main units of the Hanyang Iron and Steel Works. From a 1922 American standpoint not a single one of these units (with the possible exception of No. 3 and No. 4 blast furnaces) could be kept in operation. From the standpoint of efficient consumption of blast furnace output, the steel works are a failure and likewise the mills. From a tonnage standpoint alone these mills are an expensive luxury and the situation cannot be made better unless the open hearths and mills are scrapped and new mills (continuous rail and universal



TAYAH IRON MINES

plate) are erected at Tayeh, where there is plenty of room and good ground for foundations.

The Chinese management began to realize this last year and shut down all the mills and open hearth furnaces last November. It is almost certain that the present mills are considered obsolete by the management and there is little chance that they will ever make steel in any quantity again.

Figures on the cost of steel rails f.o.b. the plant are not officially available, but it is known through a very definite source that just before closing down the rail mill, Hanyang rails were costing not less than Taels 95 per ton, or at the present rate of exchange about $71 gold. Rails from the United States are selling c.i.f. Shanghai for $50 gold per ton, so the situation is very bad for the Hanyang product.

The primary reason why pig and steel costs are so high at the Hanyang plant of the Han-Yeh-Ping Co. is the excessively high cost of coke. Not only is coke very high in price due to costly transportation by rail and to rising coal mining charges, but it is also none too good in itself, because it is friable and high in ash and moisture. If the cost, however, could be substantially reduced on coke, the physical drawbacks could be withstood and a reasonable priced iron made.

Until coke is delivered at the furnace stock house at a cost approaching that in America, China will continue, as she is to-day, a country without a steel industry.

## Coking Coal Properties of the Han-Yeh-Ping Iron and Coal Co. (Pingsiang Colliery)

The Pingsiang Colliery, a subsidiary of the Hanyehping Co., is the only source of supply for coal and coke this company owns. The deposits of coal are variously estimated at from 100 million to 300 million tons. All coal thus far mined cokes fairly well and there is every reason to believe that the rest of the deposits are of the coking bituminous kind.

Pingsiang lies 60 miles east of Chuchow, the junction point on the Canton-Hankow Railway. Chuchow is a city about 35 miles south of Changsha and almost 260 miles due south of Hankow, or rather Wuchang, the northern terminus of the Canton line. Wuchang is on the south bank of the Yangtze River directly opposite Hankow. The mines of the Pingsiang Colliery are five miles outside Pingsiang city, at a place called Anyuan, so that the total rail haul from the mines to the transhipping point at Wuchang is about 325 miles. This distance is not considered great in the United States, but in China costs of transportation over this length of line are most excessive and these coupled with the continued political disturbances in the provinces of Kiangse and Hunan are mainly responsible for the inability of the blast furnaces at Hankow to make pig iron at a profit. The high cost of coke prevents profitable operation in every part of China and Manchuria, and it is doubtful if this state of affairs can be corrected for at least a decade, except possibly in the Chihli district near Tientsin where efficient transportation both by hand and water can readily be made to bring down costs.

There are two mines opened at Anyuan, with a present total output of about 2,200 tons per day, or 800,000 tons yearly. Washing and cleaning reduce this to 640,000 tons. About 400,000 tons of this washed coal are used in the coke ovens and the balance is used for power purposes, either at the mines, on the railway, or at Hanyang itself.

Most of all bituminous coal found in China is, generally speaking, high in ash and sulphur and very friable. The Pingsiang field, however, is not too high in sulphur for pig smelting and in fact, this coal with the possible exception of the Kai Ping coal in Chihli province, is perhaps the best coking coal in China. The coke made from this coal is very much like the coke used in the successful operation of blast furnaces in India, where despite high ash and moisture cheap pig is made.

*Analysis of Pingsiang Coal (Run of Mine).*

| | |
|---|---|
| Fixed carbon | 54,118% |
| Volatile matter | 23,490% |
| Combined water | 1,392% |
| Ash | 21,000% |

In order to prepare this coal for efficient coke oven practice, two washing plants have been installed at the mines. One of these has a capacity of but 400 tons per day. The other is larger and more efficient and could take care of about 2,800 tons daily if the output of the mines increased.

The smaller of the two mines is worked in Chinese fashion, the Company dealing with contractors who get so much a ton for washed coal having ash under 15 per cent. The company, however, furnishes the pumps to keep the mine dry and in certain places, where the workings are deeper than is usual, with the Chinese safety devices and ventilating arrangements are provided.

The large mine is opened by a long haulage way, or adit, nearly two miles long. A short adit connects with a vertical working shaft and also a ventilating shaft. These shafts are circular ones about 14 feet in diameter and extend to a depth of 800 feet. In the main passages, or adits, electric locomotives draw out the loaded cars. The rock in the mine is hard limestone, with many strata of shale and slate, as well as a large amount of clay partings in the coal seams themselves. There are two grades of coal found, a hard and a soft bituminous. The hard variety is found in small seams from 6 inches to 30 inches in thickness. In mining this coal, considerable quantities of slate have to be taken out. These hard bituminous seams are mined by the ordinary long-wall method, in which the entries are run with the dip, and along the strike, and all the coal is extracted while advancing. The soft bituminous coal is also mined in this way. There are six seams of soft coal varying in thickness from 10 feet to 40 feet. Drifts are run for ventilating purposes every 60 or 80 feet along the haulage way and connection made about 250 feet distant from the main gangways to provide the air circulation. In the thickest seams blocks 10 feet in thickness are removed, and while the roof is supported with timbers, the open space is filled with waste. Then the second cut is proceeded with. Timber costs are excessive owing to this method of working.

The coal output (run of mine) during the last six years was as follows :—

| | | | |
|---|---|---|---|
| 1916... | 992,494 tons. | 1919... | 794,999 tons. |
| 1917... | 946,080 „ | 1920... | 824,500 „ |
| 1918... | 694,433 „ | 1921... | 700,000 „ (about). |

Deducting 20 per cent. from the average run of mine output to take care of loss in weight due to washing, the average annual production of coal fit for commercial purposes is about 640,000 tons.

Most of this washed coal is made into coke either in the native or non-recovery retort ovens. The retort ovens are 262 in number and resemble the evince coffee type. The coking efficiency of these ovens is not great, and the time consumed per charge to turn out coke is 48 hours. The average daily output of these foreign batteries (allowing for relining) is not over 350 tons. Supplementing these retort ovens are a large number of native rectangular Chinese ovens, varying in number according to the coal available for coking. These ovens furnish the bulk of the coke made, averaging, all told, about 150,000 tons per year.

The output of coke at Pingsiang Colliery during the last six years was as follows :

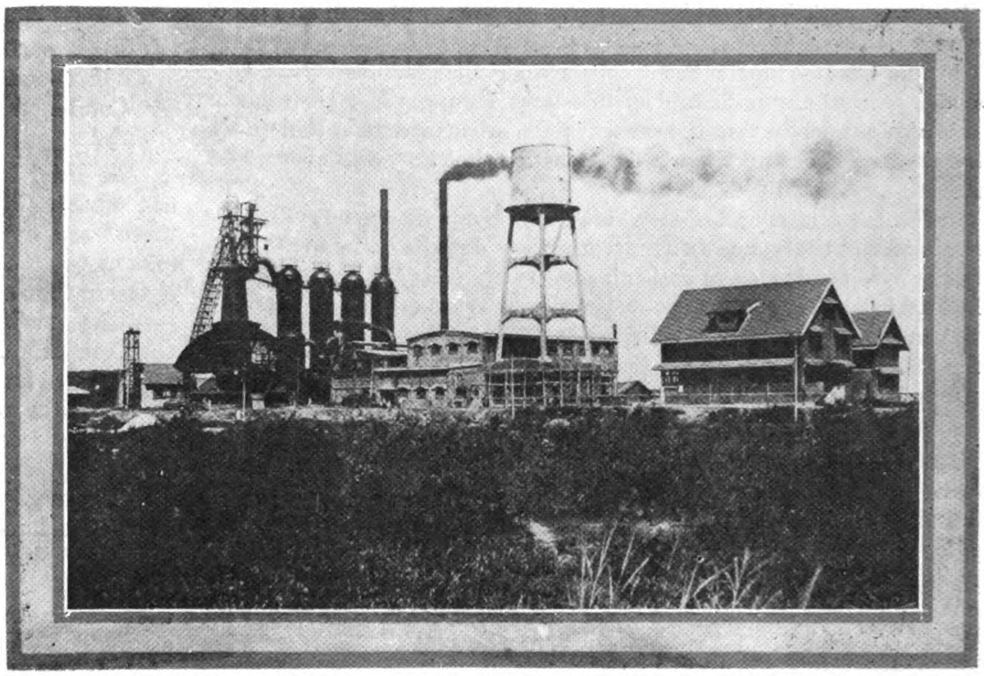
| | | | |
|---|---|---|---|
| 1916... | 266,418 tons. | 1919... | 249,015 tons. |
| 1917... | 239,797 „ | 1920... | 263,000 „ |
| 1918... | 216,013 „ | 1921... | 250,000 „ (estimate). |

*Analysis of Pingsiang Coal and Coke.*

| | Foundry Coke | Smelting Coke | Navy Coal | Washed Coal | Run-of Mine Coal |
|---|---|---|---|---|---|
| *Analysis in the Crucible.* | | | | | |
| Fixed carbon | 87.941 | 88.060 | 60.167 | 59.921 | 54.118 |
| Volatile | — | — | 30.290 | 24.240 | 23.490 |
| Combined water | 1.119 | 0.840 | 1.953 | 1.149 | 1.392 |
| Ash | 10.940 | 11.100 | 7.590 | 14.690 | 21.000 |

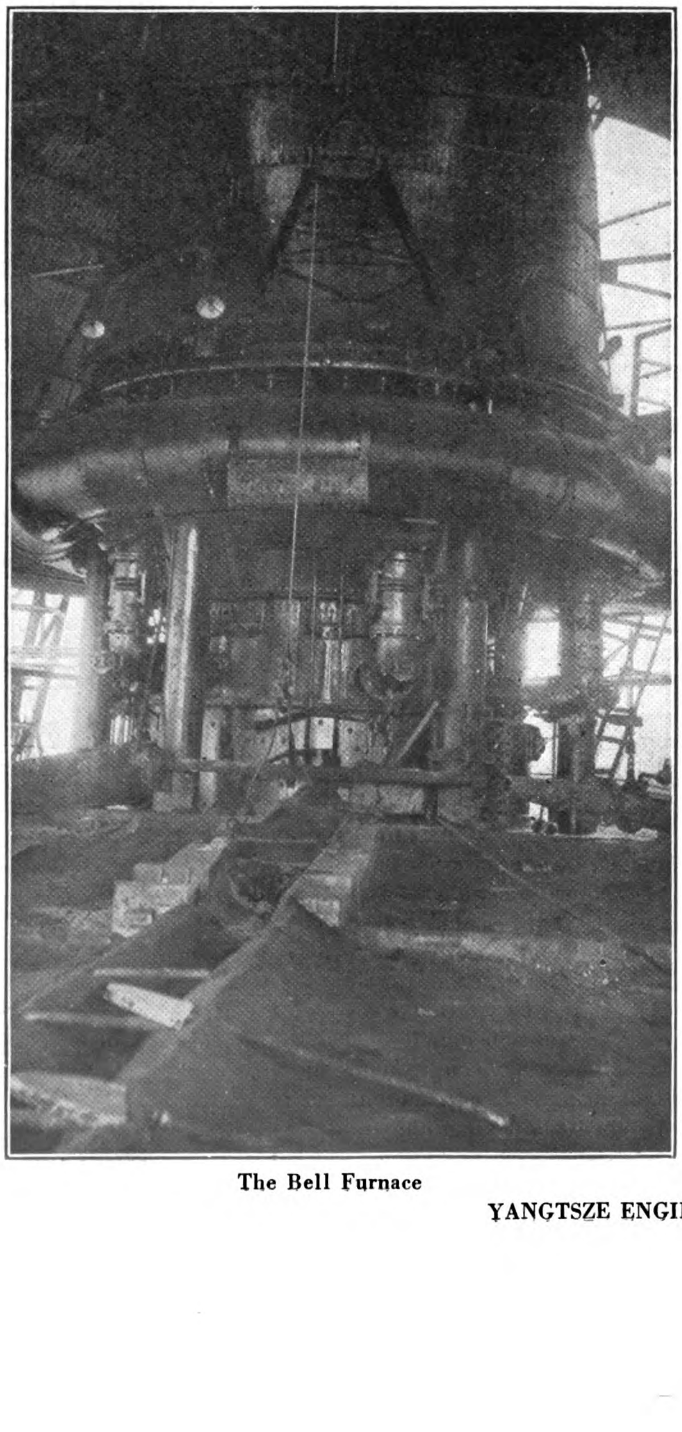
*Analysis of Pingsiang Coal and Coke.*

| | Foundry Coke | Smelting Coke | Navy Coal | Washed Coal | Run-of Mine Coal |
|---|---|---|---|---|---|
| *Elementary Analysis.* | | | | | |
| Carbon | 83.520 | 84.252 | 79.239 | 75.330 | 70.758 |
| Hydrogen | 1.067 | 0.744 | 5.099 | 4.891 | 4.012 |
| Sulphur | 0.506 | 0.618 | 0.547 | 0.522 | 0.527 |
| Oxygen | 1.833 | 1.480 | 4.102 | 2.241 | 1.107 |
| Nitrogen | 1.015 | 0.966 | 1.470 | 1.169 | 1.204 |
| Hygr. water | 1.119 | 0.840 | 1.953 | 1.149 | 1.392 |
| Ash | 10.940 | 11.100 | 7.590 | 14.690 | 21.000 |
| *Analysis of the Ash.* | | | | | |
| Silica | 62.040 | 60.820 | 49.040 | 60.520 | 65.700 |
| Alumina | 26.360 | 27.640 | 25.690 | 24.979 | 24.890 |
| Oxide of iron | 5.960 | 6.100 | 16.430 | 3.840 | 3.770 |
| Lime | 3.410 | 3.200 | 5.340 | 6.340 | 2.860 |
| Magnesia | 1.770 | 1.850 | 2.800 | 3.400 | 2.220 |
| *Melting Point of the Ash.* | | | | | |
| The ash is melted at oC. | 1350 | 1450 | 1200 | 1250 | 1355 |
| *Heating Power and Evaporation Efficiency.* | | | | | |
| Capacity of heat (Cal.) | 6977 | 6962 | 7690 | 7402 | 6815 |
| Quantity of steam at 100° C. produced by 1 kg. of Pingsiang coal from water at Oo (kg.). | | | 12.07 | 11.62 | 10.69 |

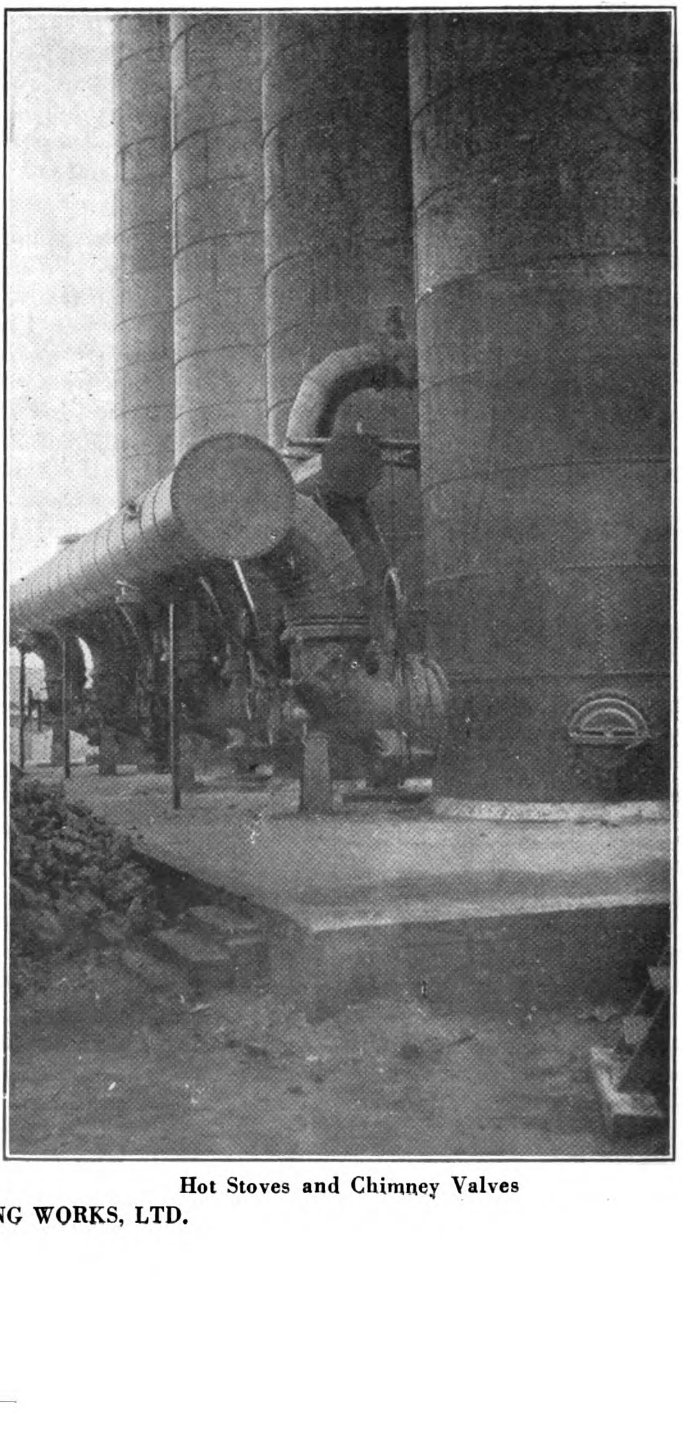


General View of Blast Furnace, Yangtsze Engineering Works, Ltd., Hankow

In addition to the mines, washing plants, and coke ovens, the Pingsiang Colliery operates a large machine and bridge shops Work is done in fabricating steel bridges for the Peking-Hankow Railway at Pingsiang. An iron foundry is also operated to supply spare castings for the various undertakings. Repairs are also made on the locomotives and cars employed on the main line railway.



The Bell Furnace



Hot Stoves and Chimney Valves

YANGTSZE ENGINEERING WORKS, LTD.

The power house installation consists of one 600 k w. generator, which is now being discarded, as two new 1,500 k.w. turbo-generator. are ready to operate. With the new 3,000 k.w. plant, all mine extensions contemplated can be taken care of.

As stated above, the net average output of coking coal is about 640,000 tons. The efficiency of the coke ovens is low and in order to make the average annual coke tonnage of 250,000 tons, 400,000 tons of coal are required. This is a showing of but between 60 per cent. and 65 per cent. The coal not used at the ovens is sold to the Canton-Hankow Railway and the Hanyang Iron Works for boiler purposes.

It is very difficult to get accurate figures on the cost of coke delivered at the blast furnaces at Hanyang, 325 miles by rail from Pingsiang. There are a great many items entering into this cost which are not constant. Under circumstances prevailing at the present time, however, this cost may be stated to be $14.00 gold per ton. This is a very high figure compared with coke costs in America, but this total is made up of charges all along the line, from coal seam to stock house, which could be to a large extent reduced through increased production and efficiency.

Run of mine coal at the pit mouth costs $2.00 gold per ton. 20 per cent. must be added for loss in weight by washing and another 5 per cent. for washing cost. Coal at coke oven then costs $2.50 gold per ton.

It takes 1.6 tons of coal to make one ton of coke, and this cost of material plus conversion charges, brings the cost ex-oven to about $6.00 gold per ton of coke. Loading charges at Anyuan, railway freight to Wuchang, reloading into lighters at Yangtze River, and the final unloading at Hanyang all these steps bring the cost at blast furnaces to $14.00 gold.

The biggest item in the above transportation costs is naturally the freight over the 320-mile haul. This is variously estimated to be between $5.00 and $6.00 gold, as the railway is almost entirely supported by the traffic from Pingsiang. This railway, in fact, belonged to the Yanyehping Company at one time, and was taken over by the government as a part of the Canton-Hankow Railway. The line from Chuchow south to a point 150 miles north of Canton, must be built before there is any possibility of increased traffic lessening the load carried at present by the coke leaving Pingsiang for Hankow.

Another factor adding to the high cost is the lack of water near the mines. All water must be brought from a point at least five miles from the pits, and as there is no reservoir built to hold what water is needed, this process is very expensive as well as inadequate. A reservoir is, however, being planned to secure water supply. Inefficiency is very noticeable all along the line, and labor conditions are very critical as well.

## The Tayeh Iron Mines of the Han-Yeh-Ping Iron and Coal Company, Ltd., China

(By Lansing W. Hoyt, Trade Commissioner, Shanghai, China.)

ARTICLE III

The Tayeh mines are located about 65 miles down the Yangtze River from Hankow near a town called Hangshihkang. They lie about 15 miles inland from the south bank of the river and are reached by a standard gauge railway owned by the company. This railway when first built (the curves have now been taken out to a large extent) was unfit for the haulage of any large tonnage of ore because it was necessary to avoid graves dotting the country, and this made a very crooked line. This railway was built in 1891 by Viceroy Chang, but even he had to listen to the protests of the native Chinese, who feared to disturb the graves of their ancestors. This short railway was the second one built in China. During recent years the superstitions of the local Chinese in regard to the graves have been overcome through money payments, and the line has been straightened.

There are four locomotives and 56 " battleship " ore cars in service. The locomotives were supplied by the American Locomotive Company and the ore cars by the American Car and Foundry Co.

The Tayeh properties were known to the medical Chinese and large dumps of slag containing 30 or 40 per cent. iron are monuments to the crude reduction methods employed during the Sung Dynasty, about 1,000 A.D. The Chinese have been scratching these ore fields ever since but it was not until the Hangyang Iron and Steel Works was started in 1891, that any attempt was made to mine iron ore on a large scale. For a number of years, however, even this company took out less than 48,000 tons annually. During the last 15 years, the output has steadily increased and in 1920, 824,000 tons were mined and shipped. 1921 figures show approximately 800,000 tons mined.

The main ore vein lies in a range of hills rising some 300 or 400 feet above level of the railway line. It is about 200 feet thick and rises almost perpendicularly between limestone and diorite (rock). Conservative estimates place the ore tonnage in sight at about 35,000,000 tons. The matallic iron content varies slightly, depending somewhat on its proximity to the limestone contact. It is a rich haematite and the run of mine ore will show 58 per cent. iron. The property is now being worked at three points, the principle workings being at Tienshan and Te-Tan-Wun where electrical sub-stations have been installed in an attempt to reduce costs and increase production by getting away from the old hand methods and dependency on expensive and unreliable coolie labor. Two large air compressors and a large number of Ingersoll-Rand pneumatic drills 75 (jackhammers) are on the ground but as yet have not been put into regular service, because the power line is not ready. The method up to the present has been the old quarry system of stripping the vein and then blasting the ore. The loaded ore cars are carried along inclines by gravity to the railway loading platforms where by means of hoppers the ore is dumped into main line cars and despatched to the Yangtze River docks or to the Tayeh furnace stock house.

*Tayeh Ore Analysis.*

| | | |
|---|---|---|
| Fe ... ... ... | 59.45 | per cent. |
| Mn ... ... ... | .63 | " " |
| S ... ... ... ... | .319 | " " |
| P ... ... ... ... | .109 | " " |
| Al O ... ... ... | 1.05 | " " |
| Cu ... ... ... | .292 | " " |
| Si O ... ... ... | 9.16 | " " |

Tayeh ore is the best iron ore in China and acts very well in the Hanyang furnaces at Hankow (but so far, not at the new Tayeh furnaces). On account of its proximity to the Yangtze River, this mine is also one of the chief sources of Japanese ore supply. Japan annually takes between 250,000 and 500,000 tons of Tayeh ore in addition to a large quantity of Hanyang pig. Under a loan agreement (1913, backed by treaty, 1918) the Japanese are entitled to ore and pig at a price fixed each year, the pig iron figure being based on a Cleveland base price. The 1913 loan from Japanese interests (others have been made subsequently) provides that within forty years the principle and interest are to be paid in ore, pig, and to some extent in steel. No steel, however, is likely to be sent in payment, for the Hanyang mills are an expensive luxury and so obsolete that they can never be run at a profit again. In time rolling mills may be erected at the Tayeh property on the Yangtze River near the mines, but even this is problematical, unless somebody steps in with new money. Under the loan agreement, it is definitely stipulated that during the period of the loan the Han-Yeh-Ping Co. must sell a total of 15,000,000 tons of high-grade ore from the Tayeh mines to Japanese blast furnaces, exclusive of tonnage already contracted for. In this connection it is further stipulated that two tons of ore are to be sold to Japanese interests for every ton consumed by the Han-Yeh-Ping furnaces. It was also agreed that commencing in 1919 the total tonnage of ore despatched to Japan, should be annually augmented by 50,000 tons, until the total going to Japan would be 500,000 tons yearly. When conditions in the iron and steel market were better, Japan took all but 45,000 tons of the pig output of the Han-Yeh-Ping

Company. At present this company is making about 150,000 tons per year ; so that Japan has been taking about 100,000 tons. It is reported, however, that owing to the depression in steel, Japan is not pressing for all the tonnage in ore and pig that she is entitled to. A price of $21 gold was originally stipulated (1913), as the amount to be credited on the loan for each ton of pig iron shipped. Owing, however, to the enormous rise in costs in all departments of the Han-Yeh-Ping Co., a compromise was arranged and the amount credited is based annually, as pointed out above, on the price of Cleveland (England) pig. Even, allowing for this more favorable arrangement, the price at which iron is delivered (and ore too) is below the cost of production.

There is no ore bridge at the river and of the Tayeh railway line and all iron ore despatched to Japan is loaded by coolie labor. It was expected that the electric power line running from the Han-Yeh-Ping power house on the Yangtze River to the Tayeh Mines would be in operation during 1922. While the lack of this electric power has seriously effected the output of ore at the mines, neverthelese the Chinese management explain this delay by stating that Japan is not taking much ore and there is plenty for the Hanyang furnaces. As a matter of fact, however, the real reason is that the Tayeh furnaces and improvements at the mines have taken all the liquid capital of the Han-Yeh-Ping Company, and owing to the disastrous inefficiency with which the new 450-ton Tayeh furnaces have been operated, the consumption of ore was necessarily curtailed. It is true that coolie labor can supply enough ore for the two blast furnaces now in operation at Hankow.

The cost of Tayeh ore delivered at furnace stock house (all charges included such as interest, etc.) is G. $2.82 per ton. This is not excessive, but by sufficient management and improved methods, this cost could be materially reduced.

### Conclusion

The Tayeh ore mines, containing as they still do, over 35 million tons of high-grade ore, are the greatest asset the Han-Yeh-Ping Co. has, and in reality are its only good collateral for a loan. If it became necessary to do so, the creditors could shut down the furnaces entirely and through efficient mining operations could easily pay off all obligations. The accessibility of the Tayeh mines and the high quality of the ore, coupled with its workability in the blast furnace, places the Tayeh properties in good potition potentially at least. If a railway were built from the Pinghsiang Collieries (only 180 miles south as the crow flies) direct to the Tayeh blast furnaces, all transhipment and lighterage charges as well as delays on coke would be stopped and Tayeh iron, and even steel, could be made at a price to compete throughout the orient. There is, however, very little chance of a direct line being built in the near future, and for this reason Tayeh pig iron can be considered out of the commercial markets of the east for some time to come.

## The Tayeh Blast Furnaces, China

### Han-Yeh-Ping Iron & Coal Co., Ltd.

The two new " stacks " recently erected on the Yangtze River about 65 miles east of Hankow are called the Tayeh (pronounced Ta Yay) furnaces. With the exception of the blast furnace (Langyen) near Peking, these two " stacks " are the newest in China. Their *rated* capacity is 450 tons of pig each per day, or a combined yearly output of about 325,000 tons. These blast furnaces were planned during 1915 and in fact the order for their erection was given at that time. Owing to the world war, however, the necessary expert licences for material could not be readily obtained and actual work at the site did not start in earnest until 1918.

A small town was laid out and built to house the more important members of the working force. There is a club-house placed at the disposal of foremen, superintendents and others of the organization who hold responsible positions. The town, itself, is well arranged, and the streets are paved.

The blast furnace plant is contiguous to the town, being just east of it on a large well graded plot of ground adjourning the Yangtze River. There is plenty of room for expansion should steel mills be added later on. The office buildings are well built as are the brick shed, machine shop, iron foundry and laboratory.

The furnaces, themselves, stand on well-made concrete foundations, the hearth jackets being about 18 feet above the railway track level. The area immediately about the two stacks is surrounded by concrete retaining walls and filled to hearth level with sand. The surface about the hearth is paved with brick. There is no cast house, in the strict sense of the word, as it was considered better to handle all iron in hot metal ladles and carry it a few hundred yards to a special pig-casting house where it is poured and allowed to cool. There is no pig-machine, however, this building being merely a detached cast-house containing the sand pig beds to receive the hot metal. When the blast furnaces are working properly, this arrangement has some advantages, because it keeps the area about the furnaces clean and there is less heat to contend with during the hot weather. The disadvantages of devorcing the cast house from the furnace are apparent, however, during a "break-out" when perhaps a ladle is not at hand or cannot be placed to receive the metal. Then, too this method increases the percentage of scrap metal because of more ladle " skulls " and runner scrap.

Between, and slightly to the rear of the furnace, is a water tank. for granulating slag. At present, however, this is not being used as all the slag is run into ladles and carried to the dump. The slag volume on all furnaces in China is necessarily large owing to the high ash coke and the heavier stone charge needed to get the required analysis.

The charging system employed is that known as the " bucket " system. Many authorities consider that the bucket distributes the charge more evenly, but whether this be true or not, it would have been better to rely (in China at least) on the old reliable skip-hoist arrangement. There are many experimental features (from a Chinese standpoint) about the Tayeh plant and due to inexperienced or inefficient construction at the site, many of these features have been responsible in part for the present disastrous state of affairs prevailing at Tayeh.

The furnaces themselves were designed ny Dr. M. Oshima (deceased), technical adviser of the Han-Yeh-Ping Co. up to the time of his death a year ago. Dr. Oshima had been adviser on metallurgical subjects in Japan and was long connected with the Imperial Japanese Steel Works. After a thorough investigation of various types of furnaces in all parts of the world, he designed the present Tayeh "studio" and ordered them built in the Riter-Conley shops in Pittsburg.

When " A " furnace was ready the concrete water tanks collapsed, and orders were given to " blow in " anyway, pumping the water direct to the furnace. This, of course, was poor judgment as on erratic supply of water was the result. Bnt it cannot be claimed that this was the main reason for the enforced shut down.

On July 4th it became evident that the bell was not closing tightly and that due to the excessive heat resulting the operating arrangements at the furnace top were not working properly. Several attempts were made to adjust the machinery, but the heat unnerved the Chinese and nothing seemingly could be done to remedy matters. This condition became more aggravated until finally the loss of gas effected the temperature of the stoves and this drop in temperature coupled with a loss in pressure soon began to be felt below the mantle. First one tuyere was lost and then another, until only two were left. Finally the entire furnace was lost and the charge froze up. When sufficiently cold, the iron was blasted out and arrangements are now being made to re-line.

" B " furnace will shortly be " blown in " and it is hoped that the experience gained on " A " will enable all the weak points in construction and operation on " B " to be overcome.

The above is a sad commentary on blast furnace operation on what appeared to be the most modern blast furnaces in the world. Evidently someone had blundered. Some people in China are not of the opinion that a 450-ton furnace will never work well here, because

the coke is too friable and the burden pressure too great. The successfully operated furnaces at Hankow are hand filled and of 250 tons capacity. Undoubtedly a smaller furnace is less intricate and its operation more familiar to the Chinese now running blast furnaces in China.

The Tayeh furnaces and plant cost Mex. $8,000,000 when a silver dollar (Mex.) was equal in value to a gold dollar. Even at the present rate of exchange the investment is close to $5,000,000 gold.

Common labor at Tayeh receives between 20 cents and 30 cents Mex. (silver) per day. Skilled labor receives from 50 cents to $1.00 Mex.

### Conclusion

While the writer is not pretending to be an authority on Chinese blast furnace practice, nevertheless he feels that he has a right to express an opinion regarding Tayeh practice because he has talked with those operating tde plant and has been present at a time when one of the furnaces was working so badly. It must not be lost sight of, that the coke used at Tayeh is very high in ash and friable. It must also be noted that Tayeh iron ore is quite refractory, resembling magnetite in this respect. The furnace, the operation of which was so short lived, is larger than any others in China or India and would ordinarily carry a heavy burden. The fact that the heat of combustion, however, was not in the proper zone—it being above the hearth to a considerable extent—prevents the carrying of a heavy burden. In addition to this the refractory nature of the ore makes for a higher top temperature too. With the zone of fusion away from the hearth and the burden lighter than expected, it was only natural that the top should become too hot for efficient working and that the temperature of the hearth should be materially reduced.

This reduction of the hearth temperature coupled with the loss of gas at the top and loss of wind pressure, invitably led to the shut down. (Ed. "B" furnace was successfully "blown in" April 1st and now producing more than 300 tons per day.) Let us hope that the Chinese management and their advisers have learned enough through costly experiment on "A" furnace, to insure efficiency when the "wind" is turned on "E."

## Blast Furnace of the Yangtsze Engineering Company—Hankow, China

The Yangtsze Engineering Company's blast furnace is the only furnace in the Hankow district not belonging to the Han-Yeh-Ping Iron & Coal Co. It is a small stack with at rated daily output of 100 tons. The design is American (Perin & Marshall) and in every respect this furnace is quite as modern as any of the larger blast furnaces in China. The foundation work was commenced in January 1919 and owing to the world demand for such material as was needed in this plant's construction, a great deal of the equipment was made at the shops of the Yangtsze Engineering Co., the Chinese concern that furnished the capital for this enterprise. Even the brick for the lining was manufactured at the Kailan Mining Company's kilns near Tientsin. This lining, however, did not stand up well under operation and a lining sent out from the United States would have been more satisfactory and less costly in the long run.

The furnace is supported by six cast iron columns. There are six tuyeres to deliver the blast and the cooling arrangements for the bosh are as simple as possible. Just above the tuyeres is one row of copper bosh plates but no cooling plates are used above the mantle. The upper part of the furnace is protected against hot spots by a spray to be used in case of emergency.

The furnace top is the stationary double bell type. A single skip hoist serves the furnace, the buggy being operated by power from two horizontal hoisting engines with 12-in. high pressure cylinders.

The usual blast furnace dust catcher is supplemented by a centrifugal whirler for thoroughly cleaning the gas before it passes to the stores and boilers.

The skip hoist buggy is hand filled below, no arrangements for modern stock-house equipment having been considered necessary. The cast house is ample for the tonnage produced, the pig being carried away by coolie labor after hand breaking. The cast house frame work is light and the roof is made of galvanized sheets.

There are two horizontal compound blowing engines and one tandem compound engine. The power end of these engines was purchased in America, but the "wind" end was manufactured, after an Allis Chalmers design, at the local plant of the Yangtsze Engineering Works. The air from the in-take in drawn through two cylindrical tanks which are arranged and cooled on the principle of a surface condenser. It is doubtful, however, if this air chilling device is very effective. It is not expensive, however, and cannot be expected to approximate results obtained in a refrigerated dry blast layout.

The boiler house contains four water-tube boilers, each of 1,500 sq. ft. heating surface and 150-lbs. pressure. Two Weir pumps are installed for boiler feed and two horizontal Worthington pumps for service. Boiler feed water is heated by the exhaust steam of the service pumps.

The water supply for the whole plant flows from a settling tank through an 18-in. cement main and is pumped to the concrete water reservoir which has a capacity of 80,000 gallons.

The Yangtsze furnace was built during the period of extreme inflation, when iron was selling in China for G. $80 per ton or more. It is a well designed stack and the Chinese who supplied the money were anxious to take immediate advantage of the prosperity prevailing in the iron business in China during 1915. The company owns neither coal properties nor ore mines and it is dependent on others for raw materials. Coking coal properties (Liu Ho Kou) several hundred miles north on the Peking-Hankow line supply the coke and the iron comes from mines along the Yangtsze River principally from the Hupeh mining bureau's properties near the Tayeh iron mines only 60 miles from the furnace.

*Analysis of Liu Ho Kou Coke*

| | |
|---|---|
| Water ... ... ... | 2.00 per cent. |
| Volatile matter ... ... | 1.54 „ „ |
| Fixed carbon ... ... | 75.60 „ „ |
| Ash ... ... ... | 20.66 „ „ |
| Sulphur ... ... ... | 0.41 „ „ |

The iron ore is of good quality (See Tayeh analysis) but the coke is very friable and high in ash.

The Yangtze furnace was "blown in" on June 26, 1920, just at the time that iron prices in China began to crumble. From a metallurgical standpoint the furnace acted well and the only criticism of the plant itself, is that the furnace is too small for efficient operation from the standpoint of costs. It is also very difficult to profitably operate a furnace that has no direct control over its raw materials and which is at the mercy of Chinese provincial officials when it comes to the transportation of coke. The political trouble in and about the Hankow district have made it impossible to operate this furnace with any degree of certainty because the coke supply due to political disturbances was unreliable and the cost of same, consequently, very high. In December, 1920, the actual cash costs of raw material per ton of pig were :—

| | |
|---|---|
| Iron ore ... ... ... | G.$ 4.93 |
| Ma. ore ... ... ... | .16 |
| Limestone ... ... ... | .42 |
| Coke ... ... ... ... | 13.73 |
| Total ... | G.$19.24 |

The above figures of course do not include labor, stock handling charges, depreciation office expenses nor interest. The furnace made during December, 1920, 2,446 tons of pig, so it can be readily seen that with so small a tonnage, the overhead, etc., would add tremendously to the cost per ton. Materials and direct labor alone at that time showed a cost per ton of G. $22.40. After this costs continued to rise and prices continued to drop, so that in March 1921 the furnace was "blown out" as it could not be profitably operated. At the present time, it is estimated that, all charges

considered, it would cost, at least $55.00 gold per ton to make iron. The present selling price of pig at Hankow is less than this figure, because there is little local consumption and iron has to be sold on a C.I.D. Shanghai basis. The Japanese are the arbiters of price on locally made pig iron and now that their market is overstocked and many of their open-hearth furnaces shut down, there is not enough business to go around. American pig could be landed, in Japan under present conditions, at a price to undersell Hankow.

Perhaps when military chiefs and provincial governors begin to see things from a national instead of a local standpoint, transportation will not be interfered with and raw material costs will come down to a basis that will permit the Yangtze furnace to compete in the Far Eastern iron markets. There is no immediate prospect of such a change taking place, however, and it is doubtful whether this furnace will ever be a factor at Hankow until it controls its own raw materials.

*(To be continued)*

## HAMMERING THE LOAN

*(Continued from page 304)*

The latest issue of the British chamber of commerce *Journal* makes no reference to any condemnatory resolutions in regard to the loan. It could not consistently do this, as British investors created the precedent of lending money to Japan for Manchurian development purposes.

The local Chinese chamber of commerce has passed no resolution concerning the loan, in fact, they know little or nothing about it, and seem to care less.

American co-operation for the advancement of national interests in China can never be successful so long as a handful of anti-Japanese propagandists are able to influence American policy in this country and intimidate people at home to accepting their viewpoint. It is a sorry spectacle when the greatest American financial institution, with its immense affiliations in China and close understanding with the state department is to be brought to task and admonished for its audacity in breaking away from the established program of the anti-Japanese coterie who for so many years have terrorized other Americans into endorsing their lop-sided views.

It goes without saying that when the National City Bank, or one of its subsidiaries with its immense Standard Oil holdings, enters into a transaction with a Japanese corporation for a loan to be devoted to Korean development, that every phase of the deal has been carefully scrutinized by the state department as well as by the financiers themselves. Common sense should tell Americans in China, that when American financiers decide to co-operate with Japan for such development, that it constitutes the surest guarantee that Japan has abandoned her old militaristic projects and is standing solidly with their own government for the preservation of principles which now typify Japanese as well as American policies towards China. The mere fact that American money is to be loaned to Japan for these purposes carries the assurance that China's interests are fully safeguarded.

# Manufacture of Tin Plate in India

The Tinplate Co. of India (Ltd.), which is said to have one of the most modernly equipped plants of its kind in existence, commenced operations in its factory at Golmuri near Jamshedpur during December. The company expects to supply sheets for the manufacture of kerosene, cigarette, and other tins for which there is a big demand in India. Plates will be rolled ranging in thickness from one-eighth inch to one-quarter inch and in widths up to approximately 96 inches. The mill has a capacity of 3,000 tons per month on an eight-hour day and will come into full commission as soon as the new open-hearth furnace of the Tata Co. is ready to supply steel ingots for rolling.

## ELECTRICAL DEVELOPMENT IN TAIWAN

*(Continued from page 323)*

The president and the vice-president are appointed by the governor-general of Taiwan. The president was formerly the chief of the central research laboratory. The vice-president is the chief of the department of civil engineering of the government general; Mr. Ogoshi is an engineer, Mr. Nagata is the chief of the Mitsui branch office in Taiwan. Mr. Takata has been for many years in the government service in Formosa. The vice-president acts as general manager, while Mr. Ogoshi is chief of construction, and Mr. Nagato is the business manager of the company.

### Other Companies

THE TAIWAN DENKI KOGYO K.K. (Taiwan Electric Industry Co., Ltd.) is a sister company of the Taiwan Denryoku K.K. It is capitalized at Y.2,775,000, all paid up. It has business offices at Giron, Rato and Suwo, and supplies lights and power to the Taiwan Denryoku K.K., and operates an ice plant. The property of this company was purchased in September, 1921 from the Giran Denki K.K., and it confined its efforts to the generation of power by steam. But since June, 1922, it has been producing power both by steam and water, its Tensohi power plant having been completed in May, 1922 It recently purchased the carbide mill of the Taiwan Kogyo K.K.

This is a new concern, and much of its funds are being used in construction work. Its profits are not yet large. It is evident though that it will be amalgamated with the Taiwan Denryoku K.K. The demand for ice is growing and the future of this concern in all directions looks bright. The president of the company is the vice-president of the Taiwan Denryoku K.K., Mr. G. Sumi. The directors are K. Ito, M. Tanaka, H. Nagat, T. Maki, Y. Komatsu, S. Asafu and I. Sakai. The auditors, K. Watanabe, K. Kawakami and T. Yamamoto.

TAIWAN GODO DENKI K.K.—This company was organized in August, 1920 to take over the business of five companies including the Toen Denki K.K. It is capitalized at Y.5,160,000, of which one-quarter is paid up. Its head office is at Toengai, Shinchiku-shu, Taiwan, with branches at Toen, Chikunan, Sansha, Sekishako, Bokushigai, Bakogai and Taitogai. It produces 280 k.w. from gas, 320 by steam, and 1,350 k.w. by water power. Most of the hydro-electric power is supplied to the Taiwan Denryoku K.K., through its Taichu branch. The Taiwan Godo Denki K.K. has lost some business in lights recently, but has increased its power supply. Profits of 7 per cent. have been earned, but if the sugar business continues active, this company will greatly increase its profits.

The president is Mr. S. Suzuki, who was acting chief of the forestry department of the government general. The managing-director is W. Sugino. The directors and auditors are: T. Kaku, T. Kawai, H. Watanabe, R. Kan, Y. Obata, Z. Akutagawa, R. Rim, T. Konishi, N. Sasaki, H. Ko, U. Kamitaki, E. Ide, Y. Okuma, T. Tanaka.

SHINCHIKU DENTO K.K.—The Shinchiku Electric Light Co. was established in May, 1912, capitalized at Y.500,000, of which Y.410,000 is paid up. It has loans outstanding amounting to Y.300,000. It generates power by steam, 50 k.w., and 200 k.w. from its hydro-electric plant. Is supplies 12,600 electric lights, but about a third of the power it uses is supplied by the Taiwan Denryoku K.K. It also operates an ice plant with a capacity of five tons a day. All its enterprises have been successful financially and the company pays dividends of 10 per cent. per annum. The officials are: President and Director: E. Nagano; Directors: T. Maki and G. Sakuse; Auditors: R. Nihara and K. Tei; Manager: T. Funabashi.

# Electrical Development in Taiwan

## A Super-Power Scheme to Supply the Island of Formosa

THE first electric enterprise in Taiwan was organized in 1902 to supply light to the city of Taihoku. The government, however, nationalised the industry because of its great importance to the development of the island as an industrial centre and in the following year took over the enterprise and constructed the first power plant at Kizan on the upper reaches of the Shinten-kei. This plant, producing 660 h.p. was completed in 1905, and later expanded to 1,000 h.p. transmitting the power to Taihoku, the capital. In 1907, construction of a second power plant of 3,000 h.p. was commenced at Shoso-ko, on the same river, and was completed in 1909.

Head Office of the Taiwan Electric Power Company, Ltd., at Taihoku, Taiwan (Formosa)

The government then decided that electric enterprises in the south and central portions of the island should be linked up with its schemes for irrigation and drainage. In 1909, a power plant generating 2,000 h.p. was constructed at Chikushimon, located to the east of Kizangai, in the central part of the island, and the power transmitted to Tainan and Takao. In the same year, a new power plant was started at Kori, on the left bank of the River Daiankei, in Taichu province, generating 1,200 h.p. which was completed in 1911.

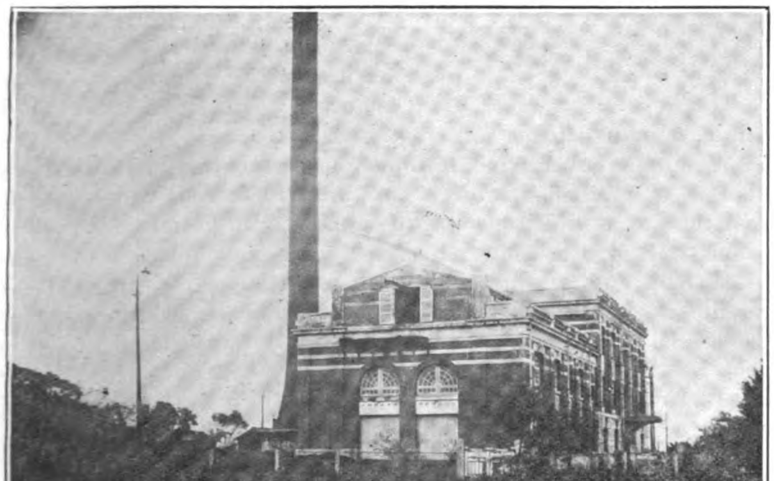
In 1917, the Toryuwan plant was completed, generating 4,000 h.p. to supply Takao and Tainan. All these enterprises were at first under the direct control of the extraordinary engineering department of the Taiwan government general, but were later placed under the department of civil engineering. In July, 1919, when the Taiwan Denryoku K.K. (Taiwan Electric Power Co., Ltd.) was organized all the government enterprises were transferred to its control and in this manner all the electric enterprises in Formosa came again into the hands of private enterprise.

### Taiwan Denryoku K.K.

This company was established by a government's decree in April, 1919, with a total capital of Y.30,000.00, half private and half official. After its formal establishment in July of the same year, all the government electric enterprises were transferred to its control on August 1, 1919. The company was organized to carry out a program involving the construction of a great power plant utilizing the waters of Jitsugetsutan lake located in the middle of the central mountain chain, to generate a total of 140,000 h.p., and supply power to all parts of the island at a very low rate.

The plans for this power plant include: (1) An immense dam to raise the surface of the lake waters some 75 feet; (2) in order to maintain a steady supply of water the Dakusui-kei river is to be directed into the lake at the rate of 954 cubic feet a minute; (3) the present volume of the lake, whose area is 593 *ko* (*Ko* equals 2,397 acres), is estimated at 660,000,000 cubic feet; this is to be increased an area of 828 *ko* or 5,747,000,000 cubic feet; (4) with this water supply, it is believed possible to generate 140,000 h.p. at the outset while a second power plant is planned to generate 55,000 h.p., in case of emergency.

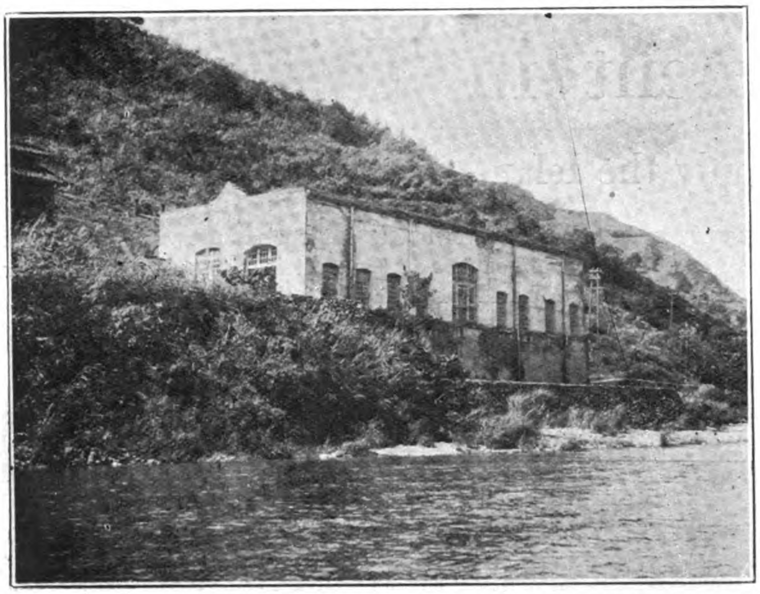
Marked progress has been made, and the work is expected to be completed by the end of 1924. The work was started on the top

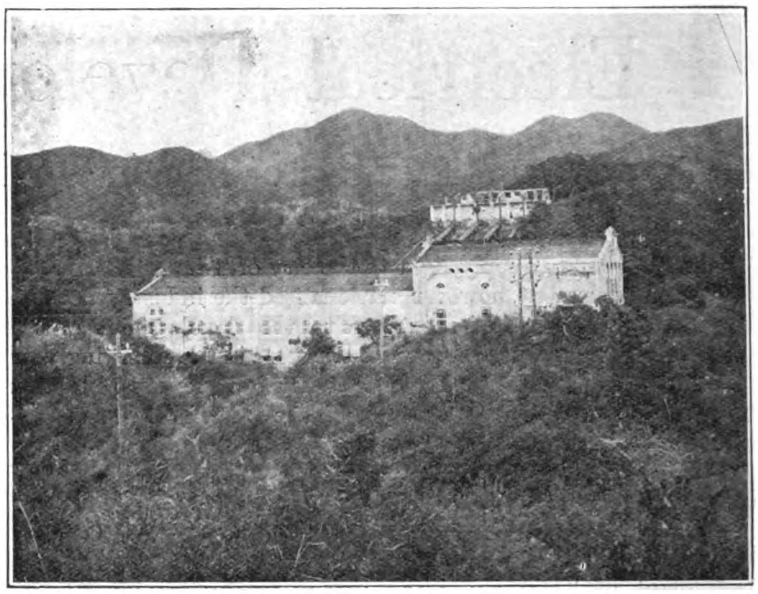


POWER HOUSES OF THE TAIWAN ELECTRIC POWER COMPANY, LTD.

Taihoku Steam Power Plant

Shosoko Hydro-Electric Plant, No. 2





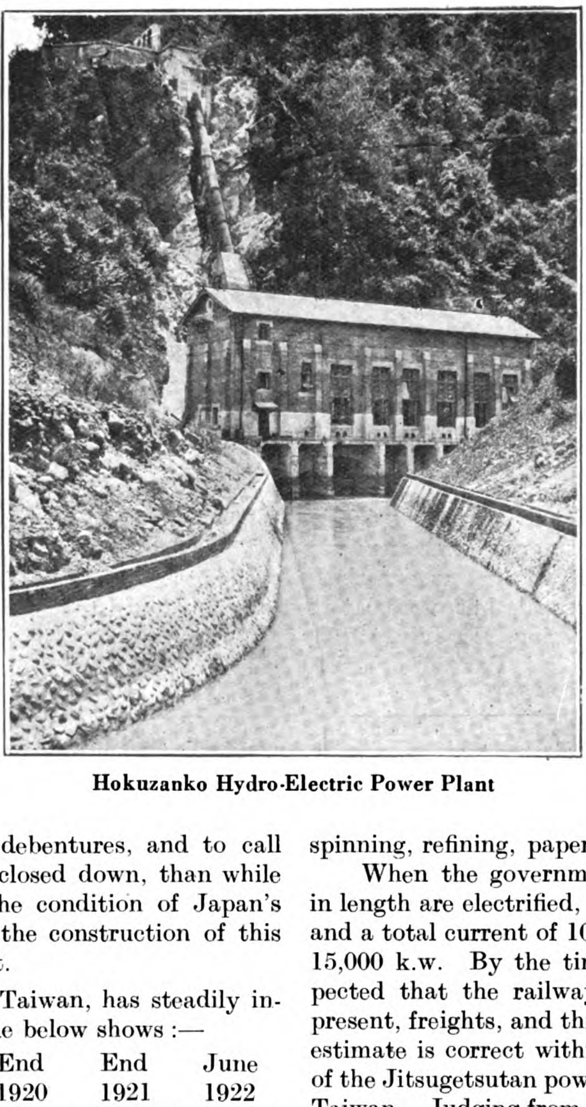
POWER HOUSES OF THE TAIWAN ELECTRIC POWER COMPANY

Kameyama Hydro-Electric Power House

Chi Kushimon Hydro-Electric Power House

ware of high prices after the great war, on an original estimate for the Jitsugetsutan power plant of Y.18,000,000 raised from capital subscribed by private interests, and by issuing debentures to a total of Y.30,000,000, making the total investment of the company about Y.48,000,000. (The value of the government enterprises taken over was capitalized at Y.12,000,000). But when actual construction was commenced, the excessive costs of equipment, materials, and the high salaries, wages, etc., which had to be met, raised the actual costs from 20 to 100 per cent. above the original estimates. Accordingly the authorities in charge of the construction work stopped work early in 1922 regardless of criticism, and confined their efforts to keeping the partially completed works in good condition.

This step caused quite a flutter in the financial world and many persons believed that the Taiwan enterprise would have to be abandoned. But the company's decisive action at once lowered wages, and remarkable to relate, it was found easier to issue new debentures, and to call up unpaid capital since the works were closed down, than while they were in full operation. Now that the condition of Japan's finances are improving it is hoped that the construction of this great power plant may soon be carried out.



Hokuzanko Hydro-Electric Power Plant

The demand for light and power, in Taiwan, has steadily increased in the past three years, as the table below shows :—

| Power used for | | End 1919 | End 1920 | End 1921 | June 1922 |
|---|---|---|---|---|---|
| Electric lights number | .. | 169,725 | 208,263 | 243,551 | 261,008 |
| Electric fans ,, | .. | 5,328 | 9,704 | 13,599 | 17,014 |
| Power supplied : | | | | | |
| in small amounts | .. | 3,969 h.p. | 5,848 | 6,664 | 7,353 |
| in large amounts | .. | 6,057 | 4,947 | 4,172 | 4,459 |

The supply of power in large amounts, sold to industrial concerns, has registered a steady decline, picking up somewhat in June, 1922. This was caused entirely by the inability of the power companies to supply the demand, and their refusal to sell to large consumers, whose trade was not so profitable as the smaller users. The Asano Cement Co., which had been taking 2,150 h.p. from the Taiwan Denryoku K.K., has been obliged to use boilers for the use of waste heat, thus decreasing the amount it required from the electric company. In addition, the Taiwan Carbide Mill was closed, releasing 1,000 h.p. Excluding these two companies, there has been a rise in the supply of power to large concerns.

The water turbines to be used in the Jitsugetsutan power plant will have a capacity of 140,000 h.p., which is about 57,330 k.w. average at the transformer station, reckoning 65 per cent. for the load. Of this total 13,634 k.w. will be used for meeting increasing demand for lights, 6,102 k.w. for fans, and for power supply, small amounts 8,244 k.w., and for large amounts 24,350 k.w. Of the total, it is expected that 10,000 k.w. will be used by the railways when these are electrified, the remaining 14,350 k.w. to be used for the chemical fertilizer industry, soda ash factories, salt refineries, and spinning, refining, paper mills, etc.

When the government railways, at present about 300 miles in length are electrified, a direct current of 1,500 volts will be used, and a total current of 10,000 k.w. will be needed, if not as much as 15,000 k.w. By the time the power plant is completed it is expected that the railways will be transporting three times their present, freights, and this will require a total of 20,000 k.w. If this estimate is correct within two or three years after the completion of the Jitsugetsutan power plant, there will be a scarcity of power in Taiwan. Judging from experience in Japan proper, there is almost certain to be a lack of power in the not distant future.

The electric enterprises taken over from the government by the Taiwan Denryoku K.K., earned profits of Y.1,000,000 annually when under official direction. After the transfer to the company, about Y.5,000,000 was invested in general improvements. The company is now making an average of Y.3,000,000 profits annually, with which it has been able to pay 7 per cent. dividends, as well as meeting the interest on its outstanding debentures, come Y.560,000 a year. There is no doubt but that the completion of this company's

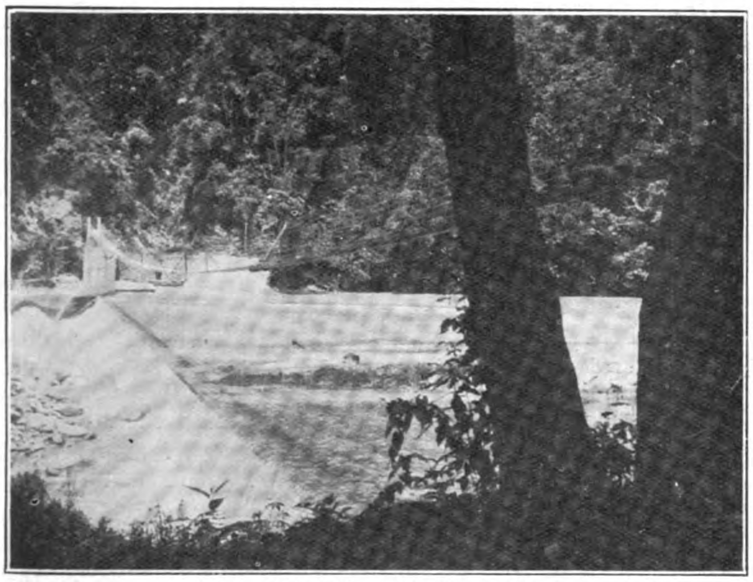
plans will have a most beneficial effect on the industrial future of the island and every effort is being made to find the funds needed for this purpose.

The board of directors of the company consists of: President T. Takagi; Vice-President: G. Sumi; Directors: D. Ogoshi, H. Nagata and G. Takata; Auditors: Kihachiro Okura and Teijiro Yamamoto.

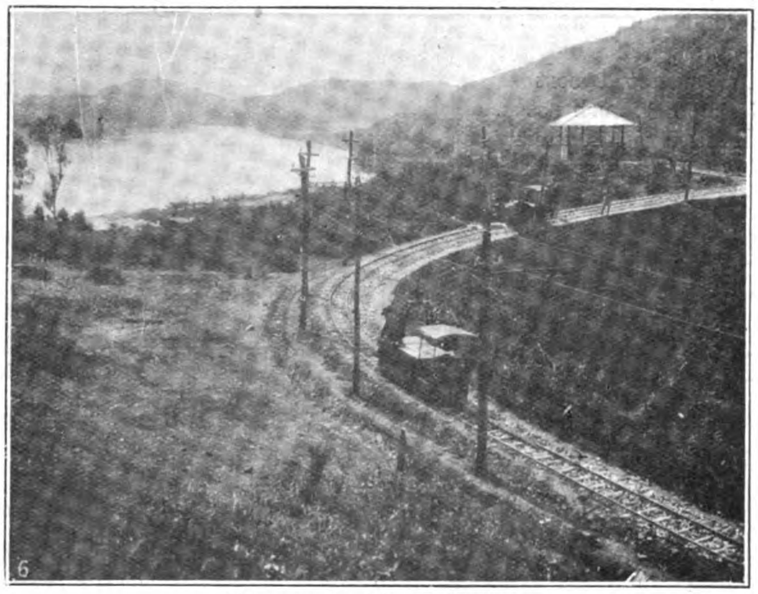
(*Continued on page 320*)

Korisho Hydro-Electric Power Plant

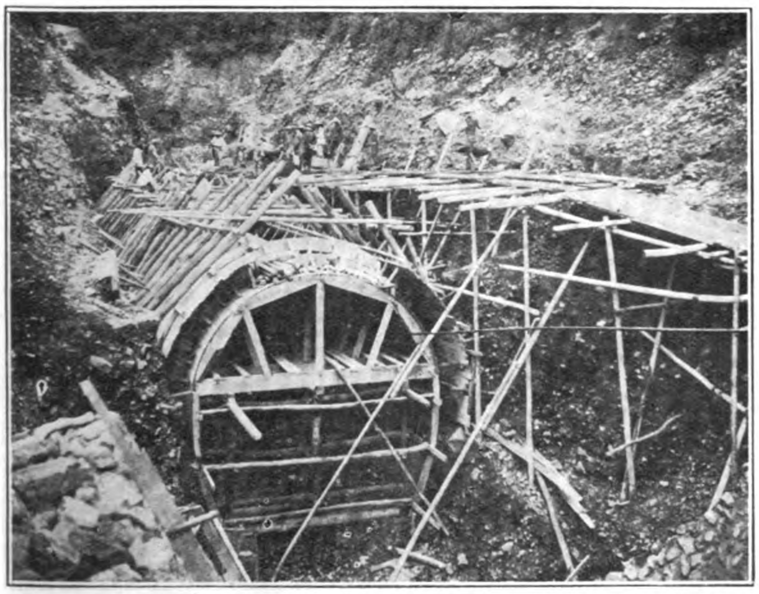
Toryuwan Power House

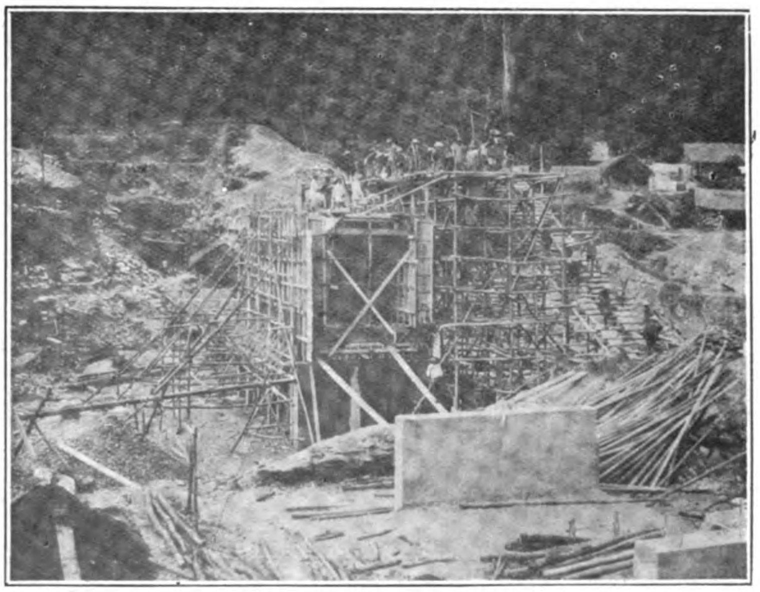


Dam of the Hokuzanko Power Plant



Jitsugetsutan Electric Railway





Hydro-Electric Construction Work in Taiwan

# Manila Water Supply

*By A. Gideon, C.E., M.Am. Soc. of C.E., M.Am. Waterworks Ass'n., etc., Manager and Chief Engineer*

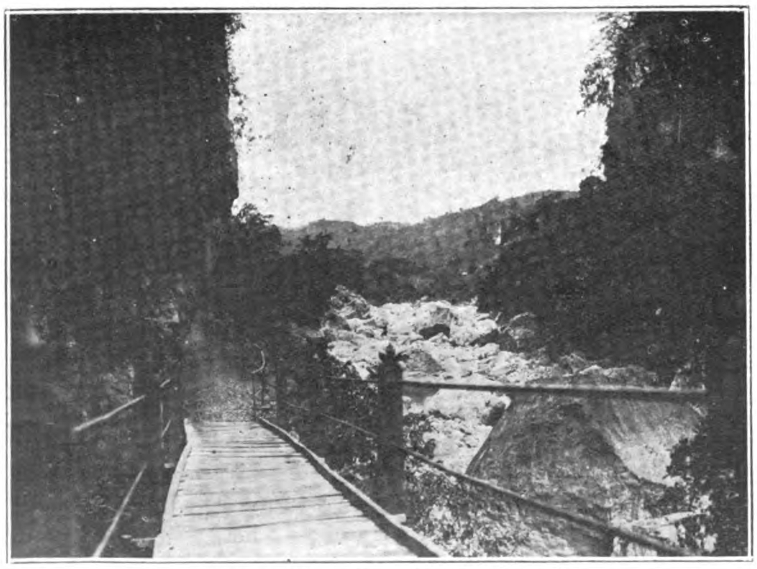
IN December, 1733, General D. Francisco Carriedoy Peredo, a Spanish gentleman, left a bequest of 10,000.00 pesos to build a water supply for Manila. This fund was made available upon his death in 1743 but as the fund was insufficient, and the time not ripe for the construction of a water supply it was invested in various ventures, until the capital and the accumulated interests were deemed sufficient to construct a water supply adequate for the city. In 1867 the capital after undergoing various vicissitudes amounted to 177,853.44 Mexican pesos. In this same year alternate projects were prepared by Señor Don Genaro Palacios to bring water to Manila, first, by a gravity system from Montalban at an estimated cost of 12,250,000 pesetas or some 2,500,000 Spanish pesos, and second from Santolan by means of pumps at an estimated cost of 745,509 Spanish pesos. Finally, in January 1878, arrangements were made to carry out the second project, and Señor D. Genaro Palacios was appointed chief engineer.

Montalban Dam with 9 feet Flash Boards up

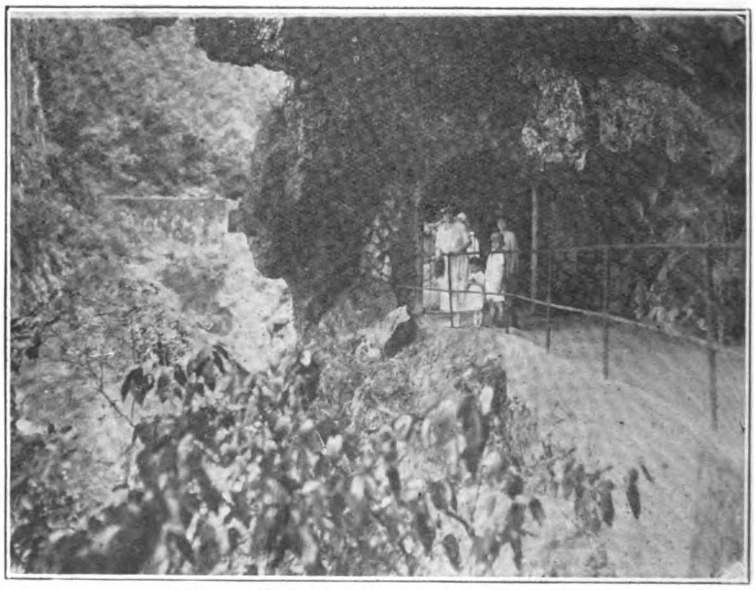
The waterworks were named the Carriedo canal, and the opening was inaugurated in August 1882, though the installation of the pumps was not quite finished then. The water at first used, to the extent of 160,000 gallons per day was the infiltration water that came through the sides of the tunnel. Later on when two of the pumps were in operation, the daily capacity of the water supply amounted to about 2,320,000 gallons per day. Additional space was reserved in the pumping station for two additional pumps which would double the capacity of the system, and thus increase it to about 4,600,000 gallons per day.

### Description of the Works

The work consisted of a low diversion masonry dam on the Mariquina River, near the village of Santolan, an infiltration gallery 1,525-ft. long, 5.6-ft. high, 3.94-ft. wide. This gallery was laid of loose stones so that the water filtered through it to the intake chamber, and which gave the wrong impression in the city that the water was filtered. From the intake chamber four intake pipes lead to the four pumps, only two of which were then installed, the second pair of pumps were ordered later and were not installed until after the American occupation, or in 1900. The pumps and boilers were of Scotch make and are still used occasionally during the very dry seasons. The pumps lifted the water through two 20-inch force mains to a small tunnel 10,800-ft. long terminating at the deposito or reservoir. The dimension of the tunnel are 5.6-ft. high and 3.94-ft. wide, and the tunnel is divided lengthwise into two parts, by a 26-inch iron cast pipe inverted syphon, 1,312-ft. long crossing a very deep ravine and river. The syphon is carried across the river on a two arched masonry bridge of 24.6-ft. span, the syphon has a blow off at the lowest place to discharge the sediment that may accumulate in the bottom of the syphon.



Down Stream View Near the Montalban Dam



Gate to Montalban Dam and Head Works

The deposito or reservoir has a capacity of 14,784,000 gallons and was increased to 18,000,000 in 1920, by raising the overflow sill. The deposito is divided into two approximately equal parts, consisting of a series of underground galleries with groined arches excavated in tunnel, and is ventilated by 207 openings through the roof, over which shelter hoods were built. The dimensions of the galleries are 19.7-ft. high and 9.85-ft. wide, and they are paved with red and white tile. The elevation of the water was 62.3-ft. above the streets in Manila. The cost of the deposito is given as 110,000 pesos. From the deposito a 26-inch cast iron pipe led to the city, where it was distributed mostly through 4-inch cast iron pipe to such streets as were deemed important enough to have a water main. There were but few houses which had water installations and the water was obtained from public hydrants or small fountains installed for that purpose. The water was carried in pails to the houses, mostly by water-carriers who charged for their labor in accordance with the distances from the hydrants. There were very few water closets and few industrial plants using water and consequently, the 2,300,000 gallons daily supplied, did fairly well for the estimated population of 230,000 prior to 1898, allowing them 10 gallons per capita per day.

Upon occupation of the islands by the United States, all substantial houses were compelled to install sanitary fixtures and it was at once apparent that even with the installation of the two additional pumps which would increase the daily supply to 4,500,000 gallons, the water supply was entirely inadequate. Measures were taken in 1902, to provide a supply of 20,500,000 gallons per day or about 70 gallons per capita for a population of 300,000, estimated for 1922. A bond issue of $4,000,000.00 United States currency was authorized and the 4 per cent. bonds, sold in the United States at an average of $108, or 8 per cent. premium over par value. Construction was started in 1905, and the work was completed in part in 1909.

The new work on the Mariquina river at Montalban consisted of an arched masonry dam of the O. G. gravity type 191-ft. long on the crest, 36-ft. high above the old river bed, and some 20-ft. below the river bed. The dam is built of concrete, faced front and back with ashlar masonry, which avoided the need of forms for the concrete. The ingredients with the exception of cement were found within half a mile from the dam site. A 4iveted steel pipe 42 inches in diameter carries the water for a distance of 46,660-ft. from the intake at the dam to its junction with a tunnel, and then 31,583-ft. in tunnel to the new distribution reservoir. From the new reservoir, the water is conveyed to the city by a 42-in. steel pipe for a distance of 5,975-ft. to its junction with the deposito or old reservoir above described and from there the water is carried to the city by a new 42-inch cast iron pipe laid parallel to the old Spanish pipe which is used as an auxiliary line. Six inch pipe was adopted as the minimum size for new installation, but some of the 4-inch pipe that existed in the Carriedo system were left in place, and utilized whenever feasible.

Subsequent to the completion of the system a venturi meter was installed to measure the water coming to the city, and as all services are metered, a fair idea is had as to the distribution of water in the city. However, soon after the completion of the enlarged system it was evident that further extension would be imperative in the near future. The city, however, had arrived to its limits of legal indebtedness and measures were therefore taken to organize the metropolitan water district, which would supply a number of towns in the vicinity of Manila as well as the city itself. The act of the legislature creating the metropolitan water district authorized the sale of bonds to an additional amount of $6,000,000.00 United States currency.

Plans, estimates and specifications are now being prepared, for the immediate diversion from the Angat river of 50,000,000 gallons per day and a total future diversion of 80,000,000 gallons per day, whenever the needs of the district should warrant same. The main features of the project such as the diversion dam on the Angat river, the tunnels from the dam to the present pipe line, are all proportioned for an 80,000,000 gallon per day supply, as the cost of the work will be practically the same for either quantity. The filtration beds, pipe lines, storage reservoirs, etc., are, however, designed for a 50,000,000 gallon per day supply, and can be readily extended when conditions will warrant same.

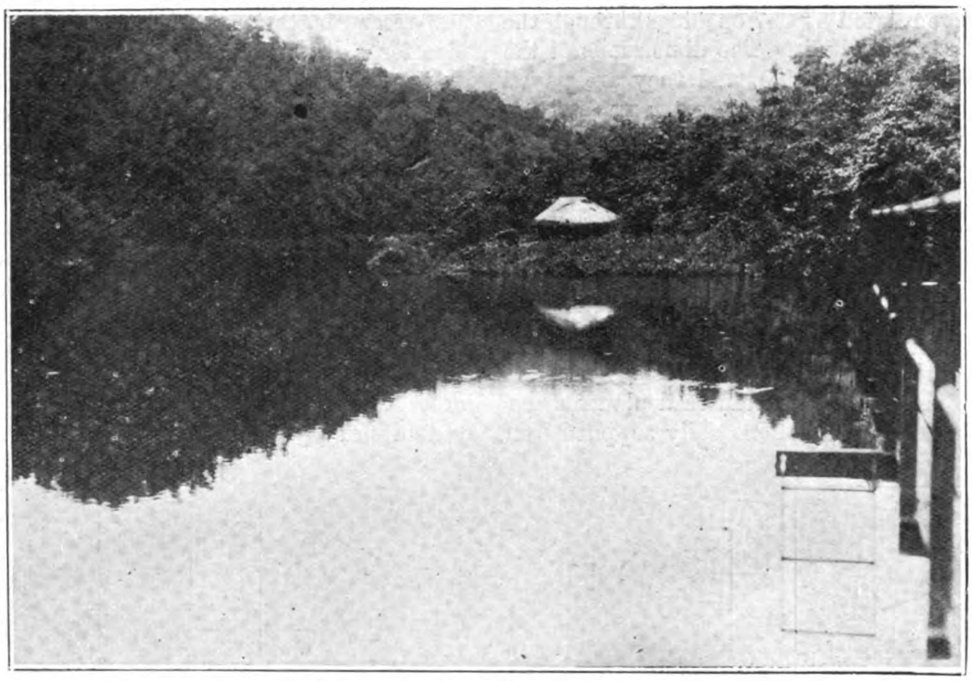
The population of the city is now estimated at 300,000, and there are about 100,000, people in the metropolitan water district outside of the city. The estimated population of the city of Manila for 1950 is 500,000 and for the suburbs 150,000, so that the 50,000,000

**Montalban Gorge and Dam**

**Montalban Dam and Gate House Showing Steel I Beams in Place to Support the Flash Boards**

**Entrance Gate to Montalban Dam and Head Works**

gallons per day provided for are estimated to be sufficient till 1950. Should the city develop more rapidly than estimated, they can draw upon the remaining 30,000,000 gallons per day, at a small additional outlay. It was not deemed advisable, at the present time, to provide for more than 25 years hence, on borrowed capital, as the accumulated interest and sinking fund contributions, on the additional expenditures capitalized at 4 per cent. for 25 years will be more than sufficient to build the needed extension at that time.



Reservoir at Montalban Above Dam

### Per Capita Consumption

The per capita consumption in 1898 was 10 gallons per capita per day, in 1908 or just prior to the completion of the Montalban system was 19 gallons, while the present consumption is 73 gallons per capita, and the indications are that in twenty years hence, the consumption is likely to reach 100 gallons per capita. The per capita consumption in Manila is the highest of any place in the Orient, and also greater than many of the larger cities in Europe, but is considerably less than for similar or larger cities in the United States. The reasons for the high per capita consumption, are, the location of the city in a tropical belt, where bathing is more freely indulged in; the universal installation of water flushed toilets; comparatively heavy street sprinkling and flushing; the installation of a sanitary sewerage system, and last but not least the very low price of water to the consumers, which is 5 centavos per metric ton, or about 8 cents United States currency per 100 gallons.

All services are metered, are read monthly, and bills rendered quarterly. Whenever any considerable increase in consumption is noted, a notice is sent to the owner of the property, calling his attention to the excessive consumption and suggesting that the fixtures and interior pipe lines be examined and repaired if necessary. We now have about 14,500 services, and they are at present increasing at the rate of about 1,500 new services per annum.

All the installations up to the meter are done by the metropolitan water district, and the interior installations by licensed private plumbers. The meters are maintained in working condition by the metropolitan water district, and on the average 25 per cent. of the meters are repaired every year. Our shops are equipped with modern machinery for all work that the district has to do, and include, machine shop, blacksmith shop, carpentry shop, foundry, tinsmithing, painting shop, etc. This arrangement enables the district to do its work promptly and economically.

The metropolitan water district is a governmental institution, but is governed by a board of directors, who meet once a month, ond oftener if necessary, and have jurisdiction of both the water supply and the sanitary sewerage systems.

All the employees excepting laborers are under the civil service rules of the government of the Philippine Islands, the manager and assistant manager are appointed by his excellency, the governor-general, with the approval of the senate.

# Singapore Water Supply

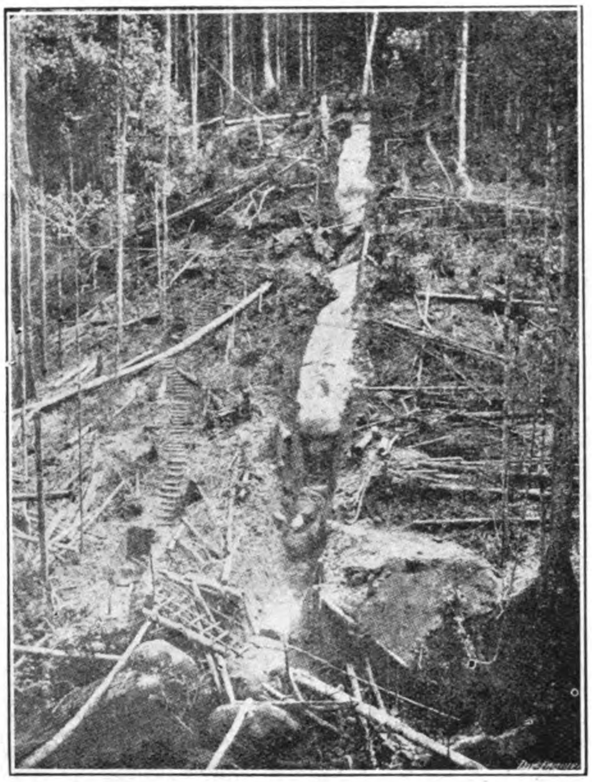
*From "The Engineer"*

IT is general knowledge that Singapore is an island which was ceded to Great Britain by the Sultan of Johore in 1824. The water supply of Singapore town, which lies to the south of the island, has hitherto been, and is at present obtained, from impounding reservoirs built within the island itself. The daily quantity of water available is 11 million gallons, and as the population supplied is 334,000 and the average consumption is 32 gallons per head, it will be realized that there is immediate necessity for seeking an additional source of supply. Indeed, the need has been evident to the municipality for some years past, but one of the difficulties in the way of meeting it has been that the local sources on the island itself are very nearly exhausted; at any rate, they are incapable of adding sufficiently to the quantity of water at present available to meet the wants of the municipality for any length of time ahead.

Several schemes for obtaining additional supplies have been considered, among which may be mentioned those for obtaining water from :—

(*a*) A source known as the Pulai rivers.
(*b*) From a source known as the Pelepah.
(*c*) From the Lenggin, a tributary of the Johore River.
(*d*) From the Skudai River.
(*e*) By development of the Seletar area on the island.
(*f*) By erecting dams across the estuaries of certain tidal rivers.

The Pulai scheme was prepared by the municipal engineers, and it was eventually approved by the commissioners. Before finally adopting it, however, it was decided, having regard to the facts that it would be costly to carry out, and that a government

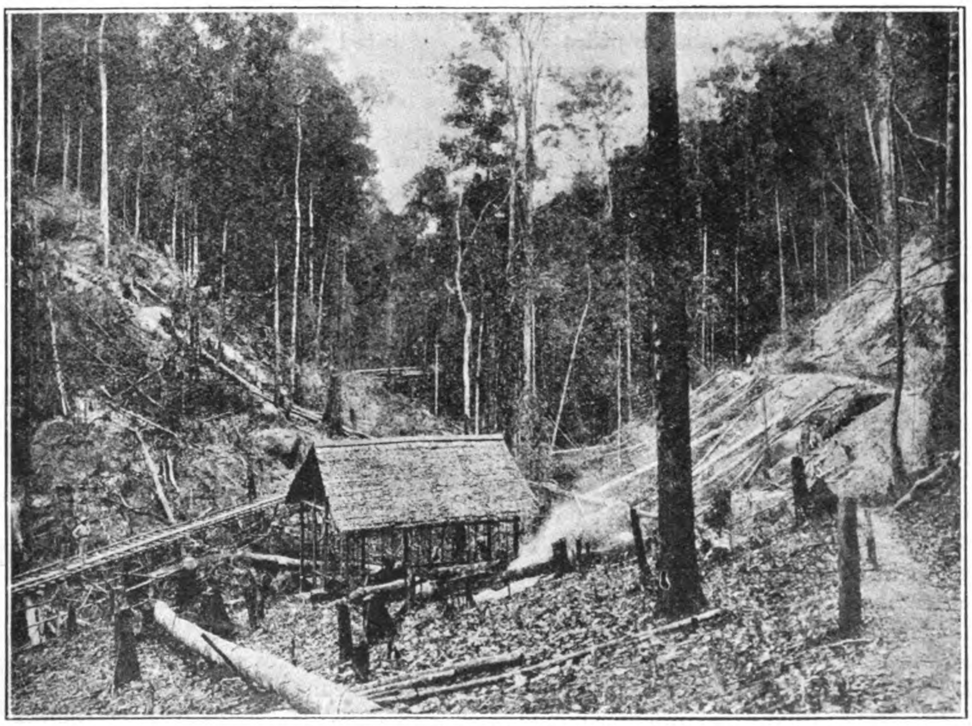


Excavations on Either Side of the Valley for Foundations of Dam

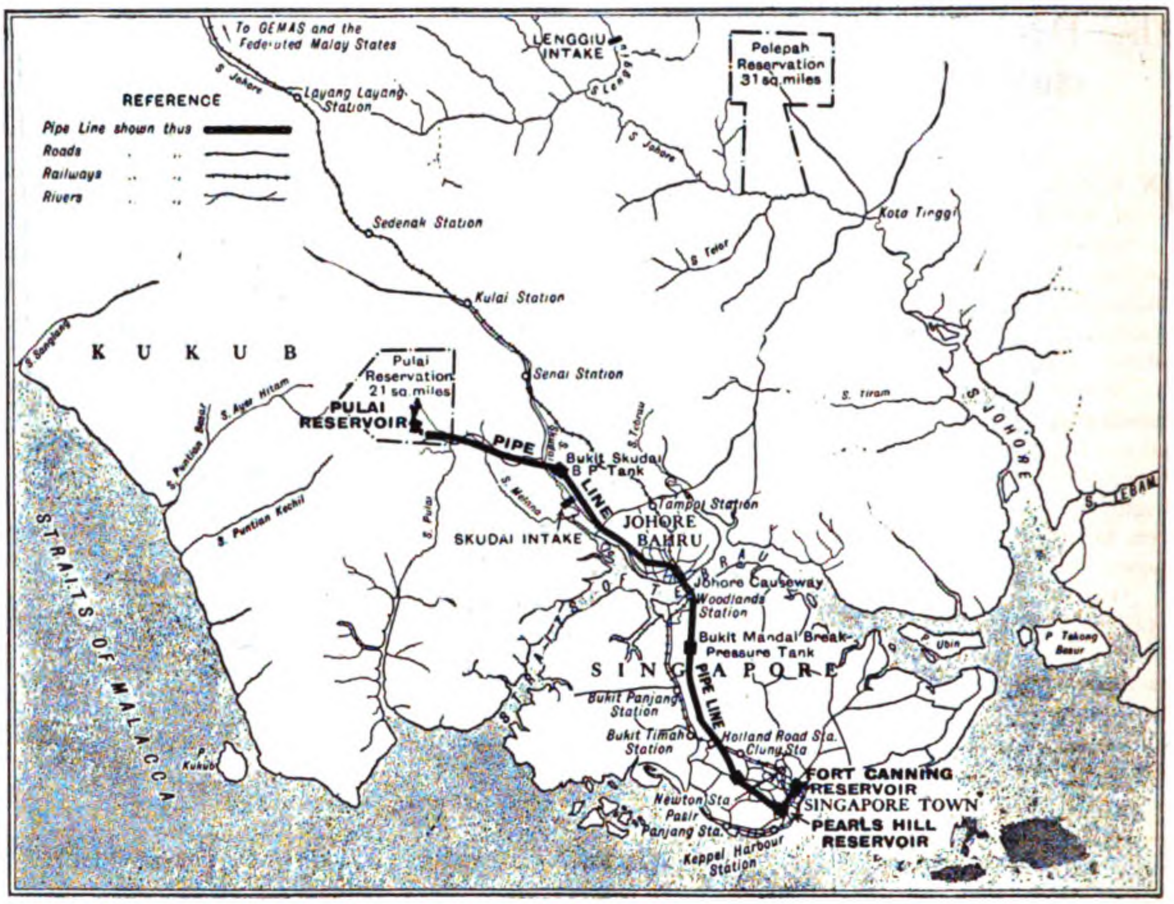
loan would be required for the purpose, to take expert advice on the subject. The crown agents for the colonies accordingly approached the firm of SirAlexander Binnie, Son and Deacon, of Westminster, and it was arranged that Mr. Martin Deacon should go out to Singapore and make a thorough investigation on the spot. He has now returned and, through the courtesy of his firm, we are enabled to place before our readers the following information.

All the schemes mentioned above were investigated, and of them all the first—the Pulai scheme—was chosen for recommendation for reasons to which we shall refer later. Meanwhile, it may be said that the municipality we also advised to make careful records of the flow of the river Lenggiu, the reason being that in that river there is, in Mr. Deacon's belief, a flow sufficient to meet the whole of the requirements of Singapore for many years to come. It is true that pumping would be necessary, but, on the other hand, no large dam or impounding reservoir would be necessary, the supply being taken direct from the river.

Before passing on to consider the Pulai scheme in detail we may, perhaps, refer briefly to Mr. Deacon's conclusions with regard to the other proposals. As concerns the Pelepah, the position of which may be seen on the accompanying map, it is acknowledged that considerably more water could be obtained from it than from the Pulai rivers, but its adoption would involve the construction of a large dam, and every drop of water would have to be pumped to Singapore—a distance of 56 miles. To pump from the Pelepah source the 6½ million gallons per day—which is the volume that can be obtained by gravity from the Pulai works without any pumping at all—would, Mr. Deacon calculates, amount to no less than between £45,000 and £50,000 per annum. Then, as regards the Skudai River there is the objection that, though without doubt there is sufficient flow to enable a supply adequate to meet the needs of Singapore for many years to come to be obtained by pumping the water is particularly dirty, and very large and expensive settling reservoirs would be required to clarify it before it could be passed on to the filters. Moreover, the nature of the ground is such that the cost of those reservoirs would be extremely heavy, so that on all counts the source cannot be considered as a serious rival of the Pulai scheme. One of the great advantages of the latter is that it can be proceeded with in sections. By laying the pipe line—which will be about 32 miles in length—it will be immediately possible to obtain a supply of 2½ million gallons of water per day without having to build any dam. The construction of a dam across the Pulai River will make available about another three to four million gallons per day. Then it is considered possible that, by erecting



Site of Pulai River Dam




**Map Showing Position of the Pulai Reservation and the Route to be Taken by the Pipe Line to Singapore**

weirs across certain of the streams to the westward of the Pulai River, and by bringing the water thus derived by gravity to a pumping station, so that it might be lifted into a second reservoir formed by the construction of another dam, not far from the first, a fur ther supply, the exact volume of which is not as yet accurately ascertained, but which would not be less than five million gallons, could be secured. This additional volume would, after being pumped into the reservoir, flow by gravity to Singapore. In all, therefore, the Pulai scheme will, it is estimated, possibly yield as much as eleven to twelve million gallons per day, and perhaps more, and it could be proceeded with bit by bit.

Without further information it cannot be said whether the valleys to the west of the Pulai River are suitable for the formation of reservoirs by means of dams. If they are, then a very much larger volume of water could be made available. Up to the present, however, it has been impossible to survey all the valleys sufficiently thoroughly to enable a definite decision to be come to on the matter. The matter of surveying is extraordinarily difficult and expensive by reason of the facts that the valleys are clothed with thick forests, and that the undergrowth is particularly dense. Survey parties must literally cut their way through every yard traversed. Sometimes the forest growth is so luxuriant that trees on the two banks of a stream interlock above it and are thickly bound together by creepers of enormous strength and thickness of vines and foliage. The result is that the work of surveying is slow and exceedingly laborious, and, furthermore, it is by no means without its dangers, for the bush is full of snakes and other poisonous reptiles and insects, including mosquitoes in vast quantities. Investigations will, however, be carried out in order to determine whether and, if so, which of the valleys can be satisfactorily dammed.

The soil throughout the district is for the most part disintegrated granite interspersed with huge granite boulders, some of them weighing 100 tons and more. In some cases curious depressions caused by erosion occur in the sides of a valley which, unless they too were dammed, would render that valley useless for forming a reservoir. So thick is the forest and undergrowth, however, that it is impossible to say whether such places exist in any particular valley until every yard of the watershed of the valley has been traversed, and, as a matter of fact, it is in many cases extremely difficult to ascertain where the watershed comes. Possibly aerial survey, such as is being used with success for similar purposes in the forest areas of Canada and the United States, would reveal the depressions ; but, so far we understand, it has not been resorted to.

As the Pulai scheme had been most favored by the municipal engineers, the ground in the neighborhood of the site proposed for the first dam had been cleared fairly thoroughly. It was, therefore, possible for Mr. Deacon to examine it more closely than was the case with any of the other schemes. The three views on the preceding page are reproduced from photographs taken from three different points. The engraving at the bottom represents a view taken a right angles to the proposed line of the dam, looking up stream. The two upper engravings show the banks of the valley on either side. Excavation work is in progress on the line of the dam, and the white patches in the upper views show some of the huge boulders of granite which have been uncovered. They are, of course, loose, and solid rock has not yet been encountered.

The water of the Pulai River is of great purity, and is exceedingly soft, but owing to the immense amount of sedimentary matter which is washed from the sides of the hills during heavy rainfalls, and which discolors the water, it will have to be filtered before it can be used for domestic purposes, the filtration being carried out before the water is sent down into the aqueduct. The island of Singapore is separated from the mainland of the state of Johore by straits, which in their narrowest part are only some ⅝ mile wide. It would have been possible, of course, to bring the water across to the island in pipes laid in the bed of the channel, as has been done in other parts of the world, notably at New York, but fortunately, what is known as the Johore causeway is being constructed so that the pipe line can be run across it, and the necessity for designing special joints for the underwater portion will be avoided.

It may be added that Mr. Deacon recommended the original scheme, as worked out by the engineers of the municipality, after making considerable modifications and alterations. It is estimated that the first additional supply from Pulai could be made available by the year 1929, and that, in the meanwhile, the situation can be eased by obtaining another million gallons per day from Seletar on the island itself.

## Siamese Contract for Rails

The contract for rails and accessories for the Siam State Railways, tenders for which were opened on April 16, was awarded to Les Petits Fils François de Wendel through their Bangkok agents, Comptoir Français du Siam. The total amount of the contract is £124,844-1-6, made up as follows: Rails, £109,769.12.5½ ; fish-plates £ 8,715.0.0 ; bearing plates £ 6,359.9.0½. The price is c. i. f. delivered at the Railway wharf.

# The Design and Construction of Machinery for the Milling and Blending of Tea

IN view of the fact that the preparation of the tea leaf is now a much more refined and scientific process than was the case years ago, the manufacture of machinery for the milling, sifting, and blending of the tea leaf has become an industry of the greatest importance.

Among the firms who specialize in the manufacture of machinery for this purpose, special mention must be made of Messrs. Henry Pooley & Son, Limited, of John Bright Street, Birmingham, who have long been known as manufacturers of the well-known Bartlett tea machinery.

One of the specialities which deserves detailed description is the Bartlett patent automatic tea blender, Type No. 2000. This machine is made in capacities up to 3,000-lb. at one operation, and is shown on illustration No. 1 herein. It is purely automatic in action and operates as follows:

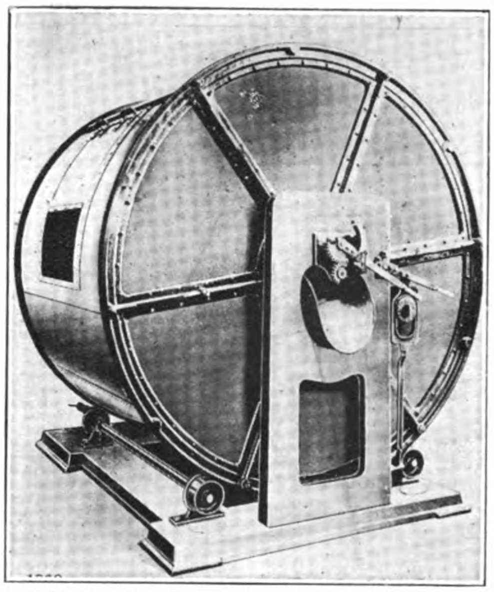


Fig. 1. Bartlett Automatic Tea Blender

The leaf tea to be blended is discharged into the main drum of the blender. The blender is fitted with an attachment described as timing gear. By means of this attachment the number of revolution of the blender, which can be varied at will, is automatically controlled, and at the end of that period the machine automatically stops, the blending operation having been completed.

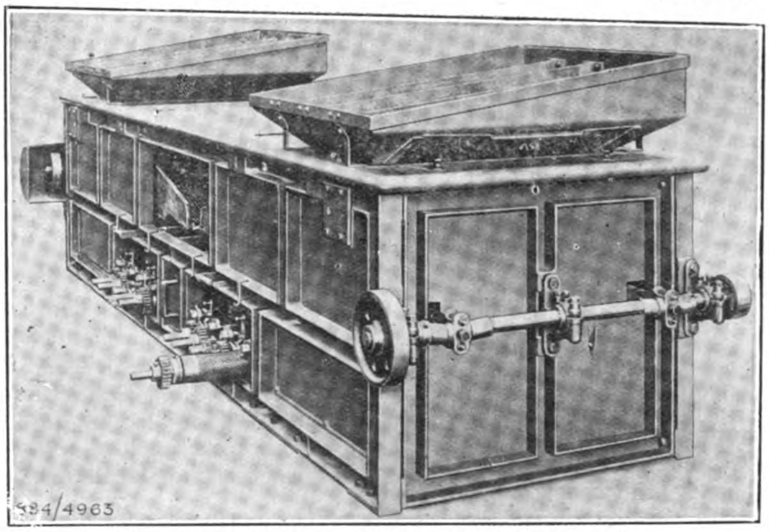


Fig. 2. Bartlett Tea Milling and Sifting Machine

When it is desired to discharge the contents of the blender, the discharge valve is opened by means of a small hand lever, and this operation automatically sets the blending drum in motion again. The blender continues to revolve as the tea is discharged until the required quantity of tea has been removed when the discharge valve is closed, which operation automatically stops the machine.

This machine can be fitted with an attachment for removing dust during the blending operation. The dust is collected in a special receiver, and it is not necessary to install a long pipe line. The machine is very compact and takes up very little floor space. The blender drum revolves on machined inter-friction rollers. The feed can be varried out either from chests of tea at the side of the machine, or from overhead hoppers. The power required to drive this machine is very small, the largest size only requiring a 4 h.p. motor. The Bartlett tea milling and sifting machine is shown on illustration No. 2.

This is a large machine having eight cutting rollers. The same machine can be supplied in all sizes to meet the amount of tea which has to be handled. The necessity and advantage of tea merchants being able to place before their customers an even and uniform tea is now generally acknowledged, but this can only be obtained by a process which sifts out the small tea and passes only the large leaves into the cutting mill. The Bartlett patent tea mill and sifting machine is designed to meet this requirement.

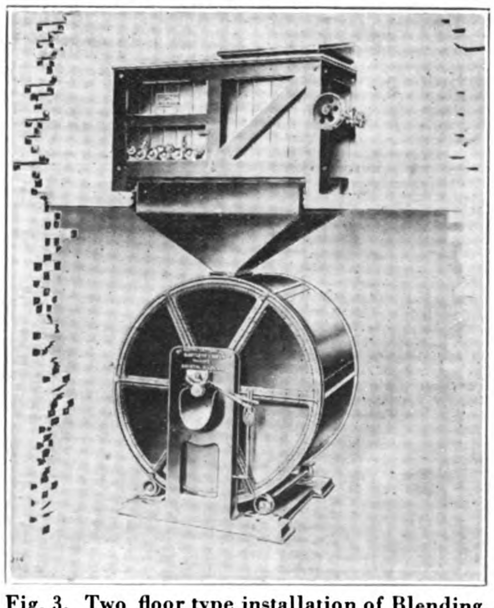


Fig. 3. Two floor type installation of Blending, Milling and Sifting Machienry

Among improvements which have been introduced in this machine is an attachment which automatically collects all foreign substances such as paper, tea, lead, pieces of wood, or other obstructions and prevents them from being driven into the cutting mill.

The machine can also be fitted, if desired, with an electric magnetic nail extractor which collects all nails which find their way into the tea, and prevents them from getting into the machinery.

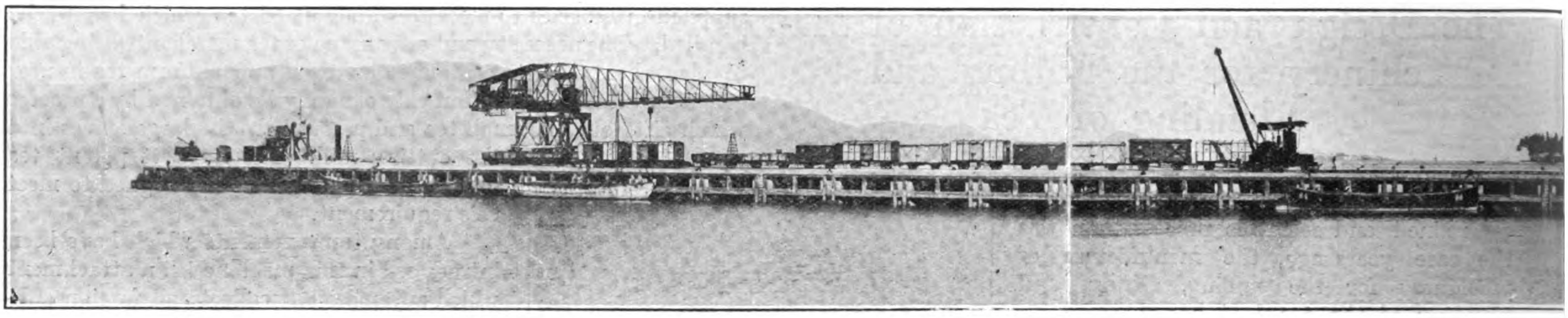
The machine is practically noiseless and requires very little power. The feed can be adjusted exactly as required, and by a simple interchange of sieves, any grade of tea can be dealt with. Another very important point is that the cutting rollers can be withdrawn and exchanged for others with a different mesh in an instant.

As a further protection against nails getting into the machine, it is fitted with a triple knife gear. Should a nail or other metal substance get through to the knives, it cannot damage them, as by an ingenious automatic arrangement, it is immediately passed through. If the electric magnetic nail extractor referred to above is fitted to the machine, the nail would, of course, not get into the machine at all. This triple knife arrangement is therefore in that case an additional precaution.

The blending, milling and sifting machinery herein described can be either used separately or combined as a complete unit. Such an installation is shown by illustration No. 3 which is described as a two floor type installation. As will be seen, the sifting and milling machine is installed on the upper floor. This discharges into a hopper which in turn discharges into the blender below. The blender then discharges into bins on wheels, or into whatever form of receptacle is used.

This is only one of the ways in which the machinery can be arranged. In the case of a one floor building the tea, after passing through the milling and sifting machine, is raised by a conveyor elevator into an overhead hopper which discharges into the blender.

Messrs. Henry Pooley & Son, Limited, have issued a new catalog which gives detailed desciiptions and many illustrations of all the Bartlett tea machinery.



Prai River Wharves: Side View of Jetty—Basin

# The Prai River Wharves

*By James Brown, M. Inst. C.E.*

As this paper is only intended to describe the works at Prai from an engineering point of view it is not necessary to say much about the history or policy of the scheme.

It may be mentioned, however, that even before 1912 when the Prye Dock property was acquired by the F.M.S. government, the wharfage and accommodation for separate shipping at Prai was known to be quite inadequate to deal with the constantly increasing traffic and the government, in connection with the railway department of the northern states of Malaya, and in view of the linking up of their railway system with the Siamese railways, decided to extend and greatly to enlarge the existing wharves, so as to provide a terminal port where the largest seagoing vessels frequenting the port could come alongside the wharves and discharge directly into railway wagons, or into the transit sheds on the wharves.

Various schemes had been suggested and early in 1913 Messrs. Coode, Matthews, Fitzmaurice and Wilson, the consulting engineers to the government, were asked to examine and report on these schemes.

As no survey or records were then available a preliminary survey of the port was made and soundings and borings, etc., were undertaken, and in 1914 the engineers reported favorably on the scheme for the extension and improvement of the wharves suggested by Mr. Anthony, the chief engineer and general manager of the F.M.S. Railways.

Drawings were prepared, but the European war intervened and nothing was done until the end of 1917, when Messrs. Topham, Jones & Railton, who were then completing the works of the Empire Dock and the Tanjong Pagar Wharves at Singapore, found themselves in a position to tender for the works.

At the time it was practically impossible to obtain any new or special plant required for the work, and it was only because Messrs. Topham, Jones & Railton had their Singapore plant on the ground that they were able to undertake the work. It was hoped that, on the conclusion of the war, conditions and prices would become much easier, but this has not proved to be the case, as prices of materials, plant and wages continued to rise for a long time after the signing of the armistice.

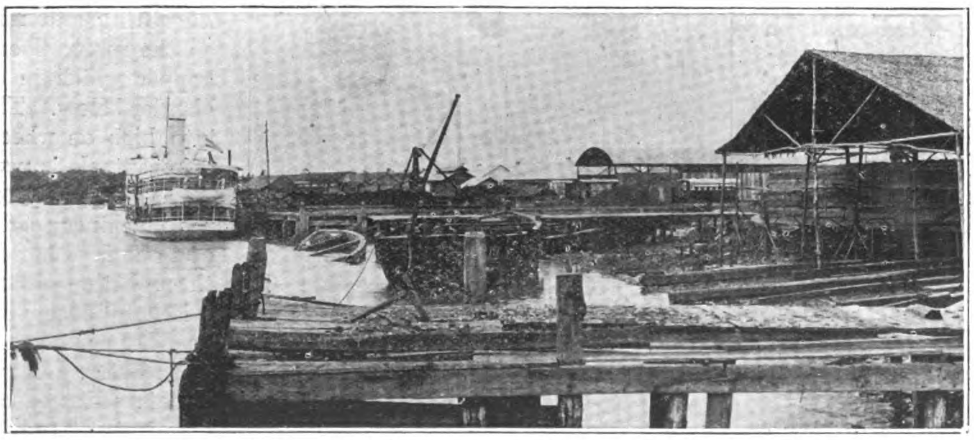
Work was begun in May 1918, and Messrs. Topham, Jones & Railton are entitled to a great deal of credit for the way they have carried on the work in face of continual difficulties.

Several additions have been made to the works since the contract was signed and these works now include :—

1. A reinforced concrete jetty of 1,100 feet in length at the mouth of the Prai River.
2. The widening and reconstruction of the existing wharf 600 feet in length (a prolongation upstream of the jetty).
3. A new coal wharf 900 feet in length in a further prolongation upstream, these three works providing a total frontage to the river of 2,600 feet with a depth of 30 feet below low water.
4. A lighter basin on the south side of the jetty 1,100 feet in length with a depth of 16 feet at low water.
5. Dredging the channel and approaches to a width of 500 feet and a depth of 30 feet.
6. The reclamation of adjoining swamps and foreshore with the dredged materials to the extent of about 170 acres.

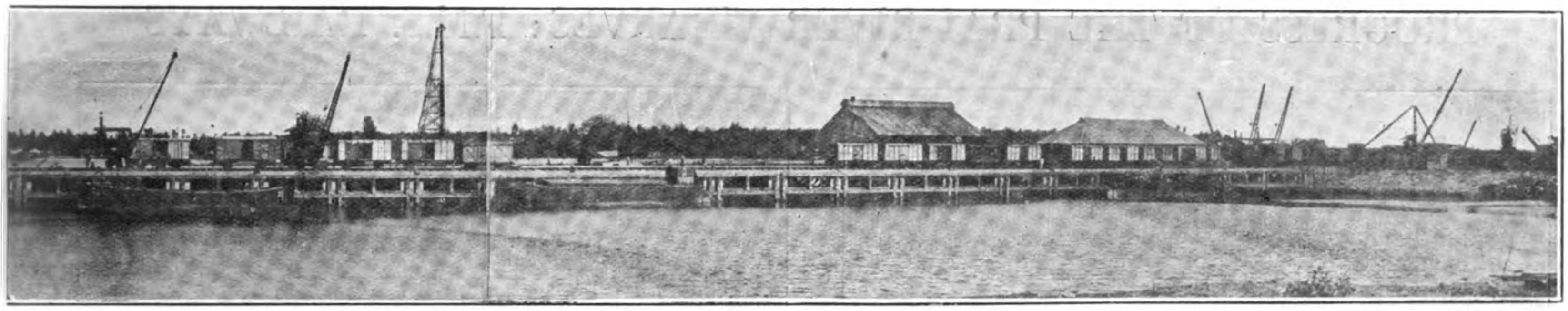
## 1. Reinforced Concrete Jetty

The borings made in 1914, and again in 1917, showed that underlying the river mud there is an extensive layer of sand at an average depth of about 55 feet below low water level, and going down to a great depth. Later borings made in search of water penetrated continuous layers of sand and gravel of varying degrees of coarseness to a depth of 320 feet below low water, where a hard igneous rock was encountered.



Prai River Wharves: Looking East along Water Front from Corner of old P.H.B. Slipway, June 7, 1918.

It was decided to make the foundations of the jetty and wharves in this layer of sand and the jetty designed is a massive reinforced concrete structure carried on concrete cylinders sunk through the mud into the sand strata. There are 45 rows of these cylinders spaced 25 feet apart centre to centre with seven cylinders each row spaced 22 feet centres, in the width over all of 142 feet.



side—from South Reclamation; January 5, 1923

The cylinders are made of 5:1 mass concrete 8 feet 6 inches external and 5 feet 0 inch internal diameter swelling out into a cutting edge ring of 3:1 concrete 11 feet 6 inches external diameter which provides a greater bearing area on the foundations and lessens the skin friction in sinking. They are built up of rings made in the blockyard and matured for three months before being used, each ring, generally 5 feet in depth, toothed into its neighbor above and below. They are sunk from a temporary staging through steel guide sleeves set accurately in position and truly upright, at first by their own weight as the mud is removed from the inside by grabs, and later by the additions of rings of cast iron kentledge weighing 5 tons each. When sunk to the required depth of 2 feet into the sand each cylinder is cleaned out by divers and loaded up with 100 tons of kentledge and is required to stand for 48 hours under this load after all movement has ceased.

After they have passed the loading test the kentledge is removed and a compensation ring is made to measured dimensions so as to bring the tops of all cylinders to a true and uniform level. On top of this ring is a special cap capable of a slight adjustment for alignment which completes the cylinder at a level of 2 feet above low water, and at this level the reinforced superstructure is commenced. After the caps have been placed and any silt that may have accumulated in bottom of the cylinders cleaned out by divers, the whole interior is filled up with mass concrete of 6:1 quality deposited in hopper bottomed skips lowered to the bottom before discharging so as to avoid dropping the concrete through the water. As a further safeguard against the disturbance of the cylinders on any of the horizontal joints through the impact of vessels coming alongside, the concrete hearting has been strengthened by placing tram rails of 90-lbs. per yard section vertically in the concrete on each side of the cylinder.

Before passing to a description of the superstructure it may be mentioned that the prescribed test load of 100 tons, additional to the weight of the concrete itself, has been borne perfectly by every cylinder and is equal to a load of 6.8 tons per square foot on the foundations.

This is a load actually borne by the foundation strata, and is not calculated by any formulae, and as the ultimate load due to the weight of the structure and the deck loads is not expected to exceed $4\frac{1}{4}$ tons per square foot there would appear to be a very safe margin. The total weight of the structure itself is 103,000 tons or three tons per square foot on the foundations.

## 2. Reinforced Concrete Superstructure

The reinforced concrete beams are moulded in the yard and matured for three months before being set in the work.

The concrete consists of 90-lbs. of cement to $1\frac{1}{3}$ cubic feet of sand and $2\frac{2}{3}$ of crushed granite to a gauge of not more than $\frac{5}{8}$ inch and not less than $\frac{1}{8}$ inch. The finer material (less than $\frac{1}{8}$ inch) is left in and considered as sand in the mixture. Special care has been taken to obtain a sound dense concrete as nearly impermeable as can be obtained which will prevent moisture reaching the steel and setting up corrosion. Test cubes are made from the mixture prepared for every beam, and several of these have been sent to England for testing purposes. They show a strength in compression of 3,600-lbs. per square inch at three months old and an average weight of 145-lbs. per cubic foot.

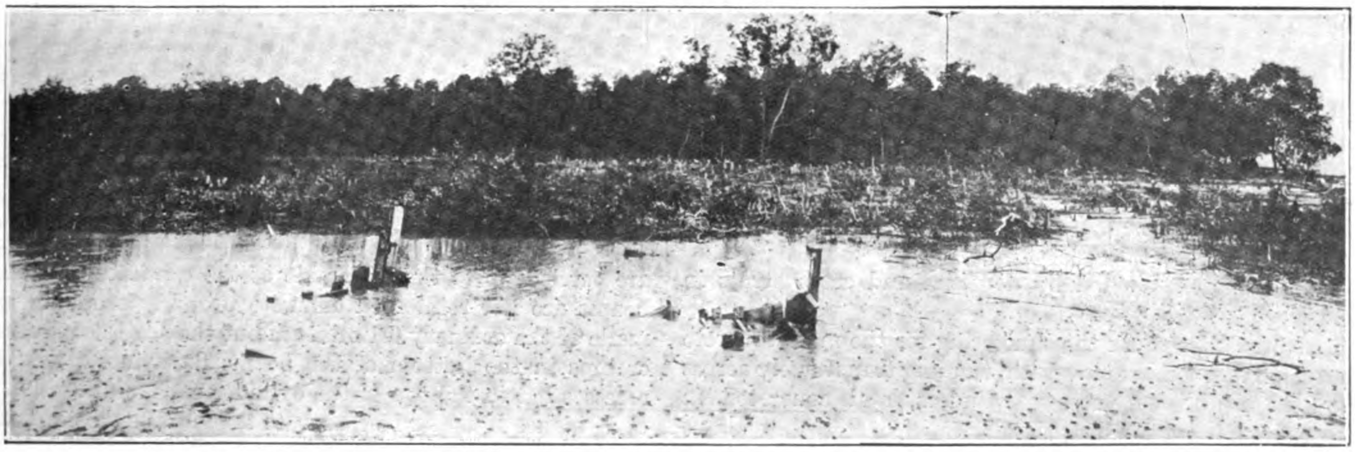
The cement is of English manufacture to the British standard specification with an initial setting time of not less than fifty minutes and a final setting time of not less than five hours.

The minimum cover of concrete allowed over the steel bars is $1\frac{1}{2}$ inches in the beams and $\frac{3}{4}$ inch in the flooring slabs. As an additional precaution against any moisture reaching the steel bars, the surface of all reinforced concrete above the level of high water of neap tides is painted two coats of coal tar, which must be quite free from acidity. It has been found that damage from corrosion most frequently occurs above the level stated.

In building the structure the first beams placed are the lower fender Walings which rest on cylinder caps on the frontage and end of the jetty tying the cylinders together longitudinally.

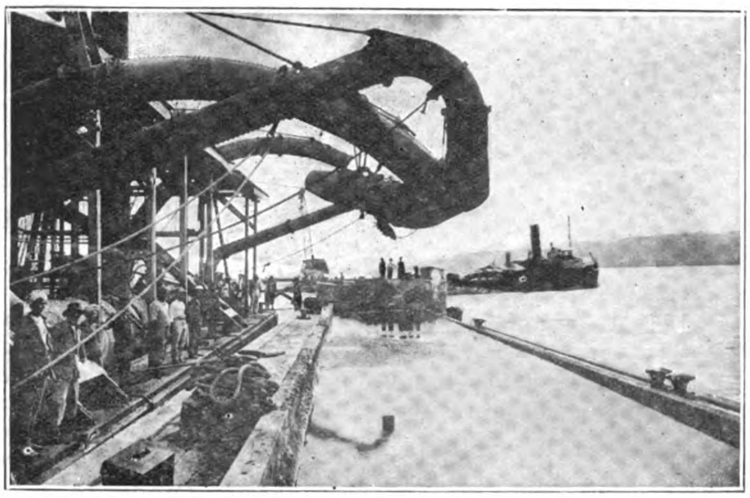
They are moulded with horizontal diagonal struts on the back of the beams the tail ends of which are housed into the mass concrete capping beams.

Every alternate front cylinder is braced to the second row by diagonal struts let into the cylinder caps and the end bays of the

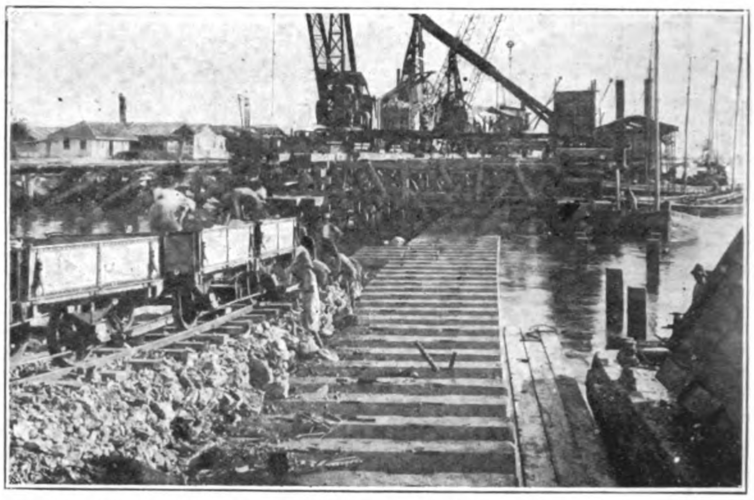


Prai River Wharves: Site of Lighter Basin Looking West from end of Old Retaining Wall: June 6, 1918

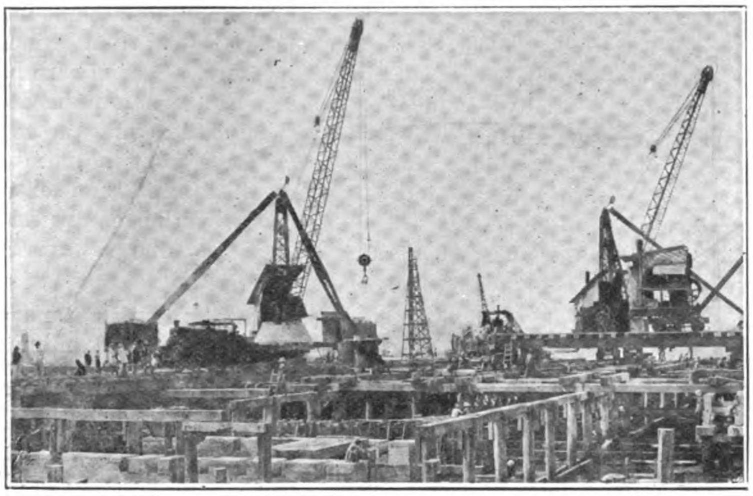
# PROGRESS OF THE PRAI RIVER WHARVES: F.M.S. RAILWAYS



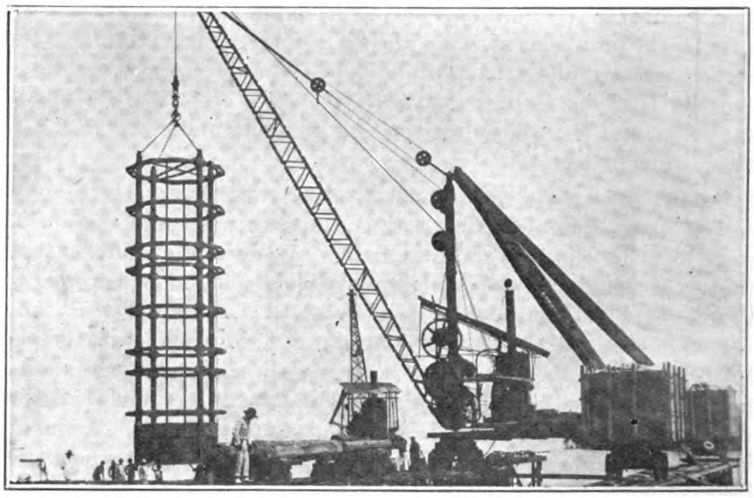
Dredged Material in Barge alongside Pumps at Reclamation: Oct. 6, 1919



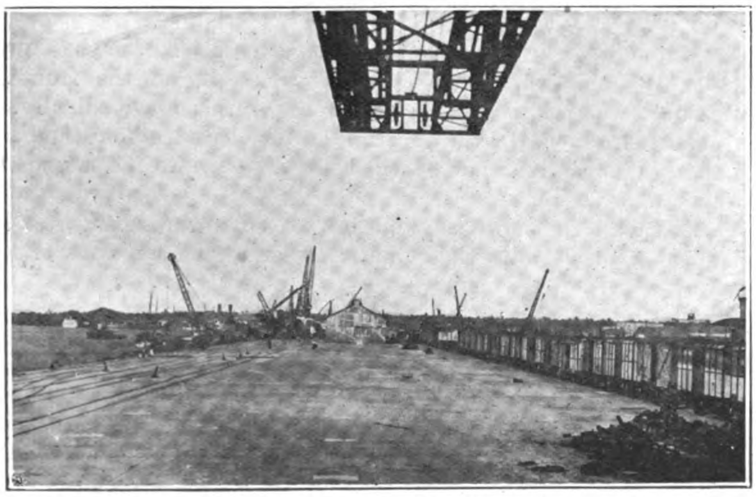
Blockwork Well Showing Top of Blocks at Low Water: May 9, 1922



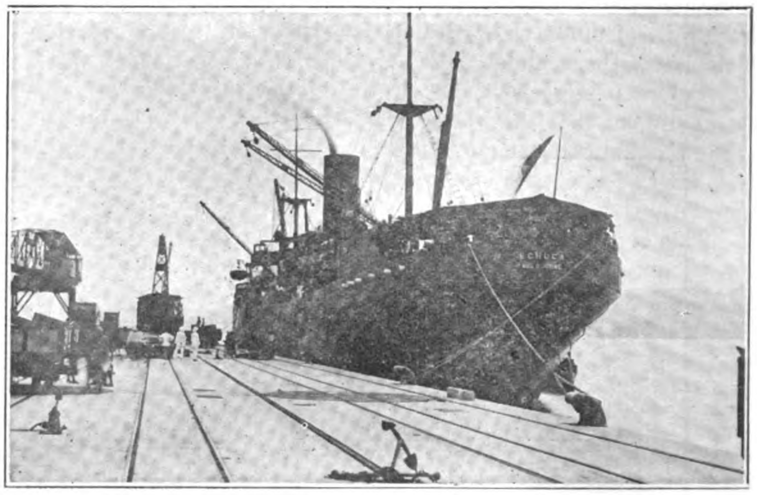
Shore End of Jetty Showing Progress of Concrete Capping Beams, etc.: Dec. 27, 1919



Wharf Widening: Pitching Steel Guide Sleeve for Sinking Cylinders: June 6, 1919



View of Deck of New Jetty, looking East: Sept. 4, 1922



Discharging Cargo from First Steamer Alongside New Jetty: Feb. 17, 1923

jetty are specially strengthened by diagonal and cross struts in the same way.

The next process is to fix the shuttering for the mass concrete capping beams, 3 feet 6 inches in width, running transversely across the jetty on the top of every row of cylinders, and concreted *in situ*. The concrete is carried up generally to 8 feet 9 inches above low water, but where special loads have to be reckoned with they are carried up to the underside of the reinforced decking. These beams are not reinforced concrete properly speaking as they are made of the ordinary 6:1 mixture but they are strengthened by rail cramps in the bottom of the beams fixed in rail collars let into recesses left in the top of the cylinder caps, and by five steel bars of $1\frac{1}{4}$ inches diameter bent so as to take up the tension and shear in the beams.

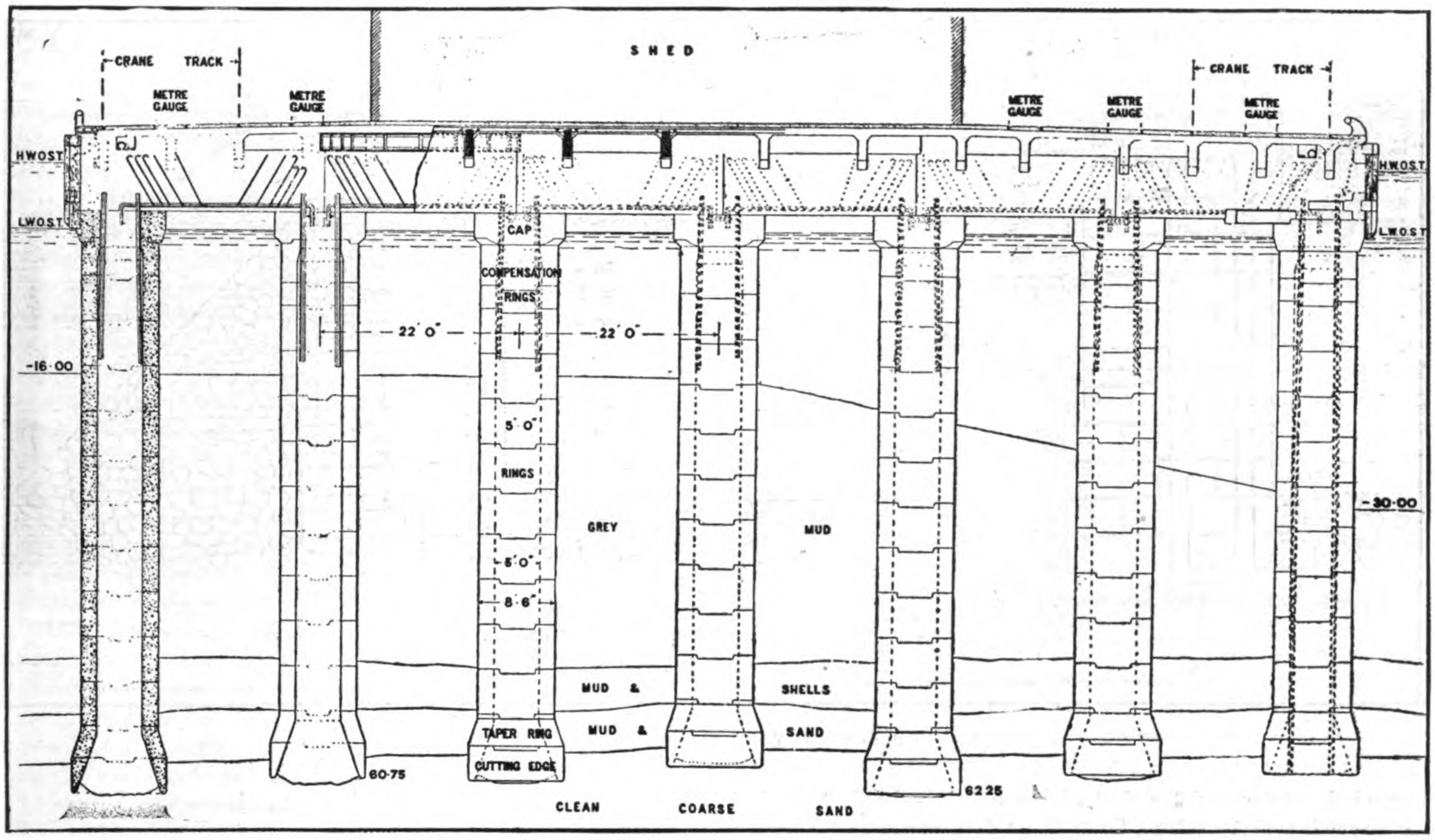



**Fig. 3. Typical Cross Section of Jetty**

Each beam 22 feet in length is concreted in one operation and formed with a grease joint over the centre of each cylinder.

After the capping beams have been concreted, the deck beams are set in recesses left for them in top of the capping beams. They are bedded in cement compôt and the ends concreted up solidly. These beams as well as the fender Walings are made continuous by the overlapping of the reinforcing bars and by the insertion of joint bars where necessary.

They are spaced as shown in Fig. 3 and are 3 feet 9 inches in depth at the ends and 2 feet 9 inches in the centre portion, by 12 inches in width and reinforced by 1¼ inches diameter steel bars. Extra deck beams are placed where required to support cross-over roads.

A special coping beam is fixed on the frontage and end of the jetty, grooved to receive the upper horizontal fender.

All beams having been fixed, shuttering is then prepared for the reinforced concrete decking.

This is 9 inches thickness over the whole area of the jetty, and is reinforced tranversely by top and bottom bars ⅝ inch diameter spaced 9 inches apart and with intermediate bars under the running roads. In the area occupied by godowns the spacing is 6 inches apart.

The longitudinal bars are ¼ inch diameter top and bottom and spaced 12 inches apart.

The crane rails and rails for metre gauge tracks are then laid on top of the 9 inches decking and held in position by ¾ inch Lewis bolts 7½ inches long grouted into holes cored in the concrete. They are 60-lbs. per yard B.S.F.B. rails rivetted to sole plates 9 inches by ⅜ inch which also carry angle guard rails rivetted on.

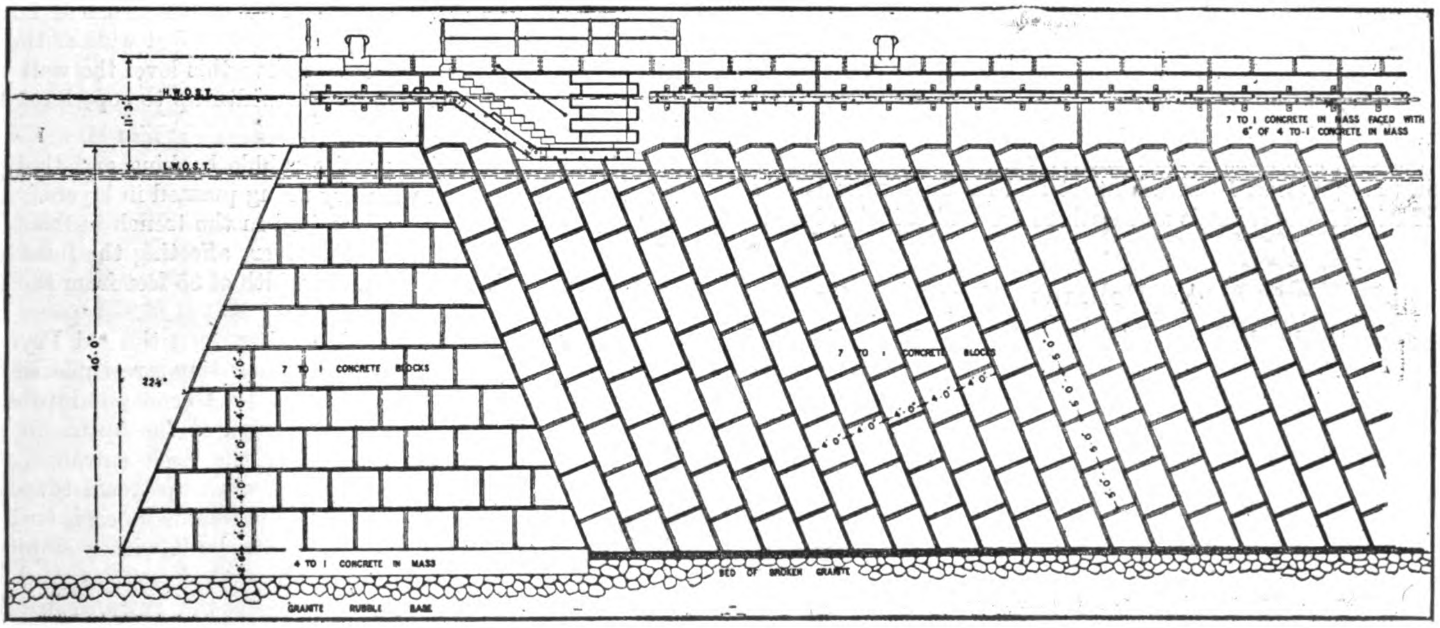
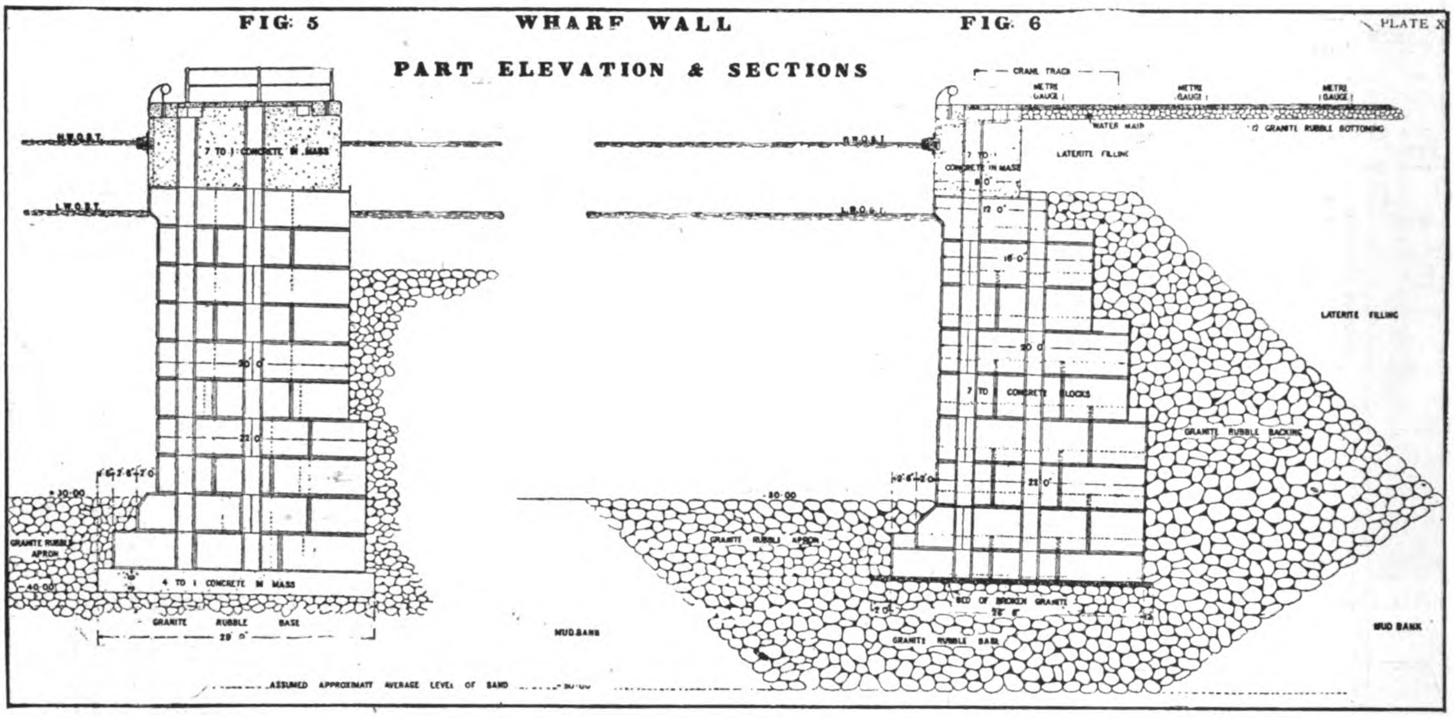



**Fig. 4. Wharf Wall: Part Elevation and Sections**




**Figures 5-6: Wharf Wall: Part Elevation and Sections**

The whole surface of the jetty is then finished off at 11 feet 3 inches above low water with a layer of 4:1 fine concrete $3\frac{5}{8}$ inches thick, on which is laid 1 inch of 2 to 1 granolithic of fine granite siftings, screeded off to the reqnired levels and falls, the top layer being laid simultaneously with the lower one and forming one homogeneous mass with it.

The total weight of the reinforced superstucture, including the capping beams is 26,000 tons, 1,200 tons of which are due to the steel reinforcement. The average amount of reinforcement is equal to 10.22-lbs. per cubic foot of concrete, the most heavily reinforced beams being the non-continuous beams under the cross-over roads where the reinforcement amounts to 19-lbs. per cubic foot.

## 3. Fendering

Fendering of the best quality Ballaw timber is provided on both sides and end of the jetty. Tapered grooves both vertical and horizontal are formed in the mass concrete capping to front cylinders and in the reinforced concrete fender Walings and coping beams to receive the backing piece 14 inches square, shaped to fit the grooves. These are secured by $1\frac{1}{2}$ inches diameter galvanised wrought iron bolts through the reinforced beams and by Lewis bolts in the mass concrete capping, the nuts and washers of the bolts being sunk in the timber and covered by turned Ballaw plugs set in red lead.

The rubbing pieces 14 inches by 7 inches are fixed on the face of the backing pieces by 1 inch diameter galvanised coach screws 12 inches long spaced 18 inches apart and inclined inwards at an angle of 1 in 10. The heads and washers are sunk 2 inches into the timber.

## 4. Bollards

Cast steel bollards are provided on the cope line at intervals of 75 feet, these being fixed in the mass concrete capping over the front cylinders. The front tie rods are 2 inches diameter and the back ones $2\frac{1}{2}$ inches fitting into cast iron washers of 15 inches and 18 inches square respectively.

## 5. Water Main, etc.

A water main 7 inches diameter is laid along the front of the jetty with 3 inch ball hydrants at intervals of 200 feet. An electric cable is also laid in a chase in the decking with plug boxes for connection to the electric cranes at 50 feet intervals.

## 6. Turntables

Turntables 14 feet in diameter are fixed in wells specially formed in the reinforced concrete superstructure, on the two cross roads (between the sheds, and at the end of the jetty) for the transfer of single wagons from one track to any other.

## 7. Wharf Widening and Coal Wharf

The wharf widening and the coal wharf which extend for 1,500 feet upstream from the land end of the jetty were originally intended to have been made of the same design as the jetty, i.e., of concrete cylinders and reinforced concrete superstructure, but owing to the necessity of supporting the ground at the back of the wharves by a rubble mound, and the risk of displacing the cylinders in the soft mud bed while depositing the rubble, it has been thought advisable to substitute a concrete block work wall of the design shown in Figs. 4, 5 and 6,

The wall is of the sloping blockwork type, the blocks 4 feet in thickness in slices set at an inclination of 67-in. to the horizontal or a granite rubble seating, which is deposited in a trench dredged out to the level of the sand strata. The blockwork is 26 feet 6 inches wide on the foundation course and 12 feet wide at the top, 2 feet 6 inches above low water. Above this level the wall is built of 7:1 mass concrete 9 feet 0 inch in width up to cope level 11 feet 3 inches above low water.

It is backed up with granite rubble backing and the ground level is made up behind with dry filling punned in layers.

A rubble apron is also deposited in the trench in front of the wall, to prevent any scour in the river affecting the foundations. This apron extends to a minimum width of 35 feet from the face of the wall.

Owing to the necessity of keeping open the old Prye Dock as long as possible, and retaining the existing screw pile wharf for use until a portion of the new works has been put into service, it has been arranged to commence work at the upstream end of the wharf and work downstream to the dock entrance. Then to begin at the downstream end and work upstream towards the dock. This entails the building of abutments at each end of the wall in horizontal courses of blockwork built with a sloping scar end on which to start the sloping blockwork courses, and it also entails closing a V shaped gap opposite the entrance to the old dock.

The method of construction is as follows :—

The river bed is first dredged over the area of the foundations to 38 feet below low water and the temporary staging is then erected on piled dolphins on each side of the wall. By cranes on the staging the trench is then grabbed out to the full width required and down to sand level.

When the bottom has been cleaned out examined and passed the granite rubble base consisting of stones varying in weight between 56-lbs. and 10 cwts. is deposited, up to the level of—37.50. The surface is roughly levelled by divers and a bed of broken granite, of not less than 6 inches in thickness, of stone broken to a 2 inch gauge is spread, levelled and consolidated by divers under the foundation course of blockwork.

The horizontal blocks of the abutment are then placed to correct lines and levels and the whole brought up course by course. The blocks are keyed together by joggles 10 inches in diameter and 2 feet deep filled with 4 to 1 concrete in canvas bags, and the outer blocks are cramped into their neighbors with strong rail cramps let into the top of the blocks. The cramps are fixed by divers and the cramp slots filled up solid with 1 to 1 fine concrete.

When the abutment has been brought up to the height of 2 feet 6 inches above low water, the sloping blockwork begins on the sloping scar face of the abutment, each slice being tongued and grooved into the adjoining slice and built up block by block to top level. The blocks are designed so that they can be handled by the existing plant on the works, the heaviest being 15 tons in weight.

When the wall has been built sufficiently in advance the rubble backing of stones between 5 cwts. and 2 tons in weight is deposited to its full height and work is then begun on the mass concrete wall on top of the blockwork.

The shuttering is set, the top joints of the blocks caulked with jute bagging and the joints grouted up with neat cement.

The tops of the blocks are roughed over with a pick and the concrete is deposited in layers, cross shuttering being provided to cause each layer to break joint with the other. The concrete is of 7 to 1 but is faced with 6 inches of 4 to 1 brought up simultaneously with the mass.

The coping is framed of moulded concrete blocks of 4 to 1 concrete, 3 feet in width and 1 foot 6 inches deep.

The crane road and the three metre-gauge tracks on the river side of the jetty are continued throughout the whole length of the wharves with the necessary cross-over roads and connections to the main line.

Two double-storey goods sheds of 475 feet and 65 feet are to be built on the jetty and one of the same dimensions on the wharf widening, while a coal handling plant will be provided on the coal wharf with stacking ground at the back of the wharf for about 100,000 tons of coal.

## 8. Lighter Basin

The lighter basin is formed on the south side of the jetty, between the jetty and the southern reclamation. It is 1,100 feet in length by 300 feet wide on the bottom level ot 16 feet below low water.

The land side is finished with a dredged slope of 1 in 5 up to ground level, and a berm of about 50 feet in width is left between the top of the slope and the toe of the bund to retain the dredged materials pumped into the reclamation.

From the cope line of the bund steel jetties run out 150 feet to tee heads in the basin alongside of which lighters will be discharged by fixed electric cranes directly into railway wagons, or the goods can be taken into the godowns to be built on the reclaimed area.

The jetties will be constructed with the screw piles and steelwork of the old wharf which has to be dismantled to permit of the construction of the new works.

This old wharf was built in 1911 and a portion of it has already been removed.

The condition of the steelwork is interesting.

The cast iron screws which were imbedded in a sandy clay are in perfect condition. The 6 inches diameter steel piles below the level of the river bed are in almost perfect condition. Above this level and extending upwards to mean tide level the piles and bracing rods were thickly coated with a shelly marine growth, oyster shells and barnacles, and on stripping off this coating the surface of the steel is found to be considerably corroded by pitting, the holes being usually filled up with a blackish powder which can be easily scraped out. The holes are numerous and vary in size from the size of a pin head to an area of ½ to ⅜ square inch and to about ⅜ inch in depth.

The edges of plates and angles in the bracings, and around bolt holes above low water level are much worn by oxidisation and almost all the tie rods and bracing beams will have to be renewed for the new jetties.

## 9. Dredging

Probably the largest item of the contract is the dredging of the channel and approaches to the wharves, and of the lighter basin, a total quantity of 2¼ million cubic yards having to be removed and in addition any siltage which may accumulate during construction, and term of maintenance.

The river is being widened to 500 feet for the full extent of the works, on the bottom level 30 feet below low water and is finished on the north side of the river with a 5 to 1 slope.

A turning basin of 750 feet radius from the inner land end of the jetty is being formed on the north side of the river to permit of the swinging of vessels entering or leaving the port.

As the amount of silt brought down by the river is very considerable the consulting engineers in their report pointed out that maintenance dredging would be required and this is being provided for. During the construction when the mud is being stirred up in all directions siltage is particularly heavy and there is a heavy deposit where the flood tide meets the flow of the river, but on the completion of the works this should be very much less.

As no interruption to the traffic on the river is allowed during construction it is impossible to pump the dredgings through a pipe line direct from the dredger, and the dredging is therefore being done by a bucket dredger which delivers the materials into specially built mud barges alongside, each carrying about 350 cubic yards.

These are towed to the pumping installation placed alongside the area to be reclaimed and the dredged material pumped ashore.

The pumps are steam-driven centrifugal pumps with a 5 feet diameter disc and suction and delivery pipes of 21 inches diameter. They are placed with boilers and auxiliary engines in a pontoon moored in a prepared berth, and rise and fall with the tides, special knuckle joints being provided on the delivery pipes to allow for the varying height of the pontoon. All machinery on the pontoon is duplicated.

Each pump is capable of delivering over 500 cubic yards per hour at 200 R.P.M. and is driven by a compound engine with 14 inches and 24 inches diameter cylinders and 13 inches stroke, using steam at 150-lbs. pressure.

The water pumps are also centrifugal with 18 inches diameter suction and 16 inches diameter delivery, the delivery pipe being fitted with a flexible tube and nozzle.

The main delivery is a steel rivetted pipe 21 inches in diameter in 16 feet lengths of $\frac{3}{16}$ inch metal, with angle iron flanges for bolting the pipes to each other. It is carried on wooden trestles from the pump delivery to the point at which it is required to discharge the dredged materials—the maximum distance in this case being 2,100 feet.

## 10. Reclamations

As the dredging of the river channel was a necessary and very important part of this scheme it was considered desirable to utilize the dredged material as far as possible in the reclamation of the low-lying swampy ground, and the shallow foreshores adjoining the works, instead of taking it to sea, and so to provide

land which will be extremely valuable for the erection of godowns, etc., and for the laying out of railway yard and sidings.

The principal area to be reclaimed is the southern reclamation lying to the south of the lighter basin and extending to an area of about 80 acres. This was originally mangrove swamp and foreshore.

One of the chief difficulties of the contract, or at least one requiring the most exercise of patience, has been the building up of the bund to retain the pumped materials. These bunds are tipped banks of stone and earth with a granite rubble facing on the sea face. On the mangrove area not much difficulty was experienced, but on pushing out the bank on the soft mud of the foreshore very considerable settlement occurred and the banks had to be made up continually as the settlement took place. The whole area has now been enclosed, but settlement still continues and the banks still require to be made up in places from time to time.

During the process of reclaiming, the whole area is divided up in nine compartments by cross banks and the filling up of three of these proceeds together, the pumps delivering the mud, which is in a liquid state, into each of the compartments for two days alternately, and while delivering into one, the mud is settling and the surface water being drained off the other two compartments.

In dry weather and with careful draining off of all surface water, the mud dries up pretty rapidly, but in wet weather six to twelve months are required before any work can be done on the surface of the mud.

Six of the nine compartments of the southern reclamation are now completely filled up, the remaining three are almost full and are being left to settle while pumping is going on in the Bagan Luar reclamation on the north side of the river. Over the first compartments locomotives and railway wagons are now being run, these bringing in the dry earth filling which is spread for a depth of about 18 inches over the whole surface before proceeding with the erection of godowns.

The mud in the other compartments is settling and drying out satisfactorily.

It would be interesting and useful to know the density of the mud in its different conditions, as it exists in the bed of the river, as it is delivered by the pumps, and as it finally dries out in the reclamation, but it is extremely difficult to arrive at any accurate figures.

I give the following with some diffidence but believe them to be approximately correct.

| | |
|---|---|
| Weight of mud per cubic feet as it lies in bed of river | 90-lbs. |
| ,, ,, ,, ,, ,, in barge at pumps .. | .. 84 ,, |
| ,, ,, effluent from pump delivery .. | .. 75 ,, |
| ,, ,, mud when dried out in reclamation | .. 96 ,, |

Taking the last figure as the weight of dry mud (although it would probably weigh considerably more if it were absolutely dry) these figures show that the mud in the river bed contains about 19 per cent. of water and 81 per cent. of dry mud. As it reaches the pumps in barges the mixture contains 38 per cent. of water and 62 per cent. of dry mud. As it is delivered from the pumps 66 per cent. of water and 34 per cent. of dry mud, and they also show that 45 per cent. of water is added to the mixture in pumping out from the barges.

This is a very variable figure depending on the stiffness of the mud, and also on the amount of water already in the mixture when it comes to the pumps, and is the result of several tests made at Prai.

In addition to the godowns to be built on the wharves and adjacent to the lighter basin there are several other incidental works which do not come within the scope of the present contract.

The principal of these are the provision of cranes on the jetty and wharves for the handling of cargo from the holds of vessels into railway wagons or into the godowns. They are to be capable of handling three tons and are of the portal type on a 15 feet gauge track, and will be worked electrically, the power being supplied by leads from the plug-boxes set in the decking at intervals of 50 feet on the main cable from the power house. The turntables, and coal handling plant will also be worked electrically and there will be an extensive lighting system for the wharves and for the town.

The plans for a power station are now in hand, and it is hoped to start work on the foundations very soon.

The station is situated at the end of the lighter basin in a convenient position for obtaining a supply of condensing water from the river and for its discharge through a short culvert into the basin. As there is about 5 feet of mud here the building will be carried on piles driven down to the sand, their tops let into a concrete raft extending over the whole area of the buildings and on which the generators and other machinery will be placed and the building erected.

It is proposed at first to instal two sets of turbine generators of 1000 k.w. capacity each and one of 300 k.w. on the 3-phase alternating system with provision for a future set of 5,000 k.w. Provision will also be made on the same foundation raft for the boilers, transformers and other plant and a space is reserved for a pulverised fuel plant.

As the building of the new wharves entails the closing and filling up of the old Prye Dock and Slipway, a new dock and slipway will be built on the area known as the northern reclamation immediately north of Prai railway station. Drawings and specifications have been prepared and work will start as soon as government can see its way to proceed with these works.

The dock proposed is to be 480 feet in length with an entrance 65 feet wide and with 21 feet of water on the sill at L.O.W.S.T. The slipway will be capable of handling vessels of 1,000 tons dead weight, the rails being laid at an inclination of 1 in 22. A sand foundation for these works will be obtained as in the case of the jetty and wharves, but, owing to the depth of the overlying mud, bearing piles will be required to carry the new works.

# Swiss Locomotives for N.E.I. Railways

IN the autumn of 1916, a contract was concluded between the Dutch colonial ministry at the Hague and the Swiss Locomotive and Machine Works, Winterthur, for the delivery of 14 2 C 2 tender locomotives with Schmidt's superheater. The engines were shipped from Holland to the Dutch Indies, especially for the State Railways at Java (destination Tandjong Triok, a harbor near Batavia.)

The program of the suburban traffic provided for a traction power of 6,000 kg. on a gauge of 1,067 mm. This corresponds to the conveyance of a train of 400 tons on up gradients of 5 per cent. and in curves with a radius of 180 m.

The speed on the above-named gradients is 50 km. the hour. The locomotives are likewise intended to run on curves of 120 m. radius and 20 mm. widening of the gauge. The maximum speed on the level is fixed at 80 km. per hour.

The locomotives are provided with Marcotty smoke consumers. A superheater on Schmidt's system permits of a steam temperature of 350 Centigrade.

The automatic vacuum brake, steam brake and hand brake act with 60 per cent. of the adhesion weight (20 t.) on the front of the driving and coupling wheels.

Besides these engines 2 C 1 superheated steam express locomotives were built, with four-axled tender were supplied in large numbers to Java, and, after drawings by the railway company, several 1 D superheated goods train engines with four-axled tender.

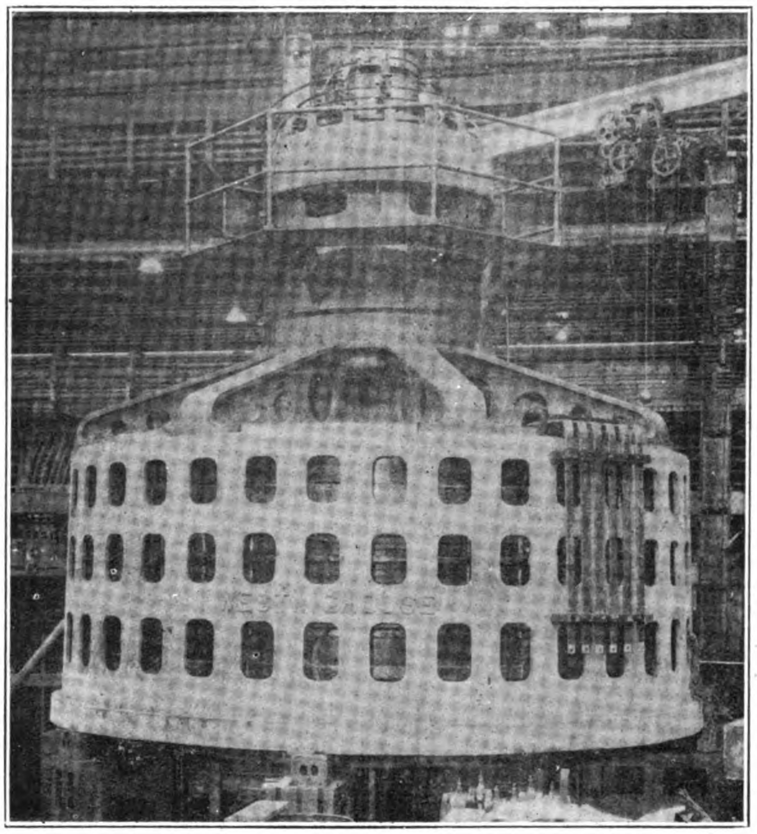
For Sumatra, combined cogwheel and adhesion engines in the Winterthur style were delivered in two styles of execution, i.e., as O-D-1 wet steam locomotives and as O-E-O superheated locomotives. The latter type has proved especially efficient.

# Electrical Developments in Japan, 1922

*By H. C. Huggins*

THE past year was one of remarkable electrical development in Japan. The outstanding tendencies were the amalgamation of small concerns in the large power supply companies, and the growing electrification of steam railways, with a return to the building of steam power plants. This last phenomena was due entirely to the decreasing costs of coal, making it profitable again to generate power by it; and also to the slowness with which hydro-electric power plants are erected in this country, causing a long tie-up of funds, in a country when finances have been at low ebb the past two years, and working capital difficult to obtain even at interest rates which would paralyze industry abroad.

The greatest installation of the year was completed by the Osaka Dento K.K. (Osaka Electric Light Co., Ltd.), at Nishino Shimono-machi, in Osaka city, where a steam power plant generating 20,000 kilowatts was erected to supply light and power in Osaka city. The second largest steam plant erected belongs to the Daido Denryoku K.K. (Daido Electric Power Co., Ltd.) and this too has been erected to supply power and light in the districts around Osaka where the demand for electric power has been steadily on the increase even in these three years of industrial depression since the panic.



**15,000 KV-A. 250-300 R.P.M. 50-60 CYCLE WATERWHEEL GENERATOR**

**This photograph shows one of the Momeyama generators of the Daido Company assembled in the Westinghouse Works. This machine is to operate either at 250 R.P.M. for 55-cycle service, or 300 R.P.M. for 60-cycle service. It is provided with the Kingsbury thrust bearing surmounted by a direct connected exciter.**

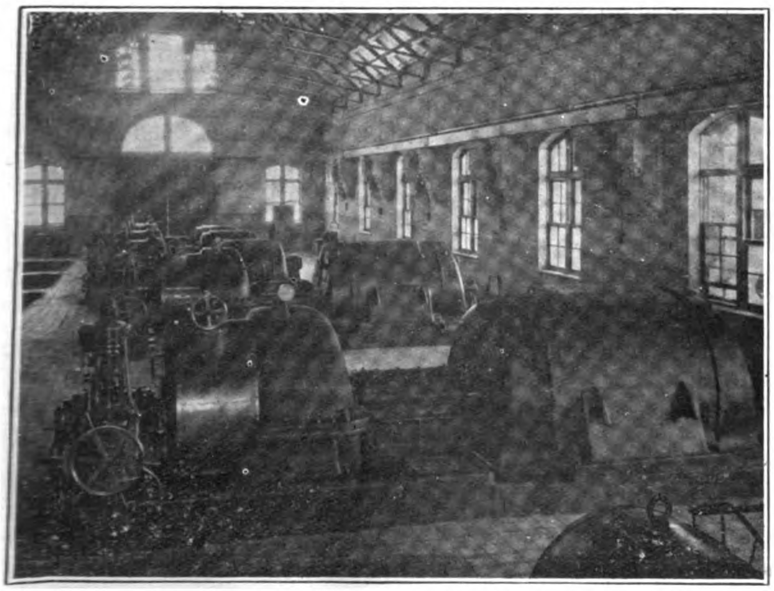
**A total of 12 leads is brought out from the stator of the generator so that the stator winding can be connected in straight star for 50-cycle operation when running at 250 R.P.M. or arranged for interconnected star for 60-cycle operation at 300 R.P.M. developing essentially the same voltage—6,600, at the two speeds, and the same field excitation.**

The Sakagami Kyuko Dentetsu K.K. (Sakagami Express Electric Railway Co., Ltd.), of Hyogo prefecture, completed a 10,000-kilowatt steam plant to supply power for its electric lines in Hyogo prefecture.

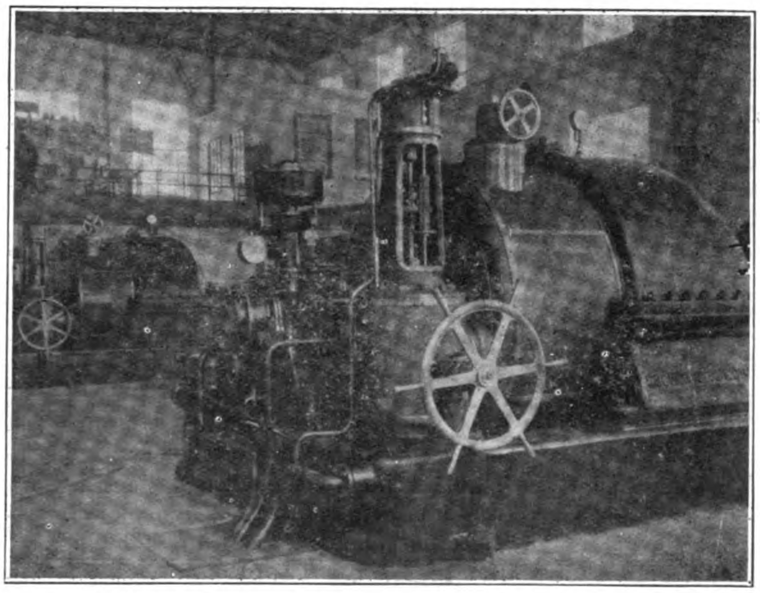
There were few large water power installations completed; the most important being the plant of the Tomino Suiryoku Denki K.K. (Tomino Hydro-Electric Power Co., Ltd.), on the Kiso River, generating 9,200 kilowatts. The next largest was the plant of the Chugoku Suiryoku Denki K.K., in Okayama prefecture, located on the Yoshii River, generating 6,000 kilowatts. The interesting point about these installations is that they were practically all completed with Japanese-made machinery.

Of a total of 128,824 kilowatts completed and started up during 1922, 85,465 kilowatts were hydro-electric, 43,024 kilowatts steam power, and 335 kilowatts gas plants.

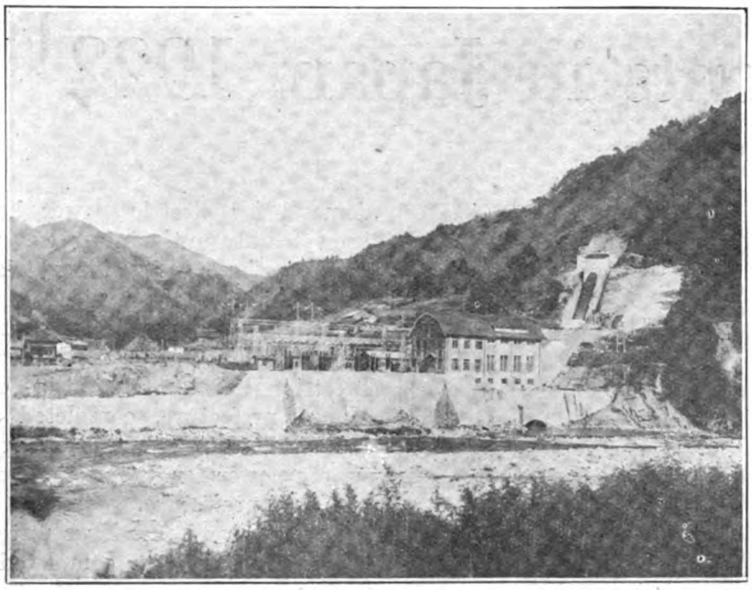
The mergers reduced the number of companies engaged in electric enterprises from 843 at the beginning of the year to 827 the end of December, with an

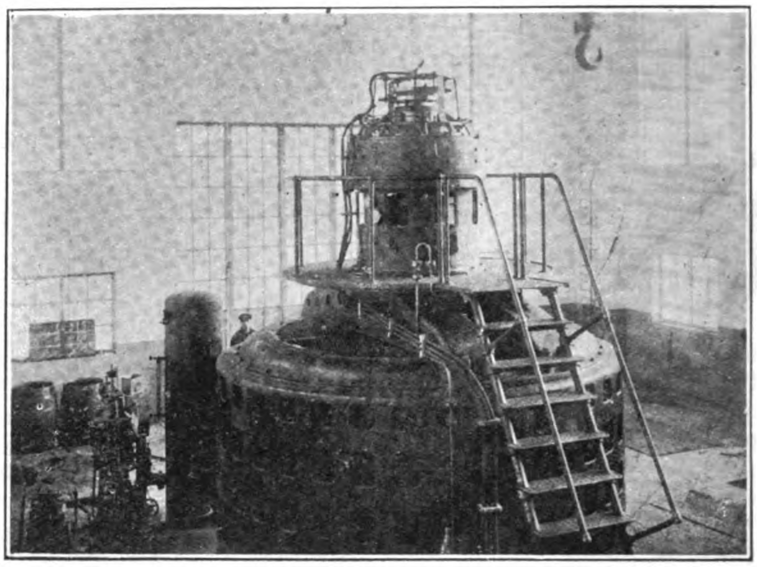


**Kyushu Hydro-Electric Company: Two 5,000 K.W. Turbo Generators: Escher Wyss & Company "Zoelly" Turbines**



**Kyoto Electric Company: Steam Plant, Escher Wyss "Zoelly" Turbines with Brown Boveri Generators**





The Tokise Power House of the Bisan Hydro-Electric Company: Equipped with a 10,000 H.P. Allis Chalmers Turbine and Allis Chalmers 7,500 K.V.A. Generator

increase in capital invested of Y.288,287,569. The following table shows the number of companies engaged in each branch of electric supply, and the capital invested at the end of 1922:—

| | Number | Capital invested |
|---|---|---|
| Power and light companies .. | 709 | Y.1,149,818,093 |
| Railways .. .. .. .. | 65 | 157,349,646 |
| Supply and railways .. .. | 53 | 134,767,752 |
| Total .. .. .. .. | 827 | Y.2,259,696,893 |

There was a decided increase in the number of companies operating electric railways, from 51 in January to 65 in December, the capital invested increasing from Y.121,716,535 to Y.157,349,646, an increase of Y.35,633,111. This was largely due to the favorable business results shown by steam railways already electrified, and to a very strong government propaganda for railway electrification. Japanese machinery and equipment is being more and more used in the smaller power houses. But where efficiency is the first requisite and for large installations, foreign equipment is steadily increasing, in popularity, and volume of sales.

The total generating capacity of all Japanese power houses completed and under construction, increased 288,597 kilowatts during the year. The next table shows the uses of the power generated.

| | Light and Power Supply kilowatts | Railways kilowatts | Railways & Supply kilowatts | Total kilowatts |
|---|---|---|---|---|
| December 31, 1922 | 1,393,099 | 6,995 | 597,342 | 1,997,436 |

The greatest increase during the year was in the generating capacity of power houses for companies engaged in power and light supply and operating railways.

The normal generating capacity of all Japanese power plants, erected and in operation, and in course of erection is given in the following table:—

*End December, 1922.*

| | Electric Supply | | Electric Railways | |
|---|---|---|---|---|
| | Hydro Kw. | Steam Kw. | Hydro Kw. | Steam Kw. |
| Completed ... ... | 556,062 | 112,351 | 615 | 600 |
| Under construction ... | 710,036 | 14,650 | 1,480 | 4,300 |
| Total ... ... | 1,266,098 | 127,001 | 2,098 | 4,900 |

| | Supply and Railways | | Total | |
|---|---|---|---|---|
| | Hydro Kw. | Steam Kw. | Hydro Kw. | Steam Kw. |
| Completed ... ... | 295,859 | 144,264 | 852,536 | 257,215 |
| Under construction ... | 140,319 | 16,900 | 851,835 | 35,850 |
| Total ... ... | 436,178 | 161,164 | 1,704,371 | 293,065 |

Power plants to be completed during 1923 will bring the generating capacity of the Japanese power houses up to more than 2,250,000 kilowatts.

*Ujigawa Electric Company.*—The Ujigawa Electric Company has closed a contract with Seimens for two 10,000 KVA water-wheel generators. These will be driven by J. M. Voith water turbines. This plant will operate in parallel with their new 50,000 KVA plant, which installation is rapidly progressing (the last issue of THE FAR EASTERN REVIEW shows a picture of the spindle used). Generators were the largest physically ever brought into Japan. They are not of high speed but are the largest in size.

*Osaka Railway Company.*—Formerly steam road. This company has purchased 13 cars, each equipped with 100 h.p. narrow gauge motors. They are operating over about half the line, half being electrified.

## Electrification of Steam Railways During 1922

The Japanese government departments carried on a strong propaganda for the electrification of steam railways in 1921, and as a result there were 33 new companies licensed in 1922 to construct electric railways, the total length of the lines to be built amounting to 436 miles. Nineteen of these companies have begun construction on 83 miles.

The old companies were not slow to adopt the government's suggestions and eight of them applied for licenses to electrify their lines, at the same time several companies licensed to construct steam railways but not yet started on construction, applied for new licenses to build electric lines. The following table shows the companies which electrified their lines during 1922:—

| Name | Terminals | Distance between terminals. |
|---|---|---|
| Chichibu Ry. Co. .. | Haniu-Kumagai | 9.3 miles |
| Musashino Ry. Co. .. | Ikebukuro-Tokorozawa | 15.5 „ |
| Chichibu Ry. Co. .. | Kagemori-Arakawa | 1.4 „ |
| Nishio Ry. Co. .. | Shinichinomiya-Tsushima | 16.4 „ |
| Osaka Denki .. | Hirahana-Tenri | |
| Joshin Denki .. | Takasaki-Shimonita | |
| Ihigawa Denki .. | Ihi-Kuwana | |
| Yoshino Ry. Co. .. | Yoshinoguchi-Yoshino | |
| Echigo Ry. Co. .. | Nishi Yoshida, Uhiko-Tsubame | 6.5 „ |
| | Total mileage .. .. | 115.9 miles |

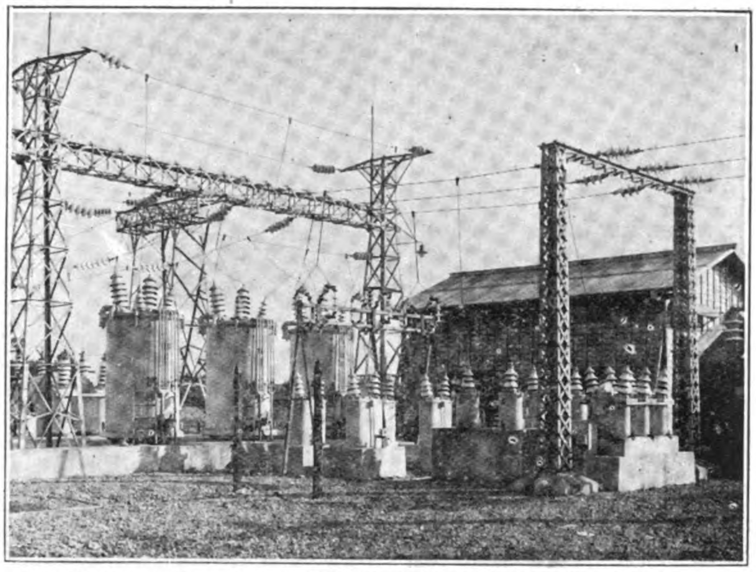
The following steam railway companies which had obtained licenses to start construction were re-licensed to build electric lines :—

| Names | | Terminals | Distance between terminals. |
|---|---|---|---|
| Nunobiki Ry. Co. | .. | Komuro-Michizuki | 9.6 miles |
| Onomichi Keiben Ry. Co. | .. | Nishi Onomichi-Ichi | 10.3 ,, |
| Shizuoka Denki | .. | Katahai-Iriemachi | 13.1 ,, |
| Echigo Ry. Co. | .. | Tsubame-Ichikido | 4.3 ,, |
| Yoshino Ry. Co. | .. | Yoshinoguchi-Unebi | 8.0 ,, |
| | | Total mileage .. .. | 45.6 miles |

The following lines were licensed to begin construction :—

| | |
|---|---|
| Daiyuzan, Odawara-machi-Minami Ashigara-mura .. | 5.4 miles |
| Onishi, Ichinomiya-machi-Nakamura .. .. .. | 10.0 ,, |
| Morioka Denki Kogyo K.K., Hanamakicho, Yumoto-mura | 5.5 ,, |
| | 21.2 miles |

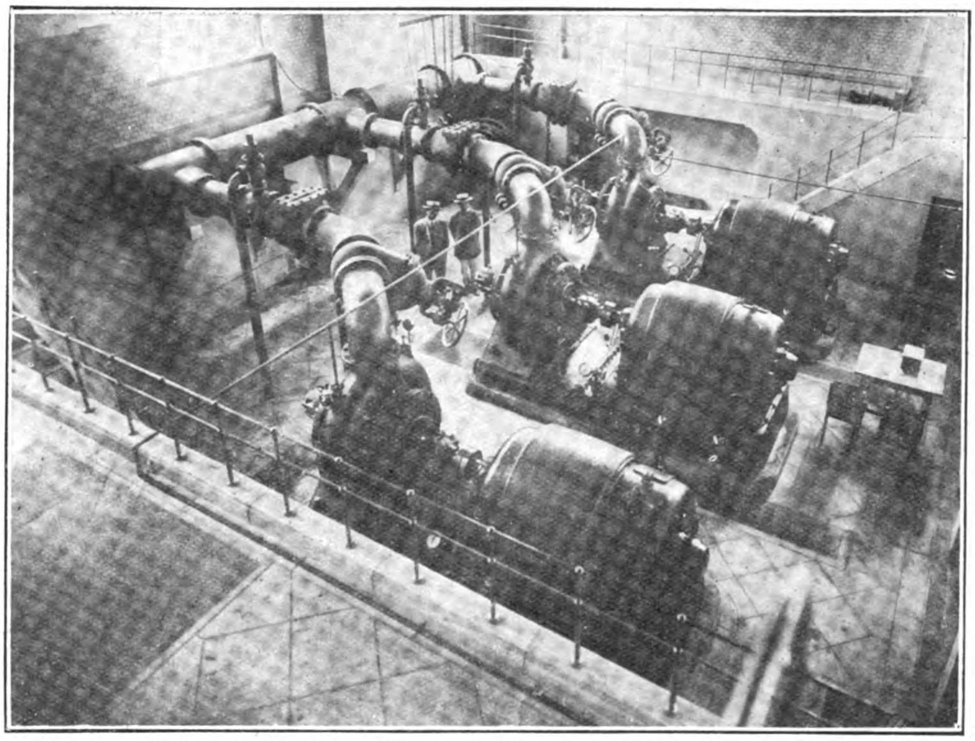
Grand total .. .. 185.0 miles



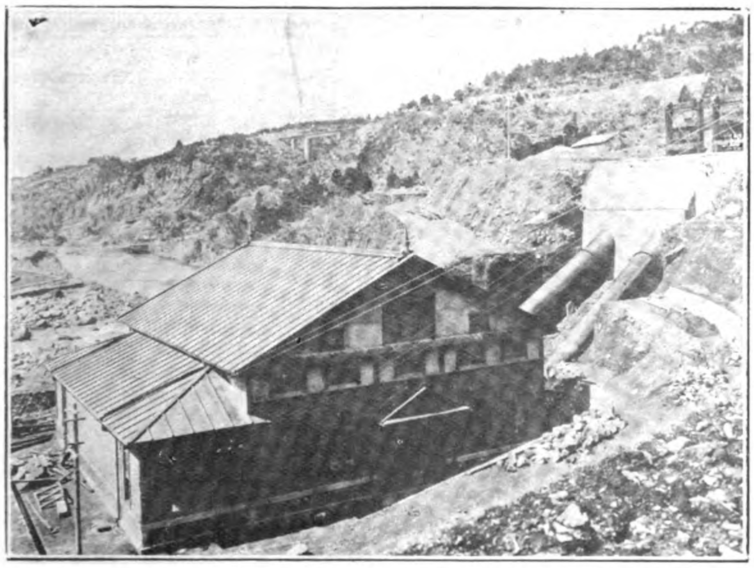
Outside Izumo Transformer Station of the Toho Denryoku Company, Installed by the Hidachi Engineering Works

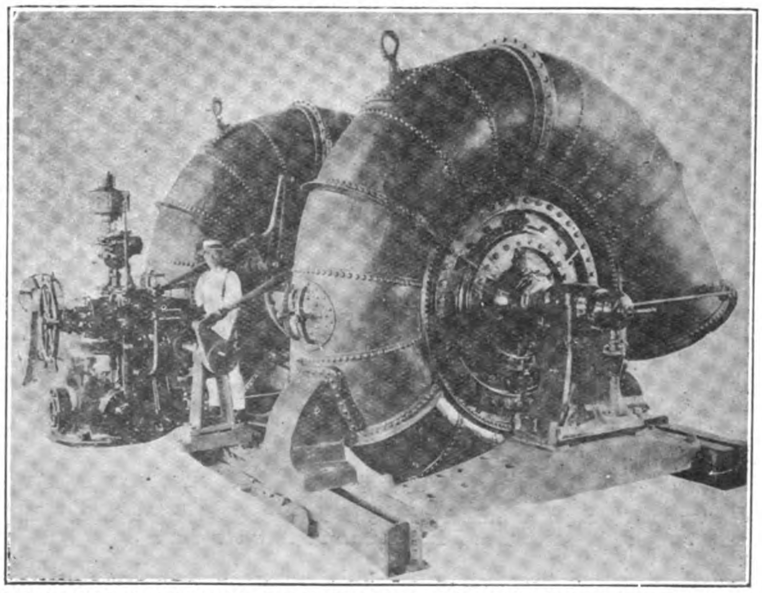
# American Equipment for Japanese Interurban Electric Line in Kyushu

During the month of February the Kyushu Tetsudo, a subsidiary of the Toho Denryoku, purchased car equipments for a new high-speed interurban line running from Hakuta to Kurumi. All of this equipment will be for 1,500 volts D.C. and consists of 18 passenger cars each equipped with 4 65 h.p. field control, Westinghouse motors, with full automatic multiple switch control. Also 4 package cars, each equipped with 4 65 h.p. Westinghouse motors with full automatic control. This installation is of special importance as it is the first high-speed interurban line in Kyushu, and in view of the fact that 1,500 volts have been adopted this voltage no doubt will be the standard for future interurban lines in that island.



Pumping Station of the Osaka Municipal Waterworks. Installed by the Hidachi Engineering Works. 14-in. Single Stage Turbine Pumps, 200-ft. Head, 450 c.m. per min., 1,170 r.p.m., 285 h.p.

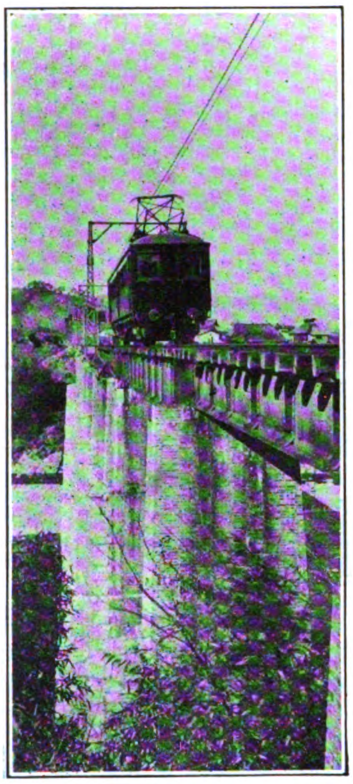




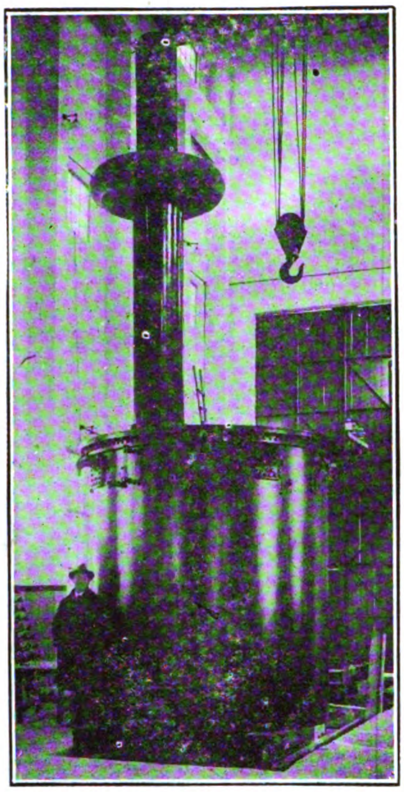
KUROKAWA No. 3 POWER PLANT OF THE KUMAMOTO ELECTRIC COMPANY INSTALLED BY THE HIDACHI ENGINEERING WORKS

Power House

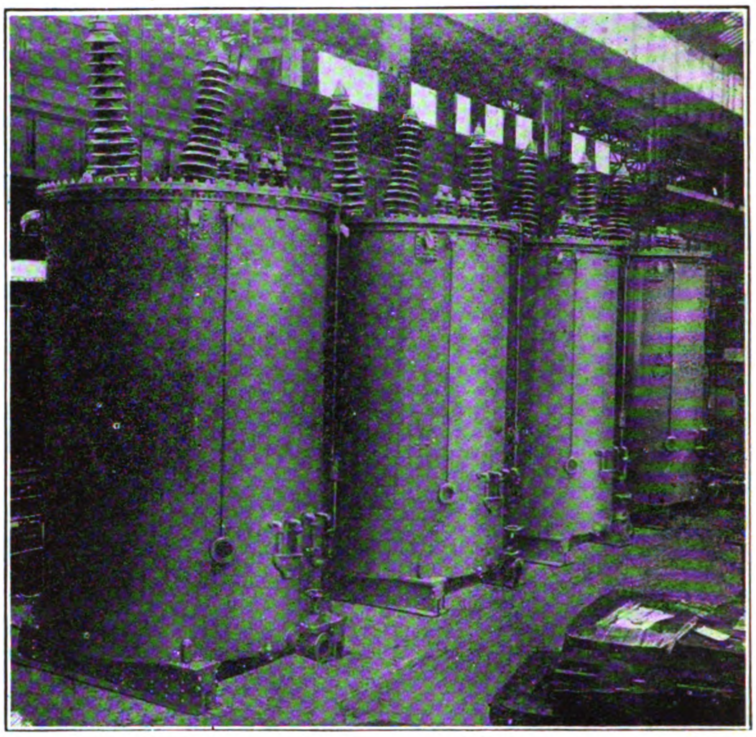
Twin Spiral Turbine, 1,950 H.P., driving 250 K.V.A. Generator, 7,000 v., 60 cycles, 257 r.p.m. Exciter 20 k.w., 125 v.



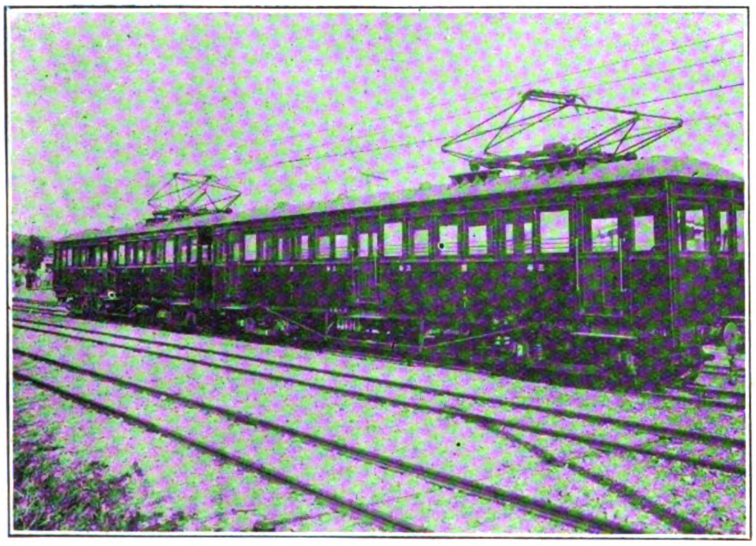
A Bridge on the Electrified Line ot the Kyushu Railway Company

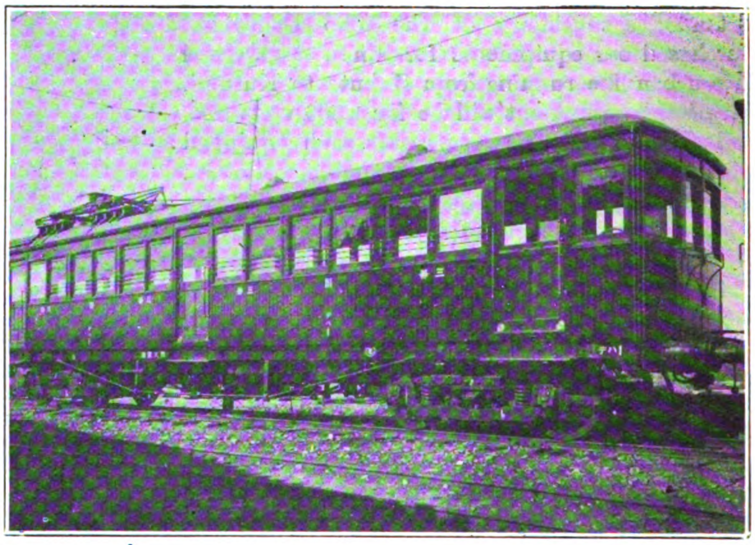


500,000 volt Westinghouse Transformer for the Tokyo Electric Company. Only two in Japan: One at Kameido, other at Nihon Denryoku K.K. Osaka

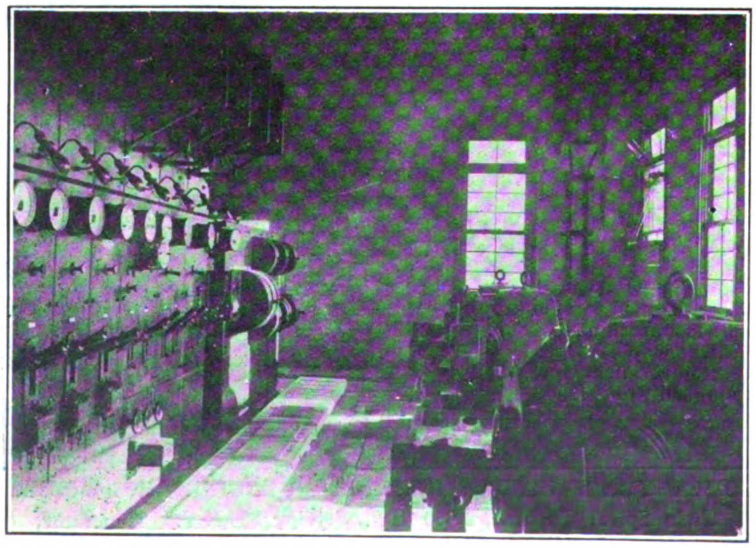


The largest transformers in the world made by the Westinghouse Electric Company are on their way to Japan. 4 each of 21,000 KVA capacity, oil insulated, water cooled, single-phase transformers, voltages of 154,000 to 66,000. They will be installed at the Komatsuo substation of the Tokyo Electric Light Gompany. There are installed at Pittsburgh, Pa., 4 transformers of larger KVA capacity but of less weight and size; as the Tokyo Electric transformers are for such high voltage that their size is materially increased

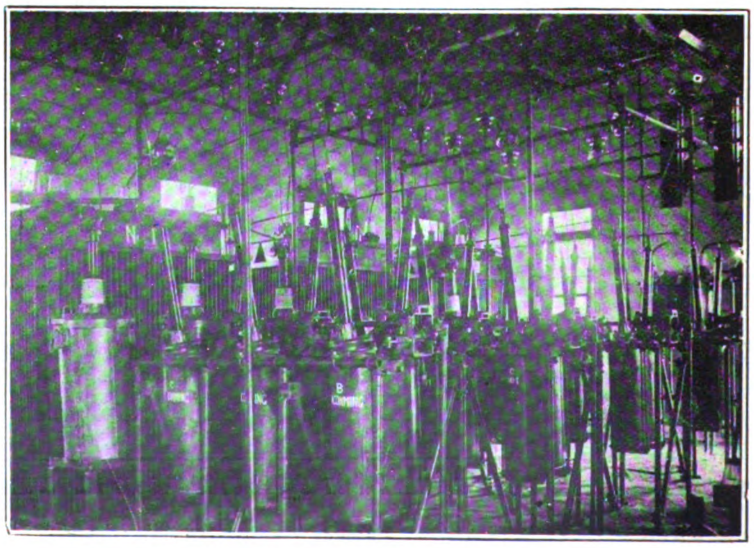




Typical High Speed Interurban Cars



Showing D.C. Generators and A.C. and D.C. Switchboards



Transformer and Oil Switch Room

## POWER PLANTS COMPLETED IN 1922

*This list is compiled from the records of the Imperial Japanese Department of Communications*

| *Prefecture in which company is located.* | *Owner.* | *Exact Location of Power Plant* | *Power Deried From* | *Capacity* of Plant Kilowatts |
|---|---|---|---|---|
| Aichi | Kansai Denki K.K. | Nakajo Mura, Minami Setsura Gun | Kankyo River | 800 |
| | Bisan Denryoku K.K. | Asahi Mura, Higashi Kamo Gun | Funato River | 1,100 |
| | | | Neha River | 2,500 |
| Akita | Amigawa Denryoku K.K. | Arase Mura, Kita Akita Gun | Ozawa Diver | 55 |
| | Yoneshirogawa Suiden K.K. | Miyagawa Mura, Shikazune Gun | Yoneshiro River | 800 |
| | Tohoku Kogyo K.K. | Ikuho Uchi Mura, Senhoku Gun | Hataya River | 23 |
| Aomori | Ikarigaseki Denki K.K. | Ikarigaseki Mura, Minami Tsugaru Gun | Fudo River | 32 |
| Chiba | Chiba Suiden K.K. | Matsuoka Mura, Aiko Gun | Kohitsu River | 87 |
| Ehime | Iyo Tetsudo Denki K.K. | Yanagiwa Mura, Kami Ukiana Gun | Kuro River | 3,750 |
| | Nakajima Denki K.K. | Higashi Nakajima Mura Onsen Gun | Gas | 37 |
| | Ayukaeri Denki K.K. | Tanisuji Mura, Higashi Uwa Gun | Inau River | 30 |
| Fukui | Nanetsu Denki K.K. | Nishi Yasui Mura, Tanjo Gun | Ikko River | 124 |
| Fukuoka | Mikasa Village | Mikasa Mura, Tsukushi Gun | Homan River | 23 |
| | Kyushu Suiryoku Denki K.K. | Minami Yamada Mura, Kushu Gun | Naruko River | 3,550 |
| Fukushima | Hiegi Suiryoku Denki K.K. | Hiegi Mura, Minami Aizu Gun | Hiegi River | 3 |
| | Kurotani Gawa Suiryoku Denki K.K. | Asahi Mura, Minami Aizu Gun | Kurotani River | 50 |
| Gifu | Azuma Shirakawa Village | Higashi Shirakawa Mura, Kamo Gun | Shirakawa River | 50 |
| | Daido Denryoku K.K. | Okuwa Mura, Nishi Chikuma Gun | Sai River | 562 |
| | Kaminoho Denki K.K. | Kaminoho Mura, Bugi Gun | Tsuho River | 15 |
| | Miura, Kenjiro | Kami Gogo Mura, Kaji Gun | Takenokura River | 6 |
| | ,, | Yenokyo Mura, Ako Gun | ,, | 6 |
| | Nohi Denki K.K. | One Mura, Motosu Gun | Nokyodani River | 140 |
| | Sodegawa Dento K.K. | Sodegawa Mura, Kichijo Gun | Oda River | 54 |
| | Tajimi Dento Sho | Sue Mura, Ena Gun | Ozato River | 180 |
| | Toki Suiryoku Denki K.K. | Toki Mura, Yoro Gun | Toriya River | 170 |
| | Tomino Suiryoku Denki K.K. | Tomino Mura, Bugi Gun | Kiso River | 9,200 |
| | Toyama Village | Toyama Mura, Motosu Gun | Kanahara River | 17 |
| | Yasaku Suiryoku Denki K.K. | Inari Mura, Kita Setsura Gun | Tsuho River | 20 |
| | Yoshidagawa Suiryoku Denki K.K. | Oku Akegata Mura, Gunjo Gun | Yoshida River | 19 |
| Gunma | Miharada Denki K.K. | Yokonomura, Seta Gun | Kurosawa River | 29 |
| | Tokyo Dento K.K. | Naganohara Machi, Azuma Gun | Kuma River | 2,339 |
| | Izumigawa Suiden K.K. | Otomura, Azuma Gun | Izumizawa River | 41 |
| | Takayama Suiden K.K. | Nakayama, Takayama Mura, Azuma Gun | Kuma River | 30 |
| | Kanagawa Village | Kamikawa Mura, Tano Gun | Funako River | 45 |
| Hokkaido | Hokkaido Godo Denki K.K. | Rumoe Machi, Rumoe Gun | Steam | 200 |
| | Hokkaido Dento K.K. | Hobetsu Mura, Akan Gun, Kushiro Province | Hobetsu River | 2,200 |
| | Hakodate Suiden K.K. | Ono Mura, Kameda Gun, Watarishima Province | Ono River | 900 |
| Hyogo | Shinoyama Dento K.K. | Miken Mura, Taki Gun | Gas | 90 |
| | Chitane Suiryoku Denki K.K. | Chitane Mura, Shishiguri Gun | Kurotsuchi River | 7 |
| | Sakagami Kyoko Dentetsu K.K. | Imazu Mura, Buko Gun | Steam | 10,000 |
| Ibaragi | Ibaragi Denryoku K.K. | Takahara, Tagano Satomae Mura | Kawashiri River | 156 |
| | Kurosawa Dento K.K. | Kurosawa Mura, Kuji Gun | Hachimizo River | 12 |
| | Hanazawa Denki Kido K.K. | Saigawa Mura, Ishikawa Gun | Steam | 24 |
| Kagawa | Seisan Denki K.K. | Kami Takase Mura, Santoyo Gun | Gas | 50 |
| Kagoshima | Toki Denki K.K. | Higashi Shuzan Mura, Gora Gun | Nishino River | 256 |
| | Banrai Suiryoku Denki K.K. | Kawabe Mura, Kawabe Gun | Banrai River | 500 |
| | Takakuma Denki K.K. | Takakuma Mura, Kimozoku Gun | Takakuma River | 320 |
| Kanagawa | Sobu Denryoku K.K. | Aikawa Mura, Aiko Gun | Nakatsu River | 440 |
| Kochi | Tosa Tobu Denki K.K. | Kiragawa Mura, Aki Gun | Kirishima River | 550 |
| | Yasuki Suiryoku Denki K.K. | Umamichi Mura, Aki Gun | Kushu River | 1,574 |
| Kumamoto | Mamihara Suiryoku Denki K.K. | Kanbi Mura, Aso Gun | Gokase River | 68 |
| | Kumamoto Denki K.K. | Seta Mura, Kikushi Gun | Kurokawa River | 2,000 |
| Kyoto | Yakuno Suiden Kumiai | Kamiyakuno Mura, Amada Gun | Asahi River | 3,200 |
| | Keishin Denki Kido Fune Kaisha | Katsuragawa Mura, Shiga Gun, Shiga Prefecture | Andon River | 880 |
| Mie | Tsu Dento K.K. | Taneoi Mura, Taka Gun | Kawakami River | 400 |
| | Ise Denki Tetsudo K.K. | Miyamae Mura, Iinan Gun | Kushida River | 832 |
| | Mie Godo Denki K.K. | Chihiroe Mura, Iinan Gun | Kushida River | 700 |
| | Toshi Denki K.K. | Ohata, Toshi Mura, Shizun Gun | Gas | 8 |
| Miyagi | Eai Suiden K.K. | Ichikuri Mura, Tamamichi Gun | Ihaya River | 3,000 |
| | Saikawa Denki K.K. | Fukuoka Mura, Karita Gun | Tarekiyo River | 75 |
| | Hatorigawa Suiryoku Denki K.K. | Moniwa, Umarede Mura, Natori Gun | Hatori River | 470 |
| Miyazaki | Minami Naka District | Kita Hikugo Mura, Minami Waka Gun | Hiroto River | 240 |
| Nagano | Ohnata Dento K.K. | Ohinata Mura, Minami Saku Gun | Nukii River | 29 |
| | Miho Village | Miho Mura, Shimo Ina Gun | Achi River | 35 |
| | Wada Suiryoku Denki K.K. | Wadamura, Shimo Ina Gun | Ikeguchi River | 48 |
| | Suwa Denki K.K. | Wada Mura, Chiusagata Gun | Wada River | 886 |
| Nagasaki | Hayaki Village | Hayaki Mura, Nishi Kubiki Gun | Gas | 25 |
| | Tsushima Dento K.K. | Keichi Mura, Shimo Agata Gun | Gas | 20 |
| Nara | Shinki Ikoma Denki Tetsudo K.K. | Heigun Mura, Ikoma Gun | Steam | 300 |
| | Ujigawa Denki K.K. | Kami Kitayama Mura, Yoshino Gun | Shira River | 1,500 |
| Niigata | Murakami Suiden K.K. | Kurokawa Mura, Kanbara Gun | Taiani River | 610 |
| | Kubiki Denki K.K. | Kushiike Mura, Nakakubiki Gun | Kiyotaki River | 44 |
| | Sarikawa Suiryoku Denki K.K. | Yunotani Mura, Kita Uomuma Gun | Sari River | 160 |
| | Yoneyama Suiden K.K. | Kami Yoneyama Mura, Nakakubiki Gun | Yone River | 11 |
| Oita | Kamiida Suiryoku Denki K.K. | Kami Ida Mura, Ono Gun | Dakufuchi River | 50 |
| | Kugimiya Suiden K.K. | Imbi Mura, Minami Umbe Gun | Imbi River | 175 |
| Okayama | Chugoku Suiryoku Denki K.K. | Hisada Mura, Tomada Gun | Yoshii River | 6,000 |
| | Mimasaku Denki K.K. | Hayashino Machi, Eita Gun | Gas | 65 |
| | Chugoku Suiryoku Denki K.K. | Katsuyama Machi, Maniwa Gun | Naka River | 1,200 |
| Osaka | Ujigawa Denki K.K. | Nakaso Mura, Nakano Gun | Yoshino River | 1,661 |
| | Daido Denryoku K.K. | Johoku Mura, Tosei Gun | Steam | 12,500 |
| | Osaka Dento K.K. | Nishino Shimono Machi, Nishi Ku, Osaka City | Steam | 20,000 |
| Saga | Tamajima Suiden K.K. | Tamajima Mura, Higashi Matsuura Gun | Ogawa River | 17 |
| | Toho Denryoku K.K. (Kyushu Office) | Nanzan Mura, Koshiro Gun | Kawakami River | 1,150 |
| Saitama | Naguri Suiden K.K. | Naguri Mura, Iruma Gun | Arima River | 217 |
| Shiga | Ujigawa Denki K.K. | Higashi Kokyo Mura, Aichi Gun | Miike River | 750 |
| Shimane | Chogo Denki K.K. | Togo Mura, Shukichi Gun | Gas | 20 |
| | Torimae Denki K.K. | Kuroki Mura, Chifu Gun | Gas | 20 |
| Shizuoka | Asahina Suiryoku Denki K.K. | Asahina Mura, Shita Gun | Asahina River | 10 |
| | Fuji Suiden K.K. | Ueno Mura, Fuji Gun | Shiba River | 1,070 |

| | | | | |
|---|---|---|---|---|
| Tochigi | Utsunomiya Branch of the Teikoku Dento K.K. | Funao Mura, Enya Gun | Kinugawa River | 1,592 |
| Tokushima | Nanishi Suiryoku Denki K.K. | Shinryo Mura, Nanishi Gun | Noma River | 130 |
| | Tokushima Suiryoku Denki K.K. | Miyahama Mura, Naka Gun | None River | 85 |
| | Umbe Suiryoku Denki K.K. | Anakui Mura, Kaiso Gun | Asahide River | 25 |
| | Hiychinada Denki K.K. | Minamura, Miyoshi Gun | Shirakawa River | 275 |
| Tokyo | Tokyo Dento K.K. | Mitomi Mura, Yamanashi Gun, Yamanashi Prefecture | Fuefuki River | 3,000 |
| Toyama | Nakakoshi Suiden K.K. | Oyama Mura, Une Arakawa Gun | Kumano River | 320 |
| | Toyama Denki K.K. | Katakai Mura, Shin Shinkawa Gun, two plants | Katakai River | 2,550<br>3,700 |
| | Jintsugawa Denki K.K. | Miyagawa Mura, Fuoi Gun, two plants | Jintsu River | 1,000<br>1,200 |
| Wakayama | Nankai Suiryoku Denki K.K. | Iwakura Mura, Arita Gun | Arita River | 500 |
| | Baibaisan Kumiai Kankitsu, of Nishikawara | Kawahara Mura, Naka Gun | Nata River | 15 |
| Yamagata | Tsuruoka Suiryoku Denki K.K. | Hongo Mura, Higashi Tagawa Gun | Otori River | 1,000 |
| Yamanashi | Katsura Dento K.K. | Higashi Katsura Mura, Minami Toru Gun | Natsukari Canal | 190 |

Water Power ... 85,465 k.w. Steam ... 43,024 k.w. Gas ... ... 335 k.w. Total capacity of all plants erected in 1922. 128,824

| *Prefecture in which company is located* | *Owner of Enterprise* | *Object of Business* | *Location of Districts of Supply Railway Line* | *Kind of Power* | *Capacity of Plant* Kilowatts | *Capital* Yen. |
|---|---|---|---|---|---|---|
| Aichi | Kaiki Dento K.K. | Light & Power Supply | Asahimura, Higashi Kamo Gun, and 1 other village | Receives power | 20 | 65,000 |
| | Onishi Tetsudo K.K. | Railway | Shin Ichinomiya to Port Kisogawa Station | ,, | 300 | 737,204 |
| | Bisan Denki K.K. | Light & Power Supply | Asuri Mura, Higashi Kamo Gun and one more village | Water from Funato River | 1,100 | 5,000,000 |
| Akita | Amigawa Denryoku K.K. | ,, | Animura, Kita Akita Gun, 4 towns and villages | Water from Ozawa River | 55 | 250,000 |
| Aomori | Okuiriso Dento K.K. | ,, | Hookuzawa Mura, Kawakita Gun | Receives power | 15 | 50,000 |
| Chiba | Chiba Suiden K.K. | ,, | Kururi Machi, Kimitsu Gun, and 10 other villages | Water from Kohitsu River | 87 | 300,000 |
| Ehime | Oda Suiryoku Denki K.K. | ,, | Oda Machi Mura, Ukiana Gun, and one other village | Receives power | 10 | 50,000 |
| | Ayukaeri Denki K.K. | ,, | Tasuji Mura, Higashi Uwa Gun | Water from Inau River | 30 | 70,000 |
| Fukui | Hinogawa Suiryoku Denki K.K. | ,, | Ojihomura, Nanjo Gun and 8 other villages | Receives power | 75 | 200,000 |
| Fukuoka | Mikasa Village | ,, | Mikasa Village, Tsukushi Gun | Water from Homan River | 23 | 22,400 |
| Fukushima | Hiegi Suiryoku Denki K.K. | ,, | Hiegi Mura, Minami Aizu Gun | Water from Hiegi River | 3 | 20,000 |
| | Kurotanigawa Suiryoku Denki K.K. | ,, | Asahi Mura, M;inami Aizu Gun, and 4 other villages | Water from Kurotani River | 50 | 100,000 |
| Gifu | Yoshidagawa Suiryoku Denki K.K. | ,, | Oku Akegata Mura, Gunjo Gun | Water from Yoshida River | 19 | 75,000 |
| | Toyama Village | ,, | Toyama Mura, Motosu Gun | Water from Kanahara River | 17 | 150,000 |
| | Miura, Kenjiro | ,, | Chonan Mura, Kamo Gun, and one other village | Water from Takenokura River | 6 | 110,000 |
| | Shizunami Village | Light only | Shizunami Mura, Ena Gun and one other village | Receives power | 10 | 28,720 |
| | Nohi Denki K.K. | Light & Power | One Mura, Motosu Gun, and 15 other villages | Water from Nokyodani River | 140 | 3,000,000 |
| | Sodegawa Dento K.K. | ,, | Sodegawa Mura, Kichijo Gun | Water from Oda River | 54 | 100,000 |
| | Tomino Suiryoku Denki K.K. | ,, | Tomino Mura, Bugi Gun | Water from Tsuho River | 20 | 70,000 |
| | Toki Suiryoku Denki K.K. | ,, | Toki Mura, Yoro Gun | Water from Toriya River | 170 | 300,000 |
| Gunma | Hara Village | ,, | Haramachi, Azuma Gun | Receives | 10 | 89,000 |
| | Izumizawa Suiden K.K. | Light only | Otamura, Azuma Gun | Water from Izumi Zawa River | 41 | 80,000 |
| | Miharada Denki K.K. | Light & Power | Yokonomura, Seta Gun | Water from Kurosawa River | 29 | 62,000 |
| | Takayama Suiden K.K. | ,, | Takayama Mura, Azuma Gun | Water from Kuna River | 30 | 30,000 |
| Hyogo | Chitane Suiryoku Denki K.K. | Light only | Chitane Mura, Shishiguri Gun | Water from Kurotsuchi River | 7 | 50,000 |
| | Kamihisa Shimo Village | Light & Power | Kami Hisashimo Mura, Hikami Gun | Water from Shinoyama River | 70 | 66,200 |
| Ibaragi | Kurosawa Dento K.K. | ,, | Kurosawa Mura, Kuji Gun | Water from Hachimizo River | 12 | 30,000 |
| | Koinose Denki K.K. | ,, | Koinose Mura, Shinji Gun | Water from Koinose River | 18 | 20,000 |
| | Kitaura Denki K.K. | ,, | 20 villages in Namekata Gun | Receives power | 15 | 530,000 |
| Kagawa | Seisan Denki K.K. | ,, | Kami Takase Mura, Santoyo Gun | Gas | 50 | 200,000 |
| Kagoshima | Takakuma Denki K.K. | ,, | Higashi Sakurajima Mura, Kimozoku Gun and 8 other villages | Water from Takakuma River | 320 | 500,000 |
| Kochi | Kamiida Suiryoku K.K. | ,, | Kami Ida Mura, Ono Gun | Water from Dakubuchi River | 50 | 100,000 |
| Kumamoto | Mamihara Suiryoku Denki K.K. | ,, | Mamihara Machi, Aso Gun, and 3 villages | Water from Gokase River | 68 | 200,000 |
| Kyoto | Yakuno Suiden Kumiai K.K. | ,, | Kami Yakuno Mura, Amada Gun and 2 other villages | Water from Hataya River | 23 | 100,000 |
| Mie | Toshi Denki K.K. | ,, | Toshimura, Shima Gun | Gas | 8 | 50,000 |
| Miyagi | Eai Suiden K.K. | ,, | Ichikuri Mura, Tamaki Gun, and one more village | Water from Ihaya River | 3,000 | 1,000,000 |
| Nagano | Wada Suiryoku Denki K.K. | ,, | Wada Mura, Shimo Ina Gun, and 4 other villages | Water from Ikeguchi River | 48 | 100,000 |
| | Nanshin Denki K.K. | ,, | Shimojo Mura, Shimo Ina Gun, and 6 other villages | Receives power | 150 | 1,000,000 |
| | Miho Village | ,, | Miho Mura, Shimo Ina Gun | Water from Achi River | 35 | 30,000 |
| | Ohinata Dento K.K. | ,, | Ohinata Mura, Minami Saku Gun | Water from Nukii River | 29 | 50,000 |
| Nagasaki | Hayaki Village | ,, | Hayaki Village, Nishi Kizuki Gun | Gas | 25 | 70,000 |
| | Tsushima Dento K.K. | ,, | Keichi Mura, Shimo Agata Gun | Gas | 20 | 40,000 |
| Nara | Shinki Ikoma Denki Tetsudo K.K. | Railway | From Oji Mura, Kita Katsushiro Gun to Kita Ikoma Mura, Ikoma Gun | Steam | 300 | 1,500,000 |
| | Akino Mura | Light & Power | Akino Mura, Yoshino Gun | Receives power | 10 | 30,000 |
| Niigata | Sarigawa Suiryoku Denki K.K. | ,, | Yabugama Mura, Kita Uomuma Gun, and one other village | Water from Sari River | 160 | 400,000 |
| | Yoneyama Suiden K.K. | ,, | Yoneyama Mura, Naka Kubiki Gun | Water from Yone River | 11 | 50,000 |
| | Kubiki Denki K.K. | ,, | Kushiike Mura, Naka Kubiki Gun, and two more villages | Water from Kiyotaki River | 44 | 100,000 |
| Saga | Tamajima Suiden K.K. | ,, | Tamajima Mura, Higashi Matsuura Gun | Water from Ogawa River | 17 | 150,000 |
| Saitama | Musashino Tetsudo K.K. | Railway | From Ikebukuro Machi, Kita Toyoshima, to Tokorozawa Machi, Iruma Gun | Receives power | 600 | 2,000,000 |
| Shimane | Torimae Denki K.K. | Light & Power | Kuroki Mura, Chifu Gun | Gas | 20 | 60,000 |
| Shizuoka | Asahina Suiryoku Denki K.K. | ,, | Asahina Mura, Shita Gun | Water from Asahina River | 10 | 40,000 |
| Tochigi | Shimotsuke Denki Tetsudo K.K. | Railway | From Imaichi Machi, Toga Gun to Fujiwara Mura, Enya Gun | Receives power | 120 | 1,000,000 |
| Tokushima | Nakajima Denki K.K. | Light & Power | Higashi Nakajima Mura, Onsen Gun, and one other village | Gas | 37 | 50,000 |
| | Umbe Suiryoku Denki K.K. | ,, | Mukimachi, Kaiso Gun and 5 other villages | Water from Nozuchi River | 85 | 300,000 |
| Wakayama | Baibaisan Kankitsu Kumiai, Nishi Kawara | Light only | Kawara Mura, Naga Gun | Water from Nate River | 15 | 100,000 |
| Yamanashi | Kyoto Denki K.K. | Light & Power | Nakamaki Mura, Higashi Yamanashi Gun | Receives power | 50 | 50,000 |

# The Most Important Rice Centre in the Philippines

*By Kilmer O. Moe*

THE railroad ends at Cabanatuan in the province of Nueva Ecija on the Central Luzon plain. Beyond this point the Manila north road, dusty, conjested and travel-scarred, extends on into the homestead country where the settlers have taken up land from the public domain and have converted the wastes of jungle and cogon grass into productive fields.

Talk about bull carts. The road is literally blocked with them. Grinding, jolting and fairly groaning under the heavy loads of paddy rice, they come on in a steady stream. The slow plodding carabao strains at the heavily loaded carts which move in long trains toward market. On the other side of the road a chain of empty carts moves homeward in the opposite direction.

Now and again a lumbering truck comes thundering along raising a cloud of dust. It is loaded down with sacks of paddy to the limits of its capacity. A heavy trailer, equally loaded, is attached to the rear end of the truck and sways from side to side in its efforts to keep up. The dust rains down on the humble bull cart driver and settles thick on his salacot or gourd hat.

A Simple Unit Rice Mill

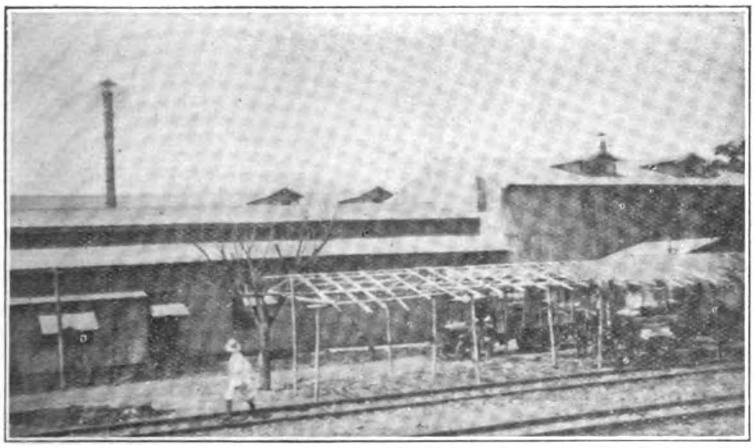
The motorist has given this section of the Manila north road a bad name. The conjestion of traffic is anything but pleasant we all admit. It interferes with the speed fiend very decidedly and prevents him from racing along on his way to Baguio where the cool breezes blow and where the famous mountain resort is located. The wheels of the loaded carts, and the ware and tear of the heavy trucks, grind up the road bed to a fine dust which rises in suffocating clouds as the swift moving auto passes through.

The motorist thinks only of the discomforts of the heat, the grime, and the irritation of numerous stops, but loses sight of the real meaning of this procession and what it signifies to the economic growth of the country. These slowly moving trains and the lumbering trucks carry to market the agricultural wealth of a considerable area of Central Luzon. This produce is milled in Cabanatuan and later distributed by rail and boat to distant provinces where it is eagerly received by the hungry masses. The tobacco grower of the Cagayan valley, the sugar baron of Negros, and the hemp and copra producer in the regions of better distributed rainfall, look to the central Luzon plain to supply them with the "Staff of Life." This plain is a vast store house, the granary of the Philippines.

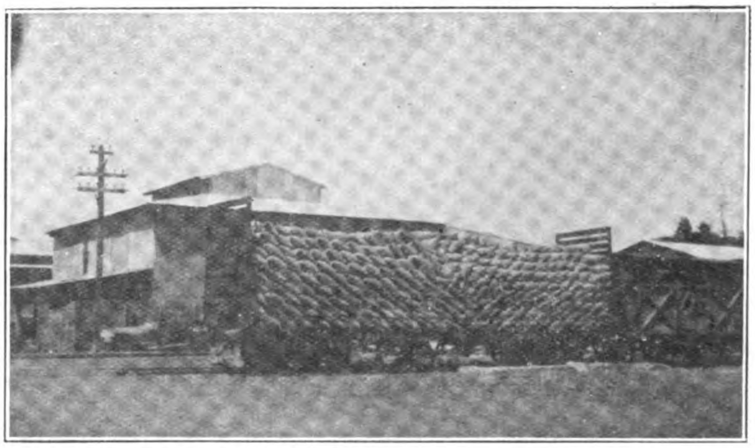
## The Loaded Bull Cart

The loaded bull cart is a factor of much greater consequence to the economic welfare of the country than the high priced and dazzling touring car. The humble bull cart piled high with paddy furnishes tangible proof that the hardy pioneer and settler is meeting with a fair degree of success. The homesteader is at last coming into his own. He has succeeded in taming the wild places. The jungles and grasslands finally gave way to cultivated fields. A thousand homes sprang into existence in the old haunts where deer and wild hogs were formerly left in undisturbed possession. The loaded bull cart means that the small farmer is bringing in the fruits of harvest and in depositing his offering is making no small contribution to the growth and well-being of his country.

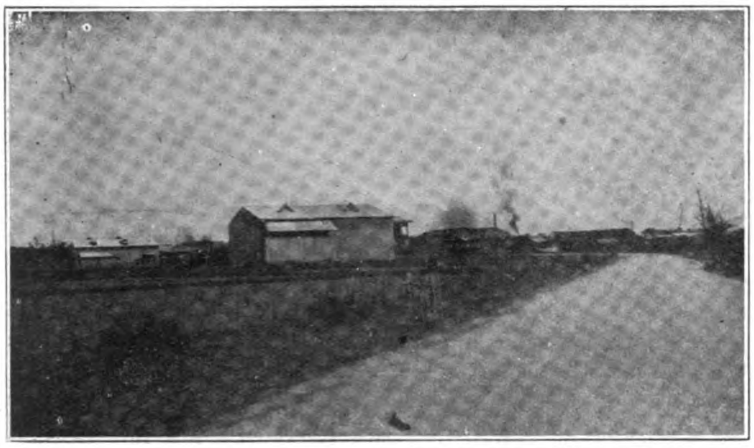
Several million cavans of paddy rice passed over the bridge at Cabanatuan last year representing a value of millions of pesos. These figures take on a greater significance than ever when the fact is taken into consideration that a decade ago the amount was hardly worth mentioning. This annual contribution is a recent development and one which speaks most eloquently for the productive labor of the small farmer. It is another story of hard work and many sacrifices. Years of toil and suffering have been necessary



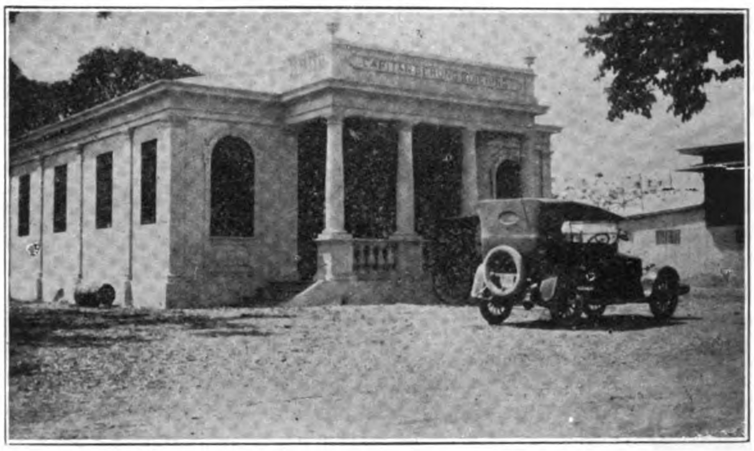
A Multiple Mill That Grew Out of Small Beginning. An Outgrowth of the Single Installation Shown in Above Cut



Ready for Market. The Milled Product is Shipped to Manila



The Town of Cabanatuan Looms up a City of Shed-like Buildings of Corrugated Iron



New Bank Building in Cabanatuan, the most Important Rice Centre in the Philippines

to bring about the present satisfactory condition. Let us follow the train of loaded bull-carts and see what becomes of it.

## The Principal Rice Market in the Philippines

Every bull cart driver in the train knows where he is going. If you ask him he will give you a name which is usually Chinese. These astute traders are the middlemen in the Philippines. They are in possession of the machinery of milling and that of distribution. Their ramifications of trade extend to all parts of the archipelago. They buy rough rice from the farmers in central Luzon, mill it, and ship the milled product to other parts of the islands where through the shops of other Chinese traders they distribute this cereal food often in exchange for other agricultural products. They have the money and the credit facilities. They have the organization and they reap the reward. The Filipino is the producer and the consumer but the Chinaman skims off the cream of the industry.

Just outside of the town there is a broad river, the Rio Pampanga, which goes on a rampage every rainy season. This explains why the railroad extends no farther. Every year when the dry season sets in the temporary bridge is rebuilt to allow for the heavy rice traffic. It is washed out again when the floods come and the traffic is ferried across for several months. This means that the season of heavy purchase is limited and that the mills to keep running through the year must necessarily store large quantities of paddy rice. It explains also why very few farmers store the grain in store houses of their own.

The town of Cabanatuan is, therefore, an aggregation of mills and storehouses—camarins, as they are called locally. The Manila north road is the main artery carrying into this centre of activity the grist for the mills. Branches extending to the right and to the left from this thoroughfare serve as feeders to swell the volume of paddy rice that converges at this point.

As we cross the river we see this vast current of cereal food flowing in from the north. This season, an unlooked-for flood took the bridge away and interrupted the steady flow of the bull-carts across the river. It became necessary to unload and ferry the sacks across. The conjestion that occurred reached for miles up the road beyond the river as cart upon cart came in and added to the number. Each had to take its turn in crossing the river.

We enter the town in a cloud of dust. The confusion of many bull carts gradually adjusts itself as they turn out to unload at this or that camarin. By the time we reach the R. R. station the last bull cart has found its destination. There is considerable milling around of men and animals going on in front of the camarin as each driver is trying to secure for himself a place of advantage so that he may unload with the least possible physical exertion, but this also adjusts itself, and the empty carts one by one, give place to others that are still loaded.

This process is duplicated in scores of other places, some large some small, each owner trying to get for himself his share of the cereal and thereby insure the operation of his mill throughout the year. Others have erected camarins without mills and are buying on speculation in hopes that the price will go up after the rains set in. This it usually does and the owner of the camarin makes a lot of easy money.

At any rate the town of Cabanatuan exists for the purpose of handling the paddy rice grown in the north end of the province of Nueva Ecija. The rapid development of this section resulted in a quick growth of the town which is built of corrugated iron and spread out over several square miles of surface.

The milling is also a dust-provoking process so that, all in all, the town of Cabanatuan ranks first in dust as well as being the biggest rice centre in the Philippines.

## The Process of Milling

A rice mill is not a very complicated affair. The horizontal mill stones remove the husks and the mixture is passed up by elevators and falls into a separator where the hulls are removed

Congestion of Bull Carts at Every Mill

The First Impression of the Rice Industry is the Absence of Labor-saving Devices

and the rice kernals separated, those that are hulled go to one side and those that are still unhulled fall on the other side. The unhulled kernals go back to be ground over again between the mill stones, and the hulled kernels are taken to the next step in the process, the cone or polisher, which takes off the epidermis and leaves the kernal white or pearly. This thin coat is the best portion of the rice kernel and its removal is the cause of beri-beri among rice eaters, but the trade calls for the white and polished product so the mills are all forced to install polishers to meet the requirements of the demand even though it is positively harmful. It will take scientists some years yet to induce the people to eat upolished rice.

The rice that has been polished is ready for market and is carried to the automatic weigher and sacker. When the sacks are filled they are sewed and stacked up on one side ready for shipment as soon as cars can be secured.

The by-products of milling are rice bran (*tiqui-tiqui*), and ground husks (*ipa.*) They are both used for the feeding of animals and served to hogs, cattle and horses.

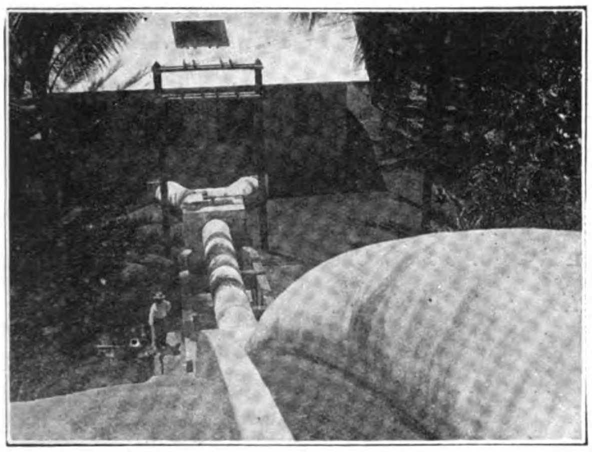
This description meets all the mills, big and small. The units are quite similar except for size. But the capacity of the mill is determined by the number of units rather than the size of each unit. A multiple mill is really a succession of several rice mills operating from one source of power. In Cabanatuan the single unit mill has a capacity of two hundred sacks of hulled rice per day while one of the multiple mills may run as high as a thousand.

In nearly every case the power used is steam generated with rice husks or *ipa* as fuel. An ingenious system of burning the ipa as it drops through space by passing it over a hot blast has been adopted in all these mills so that the utilization of an otherwise worthless commodity becomes one of the chief factors in the operation of the milling process. The milling of rice is consequently a very economical process due to the low cost of fuel.

The most imposing part of the plant is the camarin or storehouse in which the year's supply of paddy is stored. This is usually a large barn like affair built of corrugated iron and looms, upon the landscape as an ugly pile of galvanized iron. No conveniences such as elevators to lift the grain to a higher level have been introduced. The brawny strength of half clothed Malays pass in endless procession up an incline of sacks or boards and dump their burdens on the mountain of rice until it climbs to the very eaves. This is hot work and in the superheated atmosphere in the sheet iron enclosure the men perspire freely. Sometimes the homesteaders dump their own loads in this way but usually the owner of the camarin provides laborers for this purpose. He also furnishes sacks to his clients to use for the purpose of bringing the grain to market.

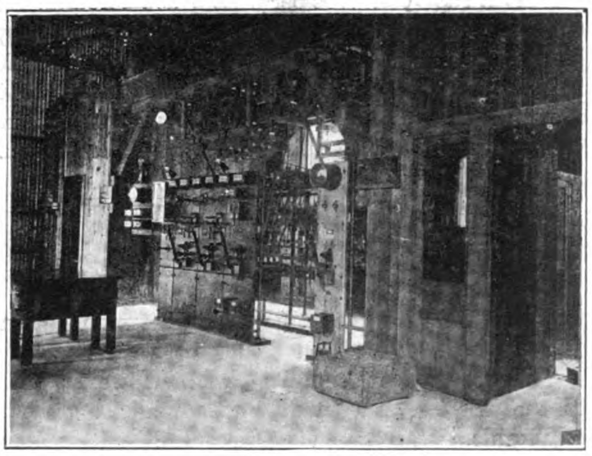
To an occidental the first suggestion that would occur to him in the rice milling industry is the introduction of labor-saving machinery in way of elevators. This is even more to the point when one considers the low cost of fuel and the consequent low operating expense. But man power is chap in the orient, at least every one assumes that to be a fact, and the toiler himself bends, under his load and plods along regardless. Why use machinery to carry the burdens when you can employ men ?

The spur of the railroad known as the Cabanatuan branch is the best feeder along the whole line of the Manila R. R. Co. Heavy trainloads of rice pull out of Cabanatuan at all times of day and night to carry the finished product from this important centre to the consumer on the first lap of its journey. Upon reaching Manila it is transhipped to interisland boats and taken to all parts of the archipelago. Thus the produce of the small farmer from the homestead country of Nueva Ecija finds its way on the tables of other producers who labor to produce other products in distant provinces.



View of Penstock looking down to the Power House

View of Penstock



Switchboards

# The Zamboanga Hydro-Electric Plant

THE Zamboanga hydro-electric system was designed by L. Vincent, supervising electrical and mechanical engineer, of the bureau of public works, and constructed in 1920 under the direction of J. C. Cookingham, then district engineer of the province of Zamboanga.

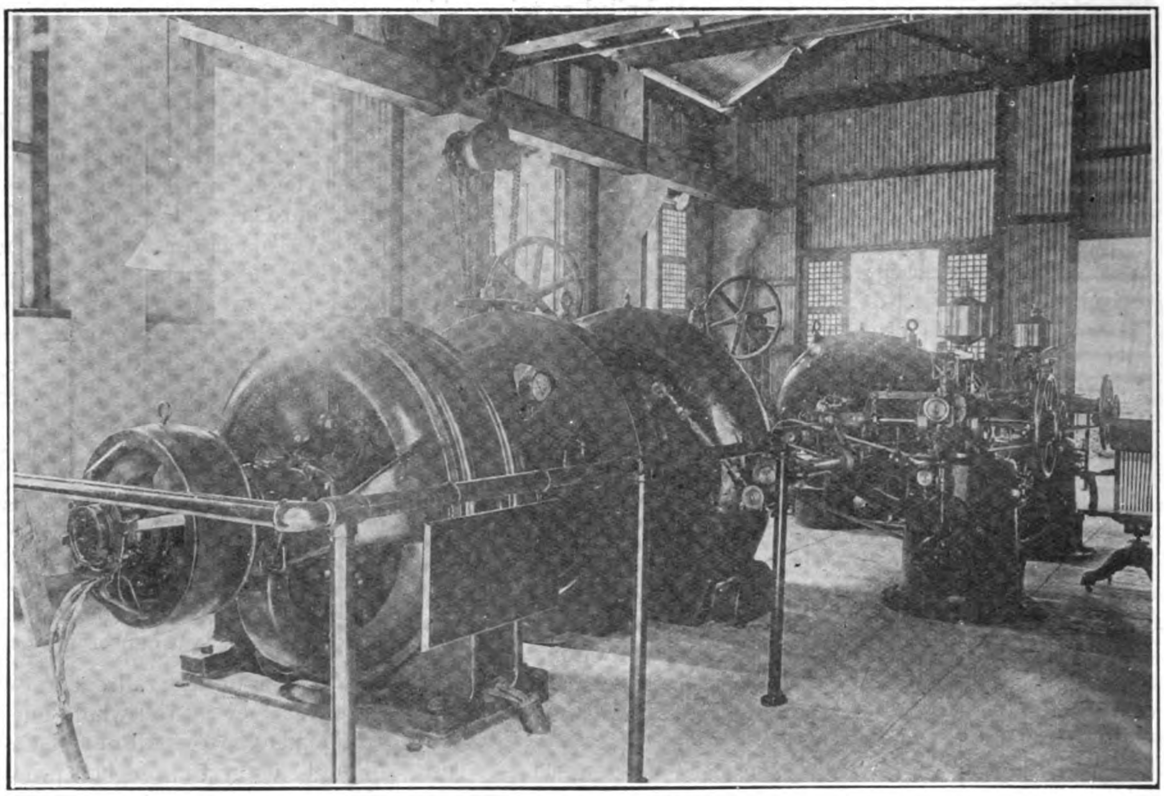
The water supply is taken from a river about one mile away from the power-house and conducted to a tower of about 32 feet high, which is slightly lower than the water level at the intake. The surplus water is overflowed and conducted to the irrigation canal from where it is distributed to several branches and utilized for irrigating the rice fields in the district of Santa Maria.

The total head available at the water wheel, that is, the combined height of the tower and the inclined penstock, is about 85 feet giving a pressure of 36-lbs. per square inch.

Two reaction turbines which are directly connected to 150 kw. generator each, are installed in the power-house, and these two generators have separate switchboards which are connected in parallel to a common switchboard. These two General Electric generators of 600 R.P.M. generate electricity of 3,500 volts, 60 cycles, and fed to the feeders at this voltage. The voltage is stepped down in the city by transformers to 220 volts for lighting service and industrial purposes.

The distance of the power-house to the city is about three miles. The plant is a provincial government project and the amount of P.250,000.00 at 5 per cent. interest was borrowed from

Tower with the Supply Pipe from the Intake



Pelton Water Wheels and General Electric Alternators

thə insular government purposely for the construction of the hydro-electric system. The total amount invested to finish the project was about P.270,000.00.

High prices of materials and difflcvlty of bringing thum to Zamboanga which is about 400 aliles from Manila by sea have caused the initial investment to the system to coem to a very high figure.

At present the plant is selling about 131,000 watts of power per month at 5 centavos per watt which amounts to about P.6,550.00 collection per month, plus the day power used by several motors installed which gives an additional collection of P.400.00 per month. It is hoped that at the end of the year when all the rice-mill and saw-mill motors have been installed, the system will be able to sell the day power to about P.2,000.00 per month.

# Wireless Developments in Japan

TELEGRAPHIC communication between Japan and Manchuria has been carried on either between Saseho and Dairen, or between Nagasaki and Dairen. However, with the completion of the wireless station at Port Arthur a great improvement in communication between Japan and Manchuria is effected.

The governor-general of Taiwan recently approved the erection of a new wireless station to effect an improvement in communication with the home country. There is, at present, only one cable line, between Nagasaki and Tamsui.

The Saseho naval depôt has been engaged in the construction of a wireless station at Nario, since 1918. This station is equipped with three triangle steel towers 450-ft. high. It is reported that two towers 300-ft. high for receiving will shortly be erected within the Sascho naval depôt yards.

WIRELESS OFFICES IN JAPAN

*Official Land Stations :*

| Location | No. | Under the direction of |
|---|---|---|
| Hokkaido .. .. .. | 2 | Sappore authorities |
| Tokyo pref. .. .. .. | 1 | Tokyo ,, |
| Chiba pref. .. .. .. | 1 | Tokyo ,, |
| Okayama pref. .. .. | 1 | Osaka authorities |
| Wakayama pref. .. .. | 1 | Osaka ,, |
| Kyoto pref. .. .. .. | 1 | Osaka ,, |
| Yamaguchi pref. .. .. | 1 | Hiroshima ,, |
| Fukushima pref. .. .. | 1 | Sendai ,, |
| Nagasaki pref. .. .. .. | 1 | Kumamoto ,, |
| Kwantung district .. .. | 1 | Kwantung government |
| Taiwan .. .. .. .. | 1 | Taiwan government |

*Official Marine Stations (On board steamships) :*

| Belonging to | No. | Belonging to | No. |
|---|---|---|---|
| Nihon Yusen Kaisha .. | 16 | Tetsudo sho .. .. | 6 |
| Osaka Shosen Kaisha .. | 15 | Teishin sho.. .. .. | 4 |
| Toyo Kisen Kaisha .. | 3 | Noshomu sho .. .. | 1 |
| South Manchurian Ry. Co. | 2 | Chosen Sotoku fu .. .. | 1 |

*Private Land Stations :*

| Location | No. | Under the direction of |
|---|---|---|
| Tokyo pref. .. .. .. | 4 | Tokyo authorities |
| Okinawa pref. .. .. .. | 2 | Kumamoto ,, |
| Shizuoka pref. .. .. .. | 1 | Tokyo ,, |
| Hyogo pref. .. .. .. | 1 | Osaka ,, |
| Fukuola pref. .. .. .. | 1 | Kumamoto ,, |

(*Note.*—Of the total, 6 offices, Tokyo, Hyogo and Fukuoka, are for experimental researches only.)

*Private Marine Stations (On board steamships) :*

| Belonging to | No. | Belonging to | No. |
|---|---|---|---|
| Kokusai Kisen K.K. .. | 61 | N. Y. K. .. .. .. | 57 |
| O. S. K. .. .. .. | 47 | Kawasaki Zosen and Kisen | 22 |
| Mitsui Bussan .. .. | 13 | Tatsuuma Kisen K.K. .. | 12 |
| Toyo Kisen K.K... .. | 11 | Kyodo Gyogyo K.K. .. | 10 |
| Taiyo Kisen K.K. .. | 8 | Neiji Kaiun K.K. .. .. | 8 |
| Katsuta Kisen K.K. .. | 7 | Yamashita Kisen K.K. .. | 7 |
| Iwamoto Kisen K.K. .. | 5 | Nanyo Yusen K.K. .. | 4 |
| Teikoku Kisen K.K. .. | 4 | Hiroumi Shoji K.K. .. | 4 |
| Itaya Shosen K.K. .. | 4 | Others .. .. .. | 55 |

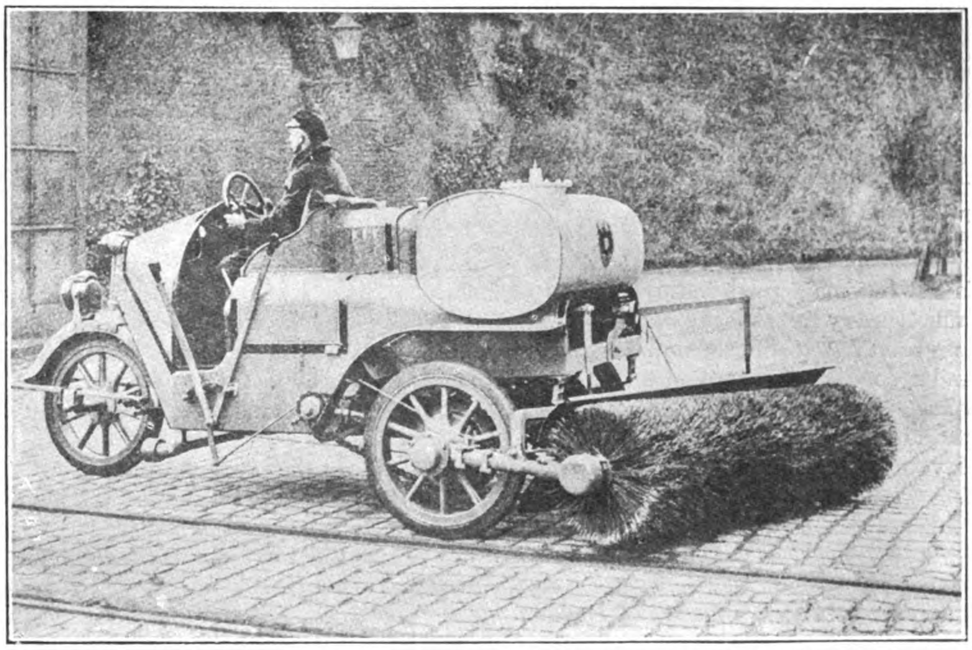
The
FAR EASTERN MOTORS
MOTORING-AERONAUTICS-MOTOR BOATING

## FAR EASTERN HIGHWAY DEVELOPMENTS

# Motor Roads in Japan

*Interview with W. I. Irvine, U.S. Trade Commissioner*

CHIEF among the handicaps to the development of motor transportation is the lack of preparedness of the country. Industrially Japan has not set its house in order and, although within recent years it has shifted decidedly from an agricultural nation to one of growing industrial strength, the transition is still in progress and old methods continue to be used by the side of the latest devices of industrialism. In the transportation of commodities this is very striking. By factories and mills where the most modern machinery is used, thousands of men are employed to draw heavily ladened carts at the rate of less than two miles an hour, while thousands lead horses or oxen to which are hitched small wagons which at best carry a ton, and generally less, at a speed but slightly in excess of the hand-drawn carts. The streets and roads near the cities are terrible by these slow moving wagons which seriously handicap the comparatively few motor vehicles from operating efficiently and thus further hindering their more general use. The growing cost of labor makes these transportation methods expensive and places an economic burden on Japanese industry which a few of the more far-sighted are realizing. Cheap labor is becoming less a factor in Japan and with its disappearance will go the argumeny that humans as beast of burden are a necessity in order to provide occupation to the thousands of men and women thus employed. And with their passing will come the highway development of which Japan is sorely in need and with which the government is now occupying itself more than at any other time in the history of the nation.



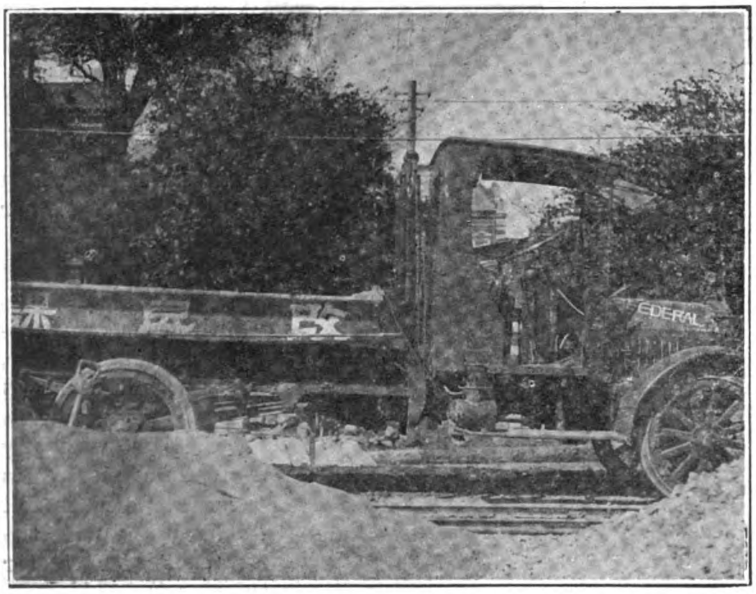
**Type of Two Motor Street Sweepers of German Manufacture supplied to the City of Tokyo by Takata & Company**

### Present State and Proposed Improvements of Highways

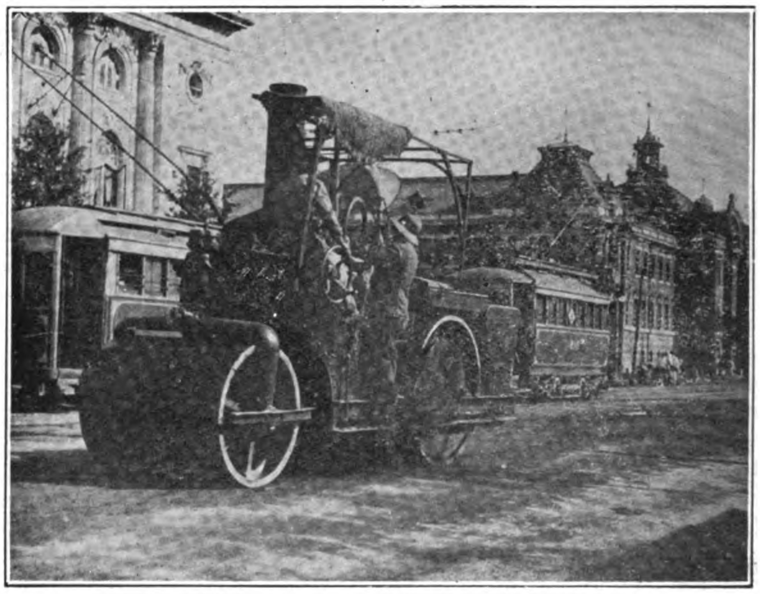
Motoring in Japan is an adventure replete with thrills, exasperations, and regrets. Japan offers to the motorist a paradise, but its enjoyment is possible only in a few sections with any degree of comfort. Its natural scenery is full of charm and were the roads fit for motor vehicles it would compell thousands of tourists to tarry longer in the country. The value of travelers is appreciated by the government and in the most important centres agencies have been established to assist tourists in their quest for interest and pleasure. But the great asset of its scenery has been, up to the present, ignored, except in so far as it could be viewed from points accessible by rail road. The Japanese people are nature lovers and will suffer a great deal of inconvenience to visit the famous beauty spots of the islands and were roads suitable to motor traffic available to permit general touring, the market for motor cars opened would satisfy the most ambitious exporter.

The existing roads suitable for motor traffic are few and these in no way compare with the motor highways in America. They are, without exception, as far as the writer was able to locate after a survey which covered the main arteries from Hokkaido, the north

island, to Kyushu, the south island, narrow dirt roads similar to the secondary county roads in the United States. Generally they run through rice growing sections and are elevated above the paddy fields as the irregularly shaped terraced irregated fields are called. The average width is about 16 feet but in many places, even on the main highway of Japan, "The Tokaido," the ancient road which runs from Kyoto to Tokyo, the width is less, so that passing another vehicle is a hazardous task, for there is always the possibility of slipping over the side into a paddy field. It is not only necessary to slow down, but at times to come to a dead stop and then, after one vehicle has been moved as far as possible to the side of the road, the other creeps past. Villages, which are most numerous, usually consist of a row of houses on each side of the road, and in these the highway is almost invariably less wide than the open road, due to the encrochment of shop keepers' stands. Passage through a village is irksome for, in addition to the limited space, the highway is usually full of carts and pedestrians, there being no sidewalks, except here and there in the cities. Some idea of the difficulty of making a motor journey on a busy road in Japan may be gained from the statement that it required two hours for the writer to make the trip of 18 miles between Yokohama and Tokyo. The conditions of this journey were not unusual nor was the time chosen when traffic is unusually heavy. The chief delay is caused in going in and out of the cities for there is but one main road and every kind of vehicle must use it and, if traffic is heavy from the opposite direction, the fast moving vehicle must soon fall in line behind a string of slowly moving carts. A similar condition was found on the short road between Kobe and Osaka.



Federal Two-Ton Dump Car, used by the Road Improvement Bureau of Tokyo Municipality



Springfield Road Roller, used in Street Construction Work in Tokyo

The roads outside of the cities are good of their kind. The porous soil is covered with layers of river bed gravel which in time is worked into the top making a fair highway. The nature of the soil is such that it drains and it is common, therefore, to find dusty roads a day after a very heavy rain. Near the cities and large town, however, the heavy traffic tears up the roads and then after a rain they are literally a morass. Traffic is further impeded by the lack of sidewalks which compel people to walk in the highway and they, together with the handcarts and rickshas, make driving difficult because of the utter disregard for the rule of the road which is to the left.

In the cities and towns the streets are generally narrow but the main arteries of traffic are wide and aside from the numerous vehicles which necessitate alert driving and constant horn-blowing, motor vehicles can operate efficiently, although at a higher cost than in America because of the absence of hard surfaces. In Tokyo, with the exception of less than ten miles, all the streets are unpaved. Yokohama, Kobe and Osaka have a few miles of paved streets, but generally speaking the city streets are dirt and, as Japan is one of the rainiest regions, the average record for the whole country reaching as much as 1,570 m.m. a year, muddy streets are common. Japan may approximately be said to have in a year four sunny days for every three days of rain or snow, rain or snow claiming 150 days on an average.

A further difficulty is the absence of straight roads and the weakness of the bridges. In the open country curves are very sinuous and at times complete right angles. The bridges are usually of wood and the strength of the majority does not permit the passage of light motor cars. This condition is so pronounced that it is necessary for army engineers to strengthen all bridges in any section where it is decided to hold manœuvres. In the cities the bridges are stronger over the numerous canals, and so trucks carrying loads of not more than two tons may cross in safety over the majority. Speed is further restricted by the many blind crossings created by the narrow streets and the absence of sidewalks.

## Plans for Improved Highways

Fortunately Japan is not unconscious of the handicap caused by its poor roads and streets, and steps are now being taken to improve its highways. Engineers, municipal, prefectural and national, have studied roads and their buildings abroad and have returned enthusiastic supporters of the good roads movement, but their ardor has been cooled somewhat by the lethargy and procrastination which is characteristic of the Orient. To this is added the further difficulty that the engineers have returned type advocates and the ensuing conflict of ideas has prevented a co-ordination of knowledge and effort. The results of their investigations have materialized so far only in the building of small sample roads, which have been very expensive.

Occidential road engineers and others interested in road building in Japan agree that so far the new streets laid down in Japan have been poorly constructed and an examination of some of these by the writer justifies the statement. An illustration is the recently completed strip of wood block pavement on "The Ginza," the most popular shopping street of Takyo. Two years have been required to lay this street of not more than three miles and although this had been completed less than six months at the time of inspection, the blocks had sunk in many places and bulged in others, and repairs will be in order before another year passes. This is due to the absence of proper base, the method being to lay the blocks on loose and without a binder. However, some streets have been well laid, notably in Osaka, which is by far the most progressive city in Japan in improving its street conditions.

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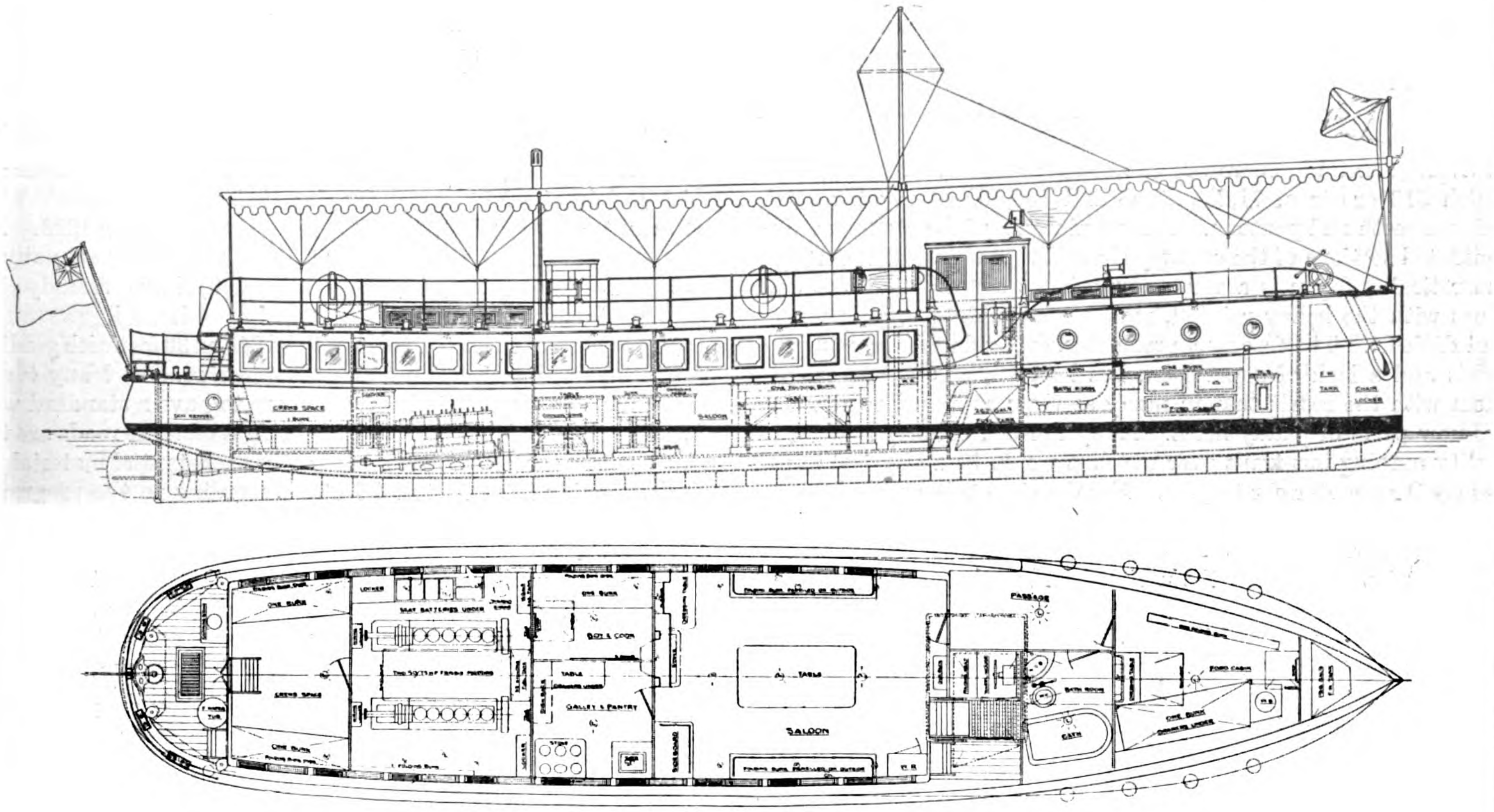

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## BRITAIN'S BEST IN MARINE ENGINES

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**SHANGHAI**

Many Japanese road engineers operate on the theory that all that is necessary is to level the road, which is done by hand, cover the surface with river bottom gravel and then roll it incidentally, the steam roller is about the only piece of road machinery used. In the town of Mito where there is an enthusiastic good roads group, streets generally are being "improved" on this basis, but unfortunately for the boosters, the cart and ricksha men, called "*kuramas*," find the pulling hard over the new roads and draw the side and there work a path more to their liking, with the result that traffic passes over only a narrow section which soon becomes as bad as before the improvement, leaving the centre a mass of stones unworked into the surface. This practice is common throughout the country. But this is only a temporary phase and certain to be corrected. The important and gratifying thing from the view-point of the motor man is that the good roads movement has started after years of talk without action.

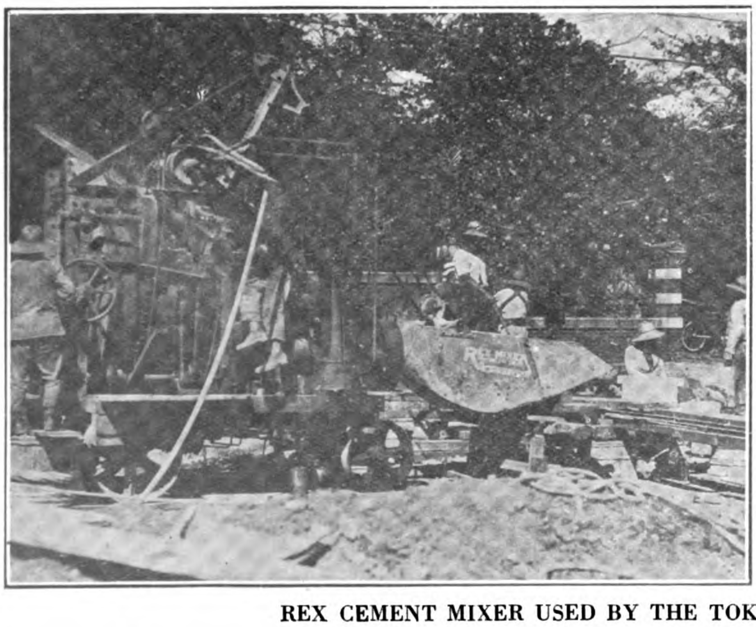
The official figures of the number of miles of roads in Japan are, from the consideration of motor transportation, useless, for they give an erroneous idea of the possibilities for the use of motor vehicles. According to these figures the national roads are supposed to be not less than 40 feet and the prefectural roads 24 feet wide. There are supposed to be 5,299 miles of national roads and approximately 23,886 miles of prefectural roads, and in addition 281,138 miles of country roads sufficiently wide to permit the passage of two vehicles of average tread. There are 346,144 bridges over these roads of which 518 are iron, 71,268 stone and 136,860 of wood, and the balance earth and pontoon. An examination of the roads in widely separated sections of the country showed that the widths are mainly theoretical. Japan is a very mountainous country and this combines with the heavy rainfall, makes road maintenance expensive and difficult. The frequent washouts have reduced the widths of roads and a lack of supervision has lead farmers to encroach on them with the result that in many sections supposed road widths are now parts of paddy fields. Many miles of country roads are in reality nothing but trails over which it would be a physical impossibility for a motor car to pass. For the time being manufacturers who would picture road conditions for the purpose of determining the use of motor vehicles must be satisfied with the statement that with but few exceptions the national and prefectural highways do not invite motor traffic.

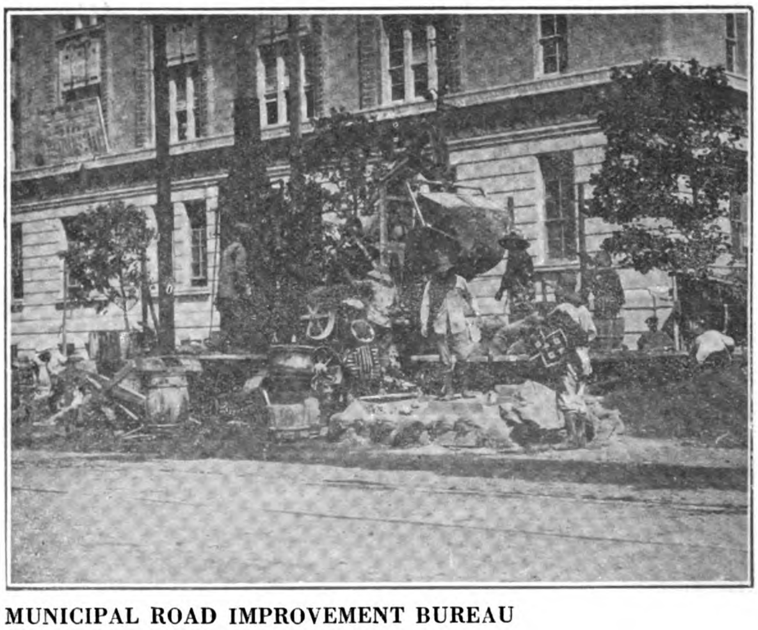
The building of new highways in Japan will necessarily be slow and very expensive for the reason that their construction means the purchasing of adjacent paddy fields and the buying and condemning of thousands of houses. Land is very expensive because of the limited areas for cultivation. An illustration is the estimated cost of the highway between Osaka and Kobe, work on which has been started. It has been decided to build an entirely new route in order to reduce the distance to 15 and ½ miles. The road will cut through not only sections of Kobe and Osaka where houses are numerous but will run straight across paddy fields, generally below the highway level which will call for great fills and the building of bridges. The road is to be 72 feet wide and will be hard surfaced and will cost on an average of $400,000 per mile. A similar situation confronts the builders of the Tokyo-Yokohama road which also has been started. It is estimated that both of these important highways, which will probably double the present use of motor vehicles, will be open within the next three years.

An ambitious national road policy has been launched which covers a period of thirty years and calls for the building of 70 *ri* (1 *ri* 2⅝ miles) of military state roads or national highways, 400 *ri* of prefectural highways and streets in Tokyo, Yokohama, Osaka, Kobe, Nagoya, and Kyoto, the six largest cities in Japan which have a combined population of more than 3,000,000, and are and will continue to be, the principal centres where motor transportation is used. The total cost of the road improvements in the cities is estimated at Y.270,000,000 ($135,000,000), divided as follows: Tokyo, Y.90,000,000 ($45,000,000); Osaka, Y.104,000,000 ($52,000,000); Kyoto and Yokohama, Y.20,000,000 ($10,000,000) each; and in Kobe and Nagoya, Y.18,000,000 ($9,000,000) each. Of this sum the central government will pay Y.90,000,000 ($45,000,000) while the balance will be defrayed by the municipalities. The cost of the state and prefectural roads is estimated at Y.282,000,000 ($141,000,000) of which the central treasury will contribute Y.167,000,000 ($83,500,000). During 1922 of this amount Y.7,000,000) will be spent and Y.9,000,000 ($4,500,000) during 1923. During the succeeding 27 years, Y.10,000,000 ($5,000,000) annually will be spent. About Y.6,800,000 ($3,400,000) have already been spent on this program.

The width of the new roads are to be 24 and 30 feet with gradients of 1 in 30 on hills and 1 in 25 on mountain roads. Many tunnels will have to be constructed and these are to have a standard width of 21 feet and a height of 15-ft. while bridges on these roads are to be rebuilt where necessary with steel or other substantial material with widths ranging from 16 to 24 feet. According to the program of the roads section of the department of home affairs, the improved streets in the city of Tokyo are to have a width of from 36 to 60 feet. The road to connect Tokyo and Yokohama is to be 72 feet wide divided into two side sections each 11½ feet wide for light traffic: a 6-foot sidewalk for pedestrians on each side and gutters 1½ feet. A space of 34 feet is thus provided for fast moving and heavy traffic. The opening of this road will afford great relief to the two cities and will unquestionably result in increased sales of motor vehicles for both passenger and freight. At the present time few vehicles attempt the trip because of the rough going and the slow moving traffic. If the authorities adhere to their plan and lay a

(*Continued on page 360*)





**REX CEMENT MIXER USED BY THE TOKYO MUNICIPAL ROAD IMPROVEMENT BUREAU**

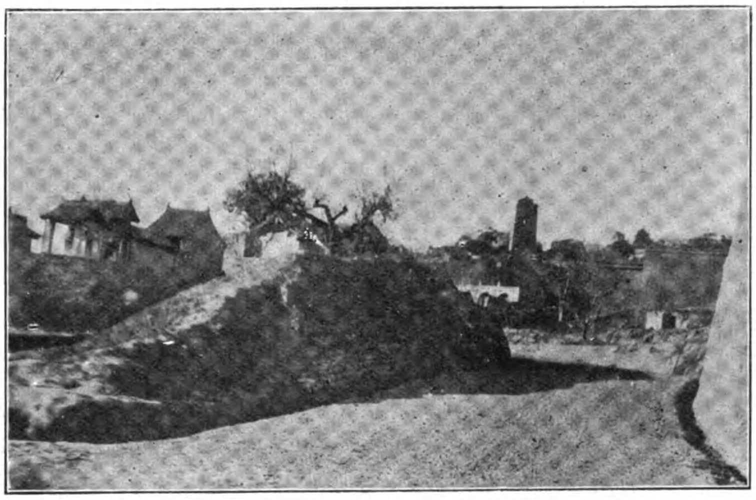
# "Do's" and "Dont's" on Chinese Roads

*By John Earl Baker*

TO urge the building of roads in China has become as safe a topic of conversation as the weather. Every shortage of crop is seized upon as an occasion to promote the building of a road as "famine relief" measure,—outside funds to be used, of course. Those who would disband superfluous troops suggest that they might be used in the construction of roads. It seems to be assumed that a road built from anywhere to nowhere in particular, regardless of length or cost, is desirable as far as it goes. It will do no harm, at least, to examine the subject somewhat analytically.

There is no need to labor the subject of China's wretched roads. Neither is any argument required by the readers of these pages as to the desirability of improved communications in this land of interminable distances. It will probably be accepted on affirmation that for the time being, at least, railway construction on any considerable scale is impossible. Chinese bonds cannot be sold abroad except at ruinous discounts. At home they cannot be sold at all. Government revenues are insufficient for current needs. The present lines are unable to pay bills for materials that are months in arrears. On top of that, the president has declared in a recent interview that "the entire system of big railway loans is wrong. The policy is to be definitely abandoned. The policy we now propose to follow is a system of tenders for materials and contracts for work by railway contractors." This means piecemeal construction, no faster than bills are paid. Evidently, if there is to be any improvement in communications it must be in respect to highways rather than railways for some time to come.

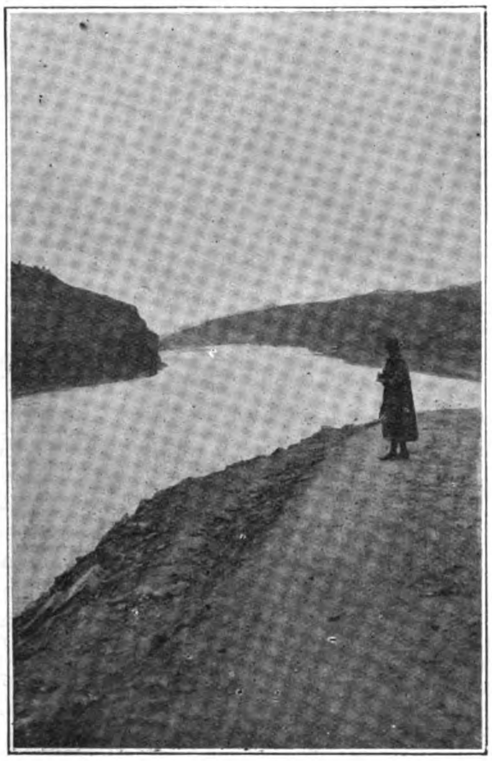
From the standpoint of the credit conditions of the country, highway construction is not impossible. While railways require a great deal of steel, machinery and wood which can be obtained only abroad and at great cost, highways require only labor, the commodity in which China leads the world. Bridges and culverts may be built of brick or stone,—all products of labor. Tools are native made. No machinery is required. Lime and cement are burned locally, in a majority of cases. The engineering is simple. Ordinary eyesight and common sense are usually sufficient, although sometimes it is preferable to "throw dirt with the transit rather than with a shovel."



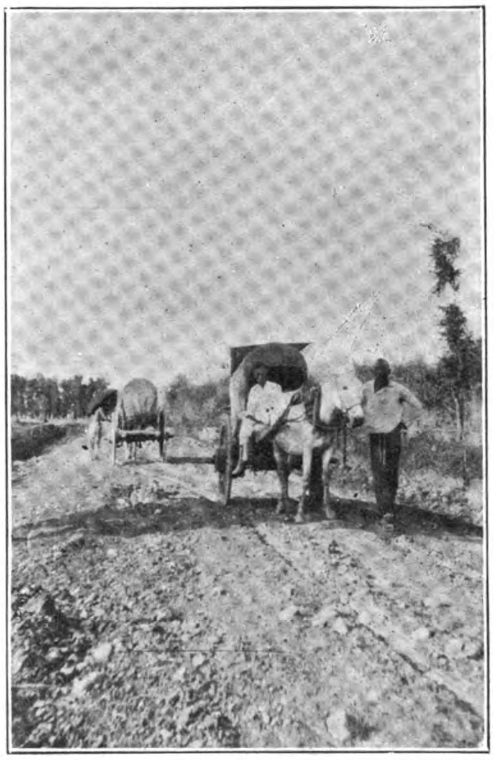
Section of the Yellow River Road, Western Shansi

At the same time there is such a thing as too much enthusiasm concerning highways. Over long distances where traffic is heavy, highways are a wasteful form of transportation, compared with railways. The average rate charged by the Chinese government railways is only a little over half a cent for the haul of a ton of goods one Chinese *li*. The average rate by carts is many times this amount,—at least six times. Within a relatively short distance, therefore, the cost of transportation by cart becomes greater than the original value of the goods carried.

Nor will the use of motor trucks change the situation. Over short distances in Europe and America motor trucks compete successfully with railways; but over long distances they do not. However, European or American experience cannot be followed blindly in China. In America, for example, the highways have been built out of the public domain and so have cost nothing for the land. They have been improved and are maintained by general taxation, so that no tolls are paid and only a moderate license fee is required of the truck owner. Furthermore, labor for the transfer of cargo is very expensive, and it is on the saving of transfer costs from truck to railway at point of origin and from railway to truck at point of destination, that motor transportation of goods thrives in America. In China, by way of contrast, the land for an improved highway in most cases must be

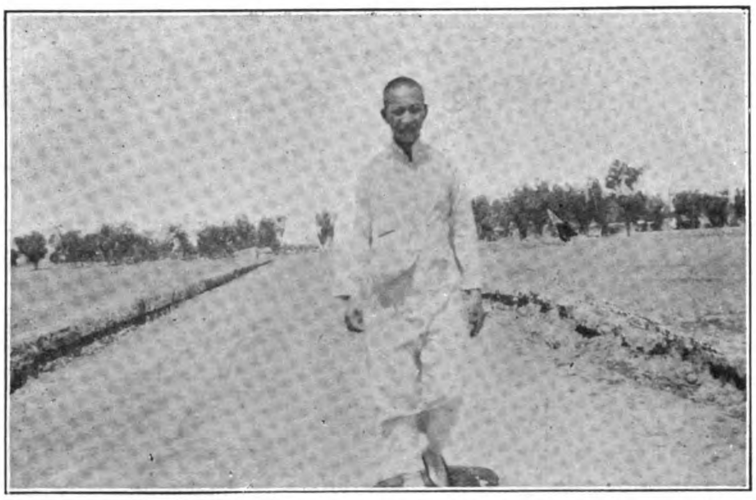


**The Yellow River, end of the Red Cross Road.** Thousands of tons of grain have been delivered here by boat during the past winter and transported over the new roads to southern Shansi where famine conditions are reported to be as bad as in 1921, were it not for this supply of grain from the outside.



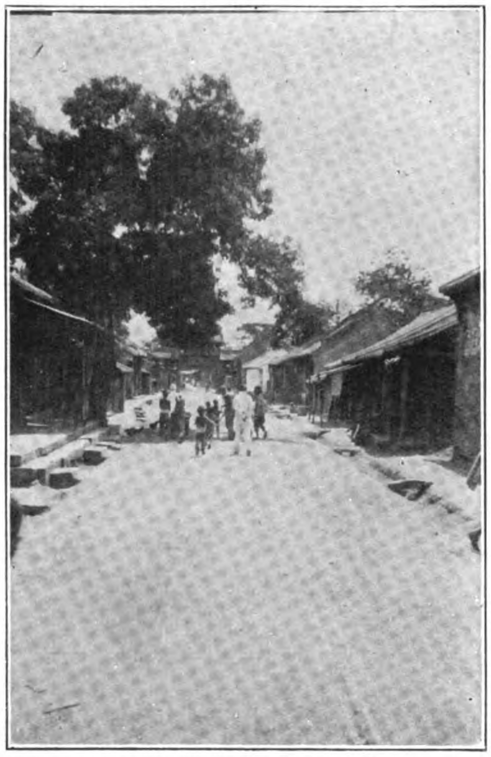
**The Honan Macadam Road After Ten Months of Cart Traffic**

purchased from private owners. No taxation would be tolerated for a moment either for the purpose of paying for this land, for building the road or for maintaining it after it is built. The road must be projected as a commercial enterprise, and the traffic must bear all of these expenses, which in America or Europe are avoided. And the cost of labor for cargo transfer is so low that in many provinces animals cannot compete with humans in the mere task of dragging the burden.



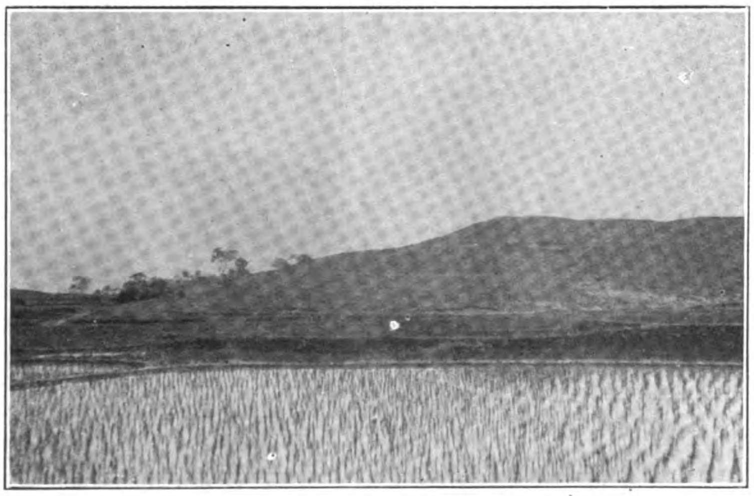
The Hantan-Tamingfu Road After Ten Months of Automobile Traffic

As a matter of fact, it is very doubtful if motor trucks in China can compete generally with carts open over roads which are furnished free of tolls. Recent data sent from America indicates that the average trucking cost is about five cents gold per ton mile,—all costs included. This is the equivalent to ten cents Mex. for practical purposes. The labor cost for drivers, repairment, etc., will be much cheaper in China than in America. But the cost for gasoline will be double at ports and treble in the interior. The cost of depreciation will be at least fifty per cent. higher and interest will be at least double,—due to the effect of higher first cost and higher rates. Repair parts will cost more and there will be more of them because of inferior care on the part of drivers. In addition, the roads over which the truck in China will operate will rarely be as well constructed nor as well maintained as those in America over which the cost data was obtained, and this factor will increase both running costs and repair charges. Hence, in all probability the average cost in China will be close to fifteen cents Mex. a ton-mile rather than ten cents, the American figure.



A street in Hwaikiangfu, Honan, after a year of cart traffic. Upon a deep foundation of old brick and rock, a mixture of clay, lime and broken stone was tamped firm

At fifteen cents Mex. a ton-mile, the motor truck on a fairly good road cannot compete with the Chinese cart on an ordinary unimproved road, except under special circumstances. When the road is level and fairly hard cart, traffic costs about ten cents a ton-mile and even under conditions somewhat unfavorable, cart costs do not run beyond fifteen cents a ton-mile. In the case of valuable goods or perishable goods where speed is an object, the motor truck has a field. In other cases, it will have to cut its costs before its use will seriously affect cart traffic, let alone railway traffic over long distances.

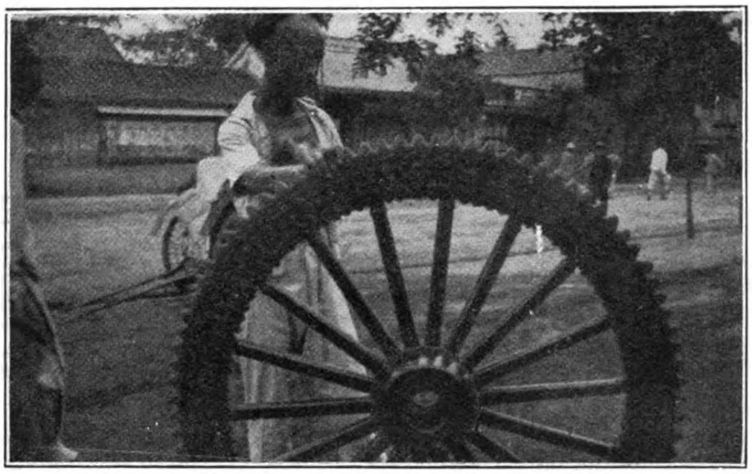


Human beings are the only motive power for transportation across the rice paddies of Hunan. An opportunity for roads as a commercial venture

So far, goods traffic has been under consideration. Passenger traffic is a different matter. In spite of trite sayings to the contrary, time does mean something to many Chinese. It means money to the Chinese businessman the same as it does to his western competitor. The time that a well-to-do Chinese can save by the use of a motor car has led to the installation of motor-bus service at several points,—not in competition to the railway but as an adjunct to the railway. In many cases, he finds that by the use of the motor bus he actually saves money. For example, there is the case of the Taiming-fu-Hantan service. Hantan is on the railway. Taiming-fu is forty-six miles away. The train for Peking scheduled to leave Hantan at about two o'clock in the afternoon. The Taiming-fu merchant must allow at least one long day and the full half-day before his train leaves Hantan for the journey,—supposing the weather to be good. His carter will figure on four days for the round-trip and charge him at least $3.00. He must take his bedding and put up at an inn *en route*. He will stop for meals during the day. Being a man of means he will be charged a plenty and must tip liberally. He will be lucky if he gets through for less than another $3.00. If he should have the road luck to be late for the train, there is another day to wait and pay for. But with the motor bus, he need leave home only a few hours before train time. He travels light. He pays only $5.50 for the trip. And think of the extra comfort! And the added safety from possible bandits! Hence, for passenger traffic to points a reasonable distance from the railway there is a distinct place for motor roads,—provided the traffic is sufficiently dense.

With so many opportunities to build, the first choice of roads should be those which would contribute most to the economic welfare of the country. That principle involves two factors: one, the amount of traffic to be transported, and two, the reduction in the carrying cost per unit of traffic effected by the building of the road. The greater the reduction in the unit cost of carriage, the greater the profit from the use of the road and the greater the prospect of developing more traffic. Also, the greater the number of units to which the reduced cost is applied, the greater the aggregate profit from the use of the road. Therefore, roads should be located at first, only between points which interchange a great deal of business. This is a principle which is being lost sight of at times. A second application of the above principles lays in the building of roads between points which at present are required to transport their goods by means of pack animals. An animal hitched

to a cart will haul on a level, hard road about four times as heavy a load as he can carry on his back. Hence the road effects a saving of three out of four animals, together with one driver, perhaps. On the Yellow River road in west Shansi, it is reported that a cart to which three animals are hitched are hauling the load which formerly required eight animals and two drivers. Grades as sharp as six per cent. are found on this route. Of course, considerable reductions in the cost of transport by cart can be made possible if the present cart roads are improved, but the reduction is not likely to be nearly so large as that brought about by a change from pack animal to cart. It follows then, that the ideal route upon which to locate a road is between two large cities separated by mountains, or upon the mountainous section of some transcontinental trading route.



"Sawtooth" Wheel used on Carts by Fashionable Gentry

Building of roads in mountainous country has other advantages. One of the foremost is that a considerable portion of the land which must be occupied is comparatively worthless. Compared with the cost of farming lands on the plain, this makes the right-of-way much less expensive. However, the additional costs of construction because of the deep cuts and fills necessary to maintain a practicable grade, the bridges and culverts, or paved "dips" necessary to get over water courses will make the mountain road much more expensive in the final cost. Yet, the material for putting on a durable surface is right at hand and need not be hauled, and there is no difficulty in keeping the road up out of flood waters. On the other hand there will be unavoidable trouble with landslides and the washing out of culverts which have not been correctly located, designed and constructed.

If mere improvement of present roads is to be attempted, the best opportunity is over low-lying or marshy regions which during much of the year are impassable by heavily loaded carts. By raising the grade of such routes, providing drainage and surfacing with clay and gravel so as to make a surface which will bake, it is quite possible to make such a route passable during most of the year. A case in point is that of the road built between Chinghua and Tsiyuan via Hwaikingfu, in Honan. At an expense of less the $3,000 per mile, cart charges have been reduced by a third during good weather and by more than half for bad weather.

Under conditions such as have been described, mountainous or marshy, road building can be put on a commercial basis. Take for example the Yellow River road in Shansi. The records of the *likin* station midway of the route showed in 1921 that about 700 tons per day passed he station. The cost of packing goods over this eighty-mile route was about $26.50 per ton. The method has reduced the cost to one-fourth the former level during quiet times and to about one-third the former cost at present, when there is more of a demand for carts than can be met. Assume that an average saving of $16.00 per ton can be effected on the average. This means, when applied to 700 tons, $11,200 per day,—or about $4,000,000 per annum. The road cost only $1,000,000.

At this rate commercial companies have a golden opportunity ahead of them. A highway concession need not involve funds beyond the capacity of Chinese companies to obtain. But far-sighted traffic policies as well as economical construction performance will be necessary in order to make use of such opportunities. A better prospect is offered to enlightened *hsien* officials who happen to be stationed in strategic districts. By a judicious use of tax funds a nucleus for construction can be obtained. If the work is timed to fit in at the slack seasons on the farms, local labor can be obtained cheaply. The wages paid remain right at home, so that the tax-paying powers of the district are not weakened,—but rather are strengthened by this distribution of ready cash. The tolls on the roads then become so much clear gain.

Little or nothing will be gained by improving the ordinary roads down on the plain unless the present type of cart wheel be changed. This wheel, with a tyre only 1¼ Chinese inches broad, if loaded with the usual burden of goods will cut through any surface that has been invented. It was once thought that a "metal" surface of water bound macadam would stand up under this tread. But during the past summer a newly finished street in Peking was worn into ruts three inches deep within two weeks by cart traffic driven by soldiers who were transferring supplies from one side of the city to the other. A macadam road built by the red cross in Honan during the famine was broken through within six months of completion. Once such a road is out of rapair the cost of resurfacing is a serious matter. Besides, any considerable amount of macadam surface is out of the question as a matter of first cost.

Assuming 20-ft. as the width of the road and that a macadam crown of 14-ft. is placed in the oentre, to a depth of 8-in. before rolling. This would give a depth of 8-in. after rolling,—none too much. Each lineal foot of road would contain 9⅓ cubic feet of crushed rock and each mile would contain 49,280 cubic feet. At 100 pounds per cubic foot this computes to about 2,500 tons per mile. If the supply of rock is within a few miles of the highway, this is serious enough, but if it is a hundred miles, as is the case over much of the plain, transportation costs become prohibitive. For the highways in Shantung built by the red cross a mean haul of about 70 miles by rail and 30 miles by cart or wheelbarrow was estimated. This works out to about $100 per mile of highway for rail haul and about $5,000, for cart haul. The rock can be quarried and broken for perhaps $750 and spread and rolled for even less. But the transportation item is tremendous. Still, if the wearing qualities of a macadam road were sufficiently superior, the cost would not be absolutely prohibitive.

The wind is the worst enemy of the rock surfaced road. It whips out the dust between the voids and thus removes the binder which holds the separate pieces solid. The jar of heavy traffic, or the suction of a pneumatic tyre then loosens the small stone. Pits are soon formed and the road becomes so irregular as to have little value over the usual dirt road. Under the traffic of narrow tyred carts, ruts are soon formed and when that takes place, one cart always follows in the track of another until the rut becomes so deep that a new path must be followed. Under these carts the improved dirt road soon becomes no better than the ordinary country road. Hence, no tolls or licenses can be collected for the use of the good road. Hence the conclusion is forced that the present roads down on the plain are plenty good enough for the present type of cart wheel, and that nothing better can be expected.

On the other hand, if a wide type of tyre could be made common, the problem of good roads on the plain would become comparatively simple. If the tyre were of a width of three Chinese inches, or four English inches, the wheel acts as a roller and each succeeding load rolls the road harder and harder. Due to the natural wavering of an animal's progress, instead of following in the same track, the broad tyres tend to roll out the impression of a preceding load rather than to deepen it. If broad tyres were to become common in the couutry, the matter of roads passable to motor cars would become simple. Even in cities with macadam streets, a decided advantage is gained

by their use. The broad tyre tends to wear off the sharp corners of protruding rubble and to pack the binder into the small depressions. This type of wheel has been in use in Taiyuanfu for four years and a beginning is being made on Peking streets. The success in Taiyuanfu influenced Governor Yen to enforce the regulation that none but broad tyres should be used on the new roads built by the red cross and by the military during the past few years.

The whole subject comes down to this. No roads can stand up under the narrow tyre wheel. Until adequate police regulations can be enforced against the use of the narrow tyre on improved roads any expenditure upon either the macadam or the dirt type is money thrown away. On the Tamingfu-Hantan road, carts have been kept off altogether, broad tyres as well as narrow tyres, by the device of digging a well in the middle of the road and cutting a notch in each side of the road opposite the well, on each side of every crossing. Thus, cart animals cannot step across the well nor is there room to turn out. The motor cars, however, can straddle the well. If animals were driven abreast in China, they might do the same, but this is an adaptation that will be years in coming. Under mere rubber-tyre traffic, this dirt road has stood up splendidly, and has been inexpensive to maintain. It is slippery immediately after a rain, and should not be used during the heavy rainy season. If traffic must be constant during the wet spell, the road must be surfaced with gravel.

If any highway program is to be worth what it costs two important lessons must be learned by the Chinese authorities. One of these is regular and adequate maintenance. The other is reasonable loads. In no other connection is the old adage more applicable than in road maintenance that "A stitch in time saves nine." In Shansi, the roads are patrolled by a local repair man who covers a ten-mile section about every two days. He carries a basket at each end of a pole. He has a shovel in one basket and a tamper in the other. If he finds a drain that needs cleaning he fills his basket and carries the dirt to some nearby depression in the road which he fills and tamps hard. If he finds a stone on the road he chucks it into some piece of retaining wall sure to be near by. He inspects licenses of passing carters and acts as highway police as well as repair man. Any unusually large repairs are reported to headquarters and an extra gang takes care of them. Down on the coastal plain, this program would have to be varied somewhat, perhaps, and the use of the "split log" or "king" drag after rains and after the frost comes out of the ground in the spring would make repair economical. But the actual cost of repair can be kept very low by the means just described.

Not only economical repair but successful transport wait upon the learning of the lesson of reasonable loads. Between Hantan and Wuan a fine example of macadam road was built by the Canadian Presbyterians as a famine relief measure in 1920-21. The road was in good shape up to the fall of 1922. Then some enterprising gentlemen became impatient with the profits which they were making from some small motor-busses and fitted up some five-ton trucks. Although these busses were equipped with double treads, these cars soon ground the surface in corrugations and the service had to be discontinued. Two-ton trucks on the macadam road made no impression. They were fitted with single tread pneumatic tyres. Over the dirt road running from Hantan to Tamingfu two-ton trucks were equally harmless.

But the motor car people will learn the lesson of reasonable loads sooner than the carters. The Chinese carter evidently feels that his load is not heavy enough unless the wheels cut in. In Peking the Rockefeller Foundation has equipped sixteen carts with broad tyres and obtained permission from the police to use the macadamized portion of the streets with them. Carts which formerly drew 1,800 to 2,100 pounds of coal are now hauling as much as 4,700 and in few cases less than 4,200. Manifestly, the wheels were never designed to bear such loads and will soon go to pieces unless something is done to correct the practice. On the Hwaiking, Honan, road the same thing happened. Because the wheels did not

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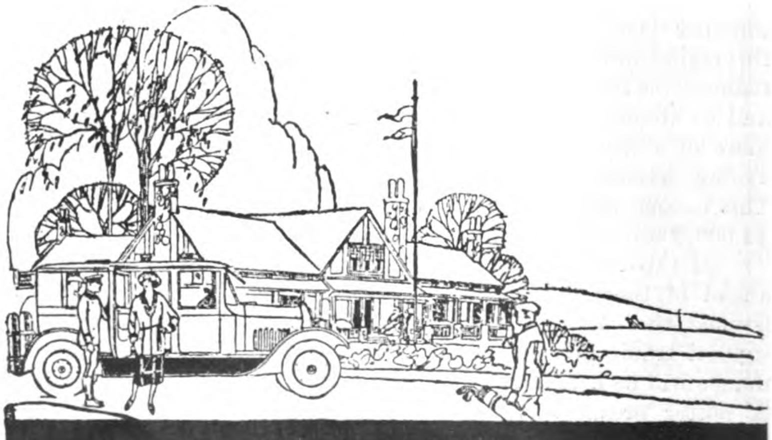
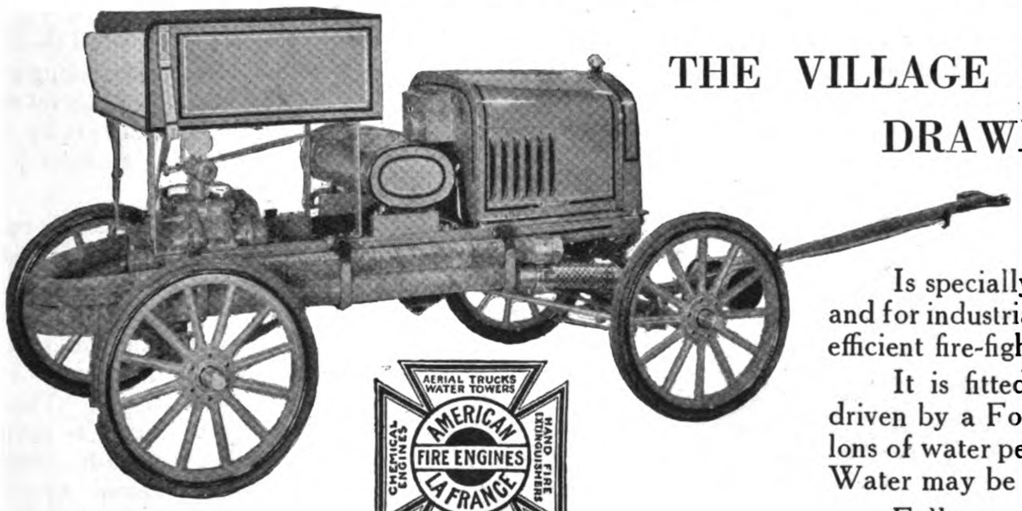


SOCONY MOTOR OILS

cut in, the carters loaded all that could be piled on, and then added more animals to the team. The wheels soon broke down. Then they went back to their old narrow tyre wheels, the foreign innovation having been proved, in their eyes, to be a delusion. The old narrow tyre wheels also did not cut in—until after a few days rain. Then when the foundation gave way, the crust broke down and the wheels churned up mud, big stones and little stones until the road was almost as impassible as before. However, the drainage has been so improved, that even after this experience, cartage costs have been considerably reduced, as mentioned heretofore.

In fact, it seems that if the full benefit of any road improvement is to be obtained, there must be a beginning in the use of the four-wheel wagon. Along winding depressed roads and within twisting *hutungs* such a vehicle is impossible. But upon the broad and straight improved roads where regular transportation takes place there is no reason why these wagons could not be used. The first cost will be greater, but no greater than the cost of two carts, and the four-wheel wagon will carry as much as two moderate cart loads. In this way the full earning power of the driver can be utilized, for he can add to his team, then, all the animals which he can conveniently handle, the same as he does now to the two-wheel cart. But the load, instead of resting on two wheels will rest on four. There is some likelihood that an attempt will be made in Hunan to introduce the four-wheel truck. On the road from Siangtan to Paoking, which is being built with money supplied by the American advisory committee under the supervision of a Chinese-foreign engineering committee, a large amount of gravelling will be done. The beast of burden in that region is the water buffalo. He is a powerful brute. His tractive capacity is probably equal to that of two ordinary mules. If this tremendous force is to be used to its capacity, on this hard and level road, loads up to 3,000 pounds must be expected. No single pair of wheels should be expected to bear such a strain, either for sake of the wheels or for sake of the road. Luckily in that section, no carts whatever are in use. There are no other roads. Everything is transported by boat, by wheelbarrow or by human porter. So there is no danger of a recrudescence of the narrow tyre. Mere principles of economy will be the motive force toward the innovation, and the new mode will be all the easier because there will be nothing almost like it to displace.

Highway programs, therefore, must take into consideration a variety of factors. Nor is it sufficient merely to build them well. They must be located where they will be of considerable service. They must be placed where they have an opportunity to endure. Once built they must be regularly and adequately maintained. They must be policed sufficiently to protect them against misuse. But simultaneously with the building of roads must be a campaign of education with respect to variations in the cart wheel and in the cart itself, in order that the highways which are built may be used to their best advantage. If this is done, highways can become profitable and extensive adjuncts to the transportation system of the country. Over long distances they cannot compete with railways, but they can be the pioneer extensions of railways developing a traffic sufficient to support the railway as soon as built. This is especially true on the plain, where if the road is well laid out, it may become roadbed of the railway. In mountainous territory, however, no economical highway location would be suitable for railway roadbed.

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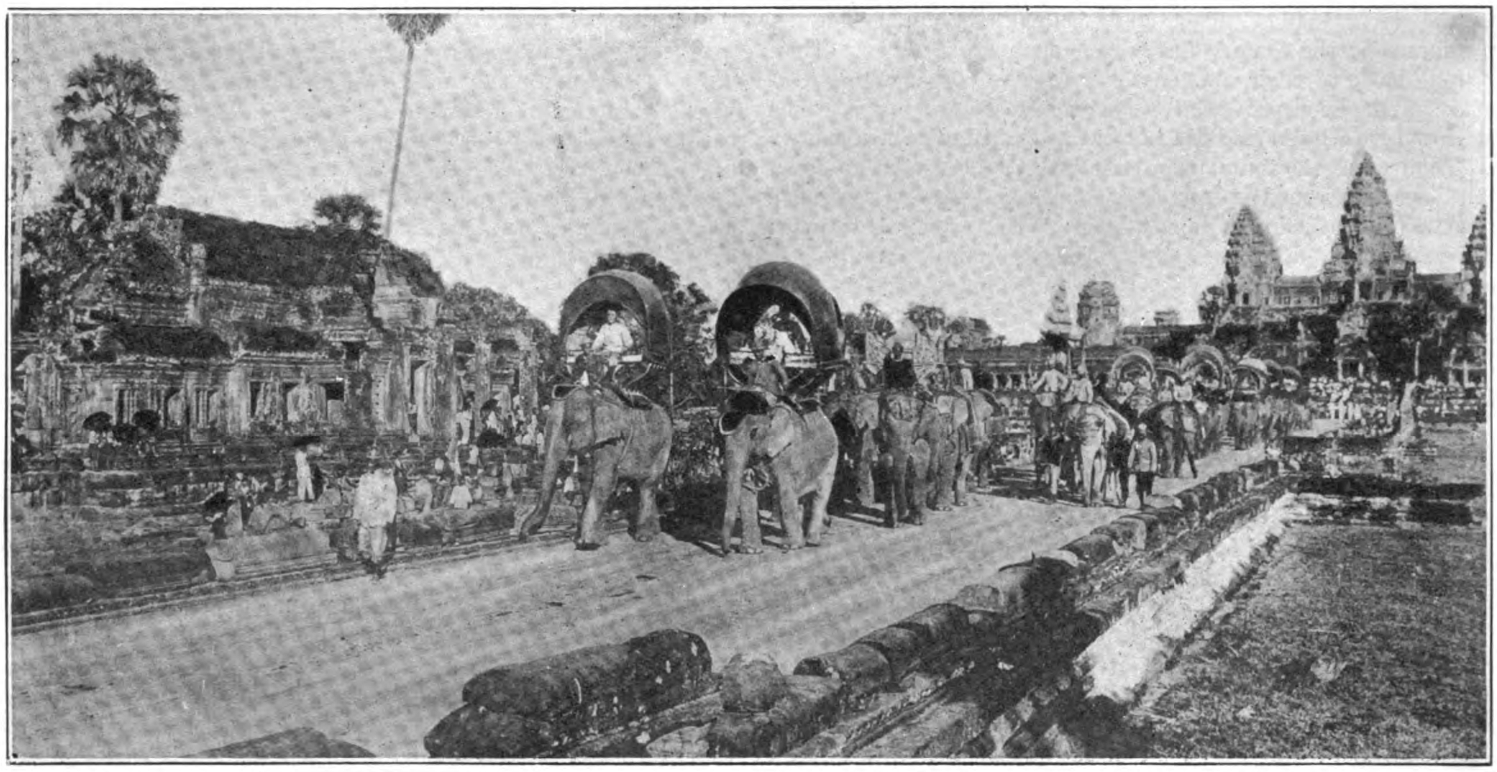


The New Road to the Ruins of Angkor-Vat in Cambodia: Procession of over 90 Elephants in Honor of the Visit of Marshal Joffre

# The Roads of Indo-China

THE length of the roads of the colony which has doubled since 1912 now attains over 16,800 miles, of which 6,200 miles are metalled and 6,000 miles are graded, thus being available for motor traffic for the greater part of the year.

These roads in accordance with the governor-general's order of June 18, 1918 are divided into colonial roads and local roads and, in Cochin-China only, into provincial and comunal roads.

## I. General

### A. Colonial Roads

Colonial roads are to the colony what the national roads are to France, for they equally serve the country as a whole. The programme now being carried out provides for 16 highroads in accordance with the order of June 18, 1918, to which two more have since been added. The most important is colonial road No. 1 or mandarin road, running from the gate of China to the frontier of Siam, via Langson, Hanoï, Hue, Saïgon and Pnom-Penn. This road is the great artery of land travel between north and south and connects up the capitals of Tonkin, Annam, Cochin-China and Cambodia. Its total length is 1,545 miles, slightly further than the distances as the crow flies between Paris and Moscow or Marseilles and Alexandria.

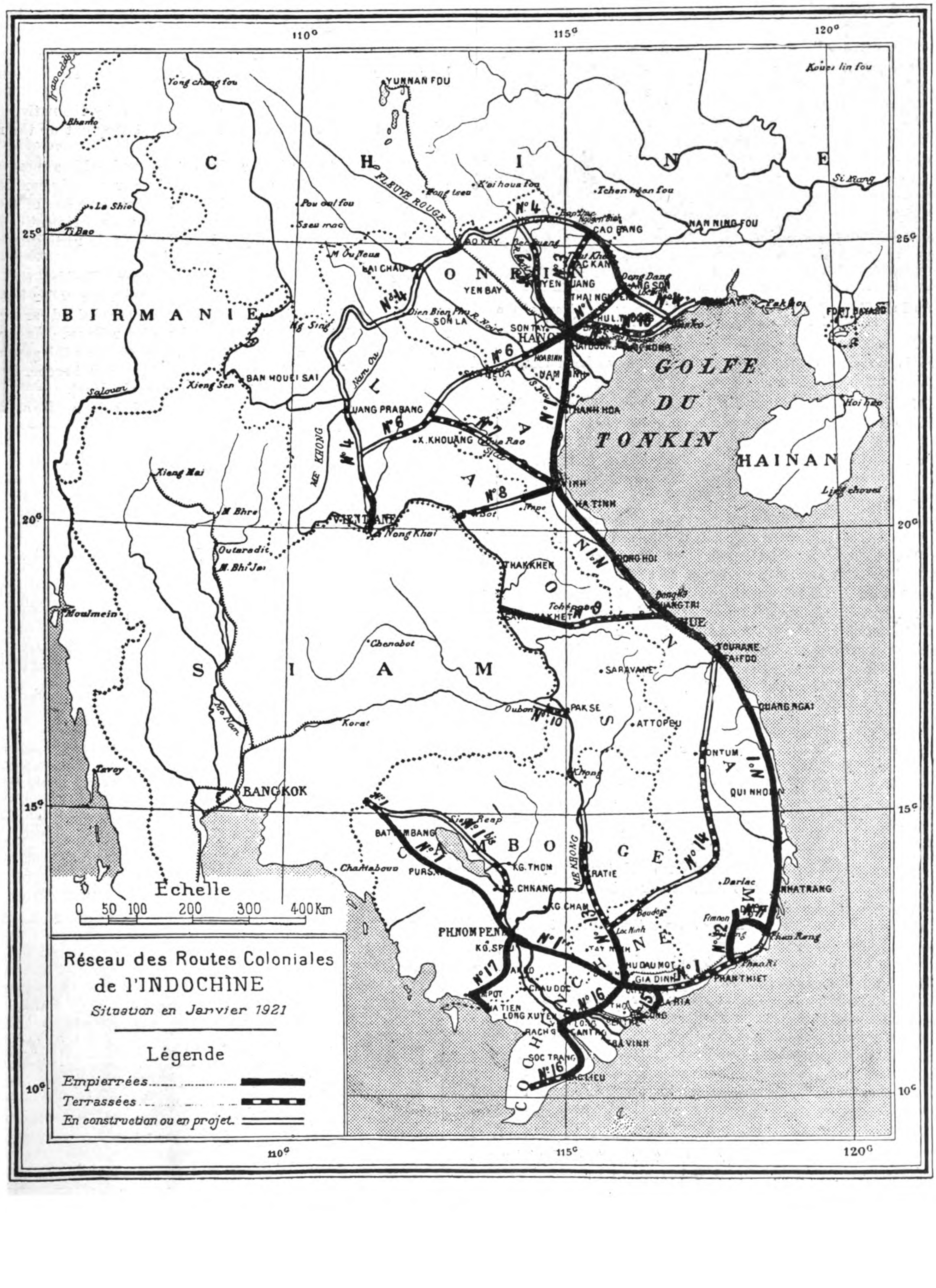
Until seven or eight years ago the greater part of the mandarin road existed practically in name only, for on a few sections only could rickshaws and light carriages be used, whereas all the rest was passable only on foot or in the saddle, the track crossing straight over passes by means of steps. The usual means of travel was the palankeen or sedan-chair and all luggage was carried by coolies, so that quite a caravan was necessary for the smallest journey. The postal service was undertaken by coolies.

In 1913 it was decided to make this into a serviceable road and the work was commenced the same year and has been steadily continued without any breaks, every year important credits for this being included in the general budget.

Parade of the Tank Corps of the Colonial Infantry at Saigon

The standard width of the actual road is 19-ft. 8-in. The radius of curves is never less than 49-ft. 2-in. and gradients are only exceptionally 1 in 17. Bridges are for the greater part in armored concrete and are calculated for a rolling load of nine tons.

The work was attacked simultaneously all along the line by means of small contracts so as to utilize small local contractors and labor. Had the usual western system of large contracts been employed


Réseau des Routes Coloniales
de l'INDOCHINE
Situation en Janvier 1921
Légende
Empierrées
Terrassées
En construction ou en projet
Échelle
0 50 100 200 300 400 Km
110°
115°
120°
25°
20°
15°
10°
C H I N E
BIRMANIE
S I A M
GOLFE DU TONKIN
HAINAN
YUNNAN FOU
NAN NING FOU
CAO BANG
YEN BAY
SON LA
BAN HOUEI SAI
LUANG PRABANG
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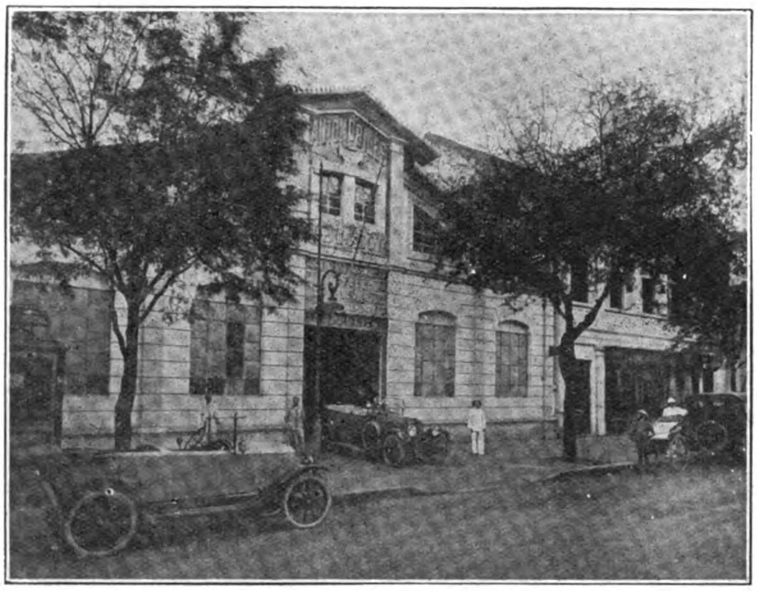


An Indo-China Garage: The "Peugeot" Agency at Saigon, of the Societe des Automobiles et Cycles de l'Indo-Chine

there is no doubt that the work would have been slower and certainly more expensive.

Up to date 1,384 miles of this road are metalled (nearly 9/10 of its total length), some 65 miles having been carried out in 1920. The sections still to complete are on the one hand at the frontier of Annam and Cochin-China and on the other close to the frontier of Siam. The former runs parallel with the Saïgon-Nha-trang railway and is therefore of a less urgent nature.

That part of colonial road No. 1 running between Phanrang and Phan-tiet is duplicated by roads No. 11 and 12 (Tur-sham-Fim-non-Phan-tiet). The lengths Phan-tiet Jiara connecting Annam and Cochin-China and from Sesophon to the Siamese frontier were completed in 1922. Even at the present time it is possible to motor from the frontier of China to that of Siam. From the railhead at Vinh of the Hanoï-Vinh railway to the railhead at Nhatrang of the Saigon-Nha-trang railway a daily service of public motor-cars for passengers and mails already exists. Between Saigon and Pnom-Penn there is a similar service.

Out of the 3,970 miles of the 17 other colonial roads, 1,471 miles were metalled on January 1, 1922 and 956 miles graded, and they can already be utilized by motor-cars during the greater part of the year. The chief ones are :

In Tonkin road No. 5 between Hanoï and Haï-phong with an extremely heavy traffic and roads 2, 3 and 6 of administrative and commercial importance between Hanoï and the mountain regions of Haï-Jiang, Cao-bang and Upper Laos.

No. 4 runs between Tonkin and Laos and starting at Mong-hai on the Gulf of Tonkin follows the Chinese frontier till it enters Laos and attains Vientian.

Roads 7, 8 and 9 run from the sea-coast of Annam towards the Me-kong River in Laos.

Roads 11 and 12 in the Dalat region of South Annam help to fill up the existing gap in road 1.

In Cochin-China roads 15 and 16 run from Saïgon to Cape St. Jacques and Cape Camao respectively, and road 1 penetrates Cambodia joining Saïgon with Kratie on the Me-kong River.

In Cambodia are to be found road 17 connecting Pnom-Penn with Ha-tien on the sea-coast and road 1 bis which passing to the north of the Great Lakes finally attains the marvellous ruins of Angkor.

### B. Second-Class Roads

These second-class roads branch out from the colonial roads and together with the provincial and communal roads of Cochin-China aggregate some 11,800 miles, of which three quarters at least can be utilized by motor-cars during the greater part of year (1,370 miles metalled and 735 miles graded). They correspond to the departmental and communal roads in France and are naturally few and far between in the mountains of Tonkin and Upper Laos. but there are many more in the thickly populated palins and deltas,

## II. Methods of Circulation

In Asia goods are carried either on men's backs or in wheel-barrows or by means of light carts drawn in the north by men and in Cochin-China by horses.

These light carts and the rickshaws used by the natives have wheels with as a rule narrow tread so that they cut up the roads very badly.

Pedestrian traffic is very important, and utilizes more often than not the sides of the roads as the natives are usually bare-footed and prefer to avoid the rough highway. These long files of natives, men and women, each carrying a heterogenous assortment of packages slung from each end of a long flexible pole resting on their shoulder, form a very characteristic sight.

Europeans travel chiefly by motor-car. Besides the very numerous private cars in Cochin-China and the smaller but fast increasing number in Tonkin, there are various subsided car services running to points not yet connected up by railway. As already mentioned there is a daily service of cars covering the gap in the Trans-Indo-Chinese Railway and enabling travelers to cover by land the distance between Hanoï and Saïgon (in six days).

Tourist cars form the bulk of those using the roads, as heavy lorries are still rare.

## III. Planning and Constructing

All preliminary plans are made under the control of the engineer by native technical agents assisted by men who clear the ground.

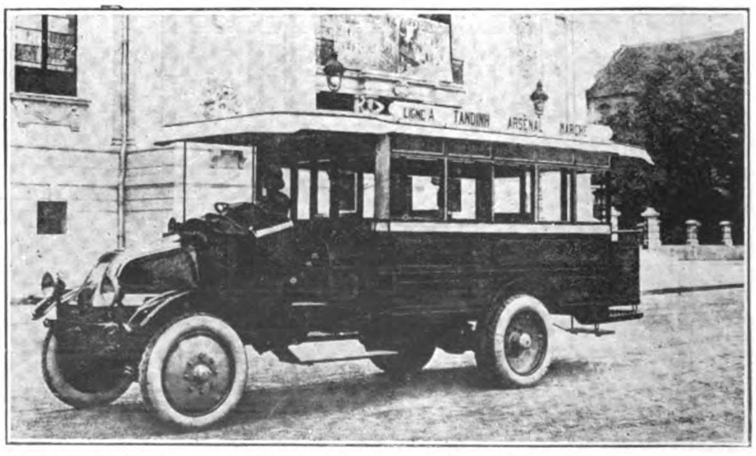
Unfortunately it was not always possible to acquire the necessary technical staff and it became sometimes necessary to enlarge existing native roads and paths without preliminary planning.

In 1902, a school of public works was opened in Hanoï, which furnishes a technical native staff who, though not sufficiently instructed to efficiently get out plans, yet perform good service after a few months' training on the ground. These agents can, under an engineer, replace the former European staff. This school also turns out native technical agents for the board of surveys.

Whatever may be the class of road, the work is carried out in the same manner.

### A. Grading and Building of Bridges, Etc.

The construction of part of a road is let by means of tenders based on a schedule. Contracts for a lump sum or in competition are not admissible. These contracts are regulated by the general and technical clauses and conditions as is usual in France. The contractor supplies all materials and carries out the whole of the work. As a rule a contract covers from six to twelve miles of road and these units have been determined by two conditions. On the

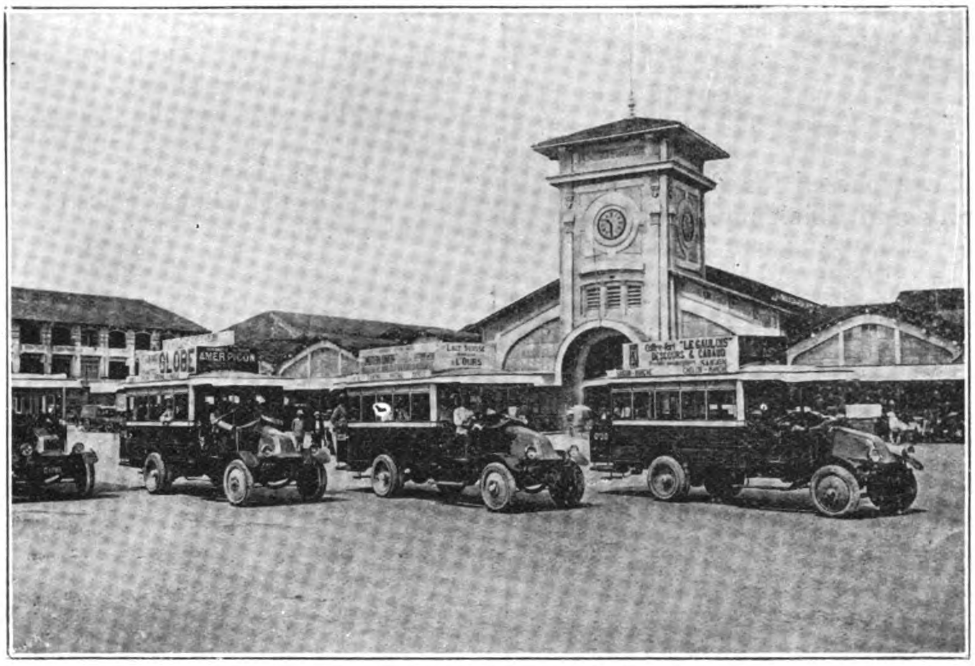


Bus Body Built at the Works of C. Perrin, Saigon: Renault Ageucy

too high and contractors would have hesitated before undertaking the work. On the other hand, if too large, it would have been one hand, if made too small, the general expenses would have been difficult to let the contracts as the contractors were more often than not natives, some of whom were of modest means and, although they efficiently ran their own small businesses, were not in a position to undertake a big job, and for this reason the choice of contractors would have been limited. Where the native contractor was well off, his business was often inefficiently run or sub-let to incapable Caïs (master workmen) or to smaller contractors, which would have introduced useless middlemen with attendant extra expense. Few Europeans are to be found among the contractors.

The road-bed is generally 16-ft. 6-in. wide except where from motives of economy or in mountain districts it was occasionally reduced to 14-ft. 9-in. or even 13-ft.

Most of the bridges are from 11-ft. 2-in. to 12-ft. 6-in. in width, including a path of 1-ft. 4-in. on either side. These are certainly somewhat narrow, but all those of a later type, which like some of the old ones are all constructed of armored concrete, can easily be widened later on.



**The Bus Terminal at the Central Market, Saigon**

These newer bridges are generally calculated according to the latest French official regulations and are able to carry the loads therein specified. This unhappily is not the case with the numerous older bridges and culverts which are often in metal; they will be, however, gradually replaced or encased in concrete.

### B. Metalling of New Roads

This is invariably carried out by schedule, and the metalling is laid without upright stones; the first lot is laid allowing for from 950 to 1,050 cubic yards per mile on a width of 9-ft. 10-in. to 13-ft. The stone used is often limestone or Bien-hoa stone (laterite) these being almost the only stones available in the deltas of Tonkin and Cochin-China. At the present time, however, stones of igneous origin, such as granite, quarzite and rhyolite, are being more and more utilized especially where the traffic is great, as limestone wears too rapidly. The camber of the roads had been diminished and is now from 1/80 to 1/100.

### C. Maintenance

The roads are maintained by roadmen working more and more in gangs, supplemented by special gangs to meet special cases.

Remetalling is carried out similarly to the original metalling allowing from 630 to 735 cubic yards of stone per mile.

For surface repairing more and more use is made of broken stone, laid without previous scarifying of the road, at the rate of from 85 to 105 cubic yards per mile.

The material is supplied by contract or by tenders; the actual mending is as a rule done by schedule.

In the mountain regions, where most of the roads with the exception of the colonial roads, are little more than tracks or paths, the maintenance is undertaken by the villagers to whom small subsidies are allowed where work in kind has been redeemed by the villages as is the case more particularly in Tonkin.

## IV. Machines Employed

These are confined almost exclusively to road-rollers. Diggers and excavating machines would be of little use as the cuttings are rarely deep and the difficulty of bringing such ponderous machines up to the working face would be practically insurmountable. Further the natives evince great repugnance to working with modern appliances and cases have even occurred of their flatly refusing to make use of the usual portable contractor's lines.

The public works department possess a very large number of hand rollers, weighing about $2\frac{1}{2}$ tons but as these wear out they are not renewed, but replaced by steam rollers of from four to ten tons of the usual French type.

This material is divided among the different countries as follows:

Steam-rollers of the following weights:

| In Tonkin. | In Cambodia. | In Cochin-China, |
|---|---|---|
| 1 of 5 tons | 1 of 3.5 tons | 9 under 6 tons |
| 3 of 6.3 ,, | 2 of 4 ,, | 7 from 6 to 9 tons |
| 6 ,, 6.5 ,, | 2 ,, 5 ,, | 5 of 9 tons over |
| 8 ,, 8 ,, | 7 ,, 7 ,, | —— |
| 2 ,, 9.5 ,, | 6 ,, 7.5 ,, | 21 |
| 2 ,, 10 ,, | 2 ,, 8 ,, | |
| —— | 2 ,, 9 ,, | |
| 22 | 3 ,, 10 ,, | |
| | 1 ,, 13 ,, | |
| | —— | |
| | 26 | |

| In Annam, | In Laos. |
|---|---|
| 5 of 4 tons | 7 of 5 tons |
| 4 ,, 5 ,, | In Dalat |
| 2 ,, 6.5 ,, | 1 of 4 tons |
| 3 ,, 7 ,, | 8 ,, 5 ,, |
| 1 ,, 9 ,, | —— |
| —— | 9 |
| 15 | |

Making 100 steam-rollers in all, only one of which is more than ten tons, all the others being comprised between four and ten tons.

The somewhat feeble weight of these rollers is necessary on account of the softness of the stone hitherto employed, but harder stone is being more and more introduced.

Besides the steam-rollers watering-carts of the usual French construction are employed.

This material has proved insufficient and the public works department proposes to acquire "Albaret" steam-rollers; as follows:

For Tonkin: 2 of from 8 to 12 tons; for Cochin-China: 1 of 4 and 4 of 5 tons; for Annam: 4 of 6 tons; for Cambodia: 4 of 8 tons and 2 of 10 tons; for Laos: 3 of 5 tons and for Dalat, 3 of 7 tons.

The department also possesses a stock of Decauville light railways of 50 and 60 cm gauge (1-ft. $7\frac{5}{8}$-in. to 1-ft. $11\frac{5}{8}$-in.) of which $7\frac{1}{2}$ miles are in Tonkin, $1\frac{1}{4}$ miles in Cochin-China, 5 miles in Annam, 67 miles in Cambodia, $64\frac{3}{4}$ miles in Laos and 28 miles in Dalat.

## V. Present State and Cost of Road-making

### 1. Colonial Roads

Ever since 1912 important credits for the making of colonial roads have been included in each of the general budgets. Out of a total sum of 51,500,000 piastres for which provision has been

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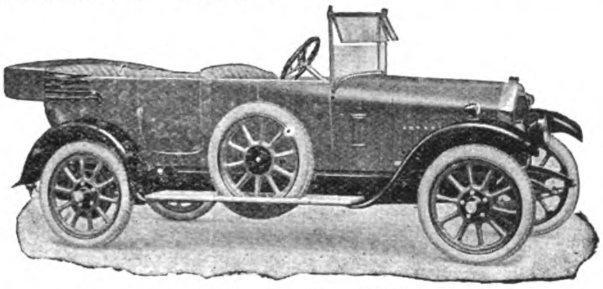

11.4 H.P. TOURING MODEL.

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| | | | |
|---|---|---|---|
| 8 H.P. Light Car ... | £275 | 11.4 H.P. Saloon ... | £625 |
| 11.4 H.P. 2-Seater ... | £510 | 11.4 H.P. All Weather | £650 |
| 11.4 H.P. 4-Seater ... | £525 | 15.9 H.P. 5-Seater ... | £750 |
| 11.4 H.P. Coupé ... | £615 | 15.9 Saloon ... ... | £985 |

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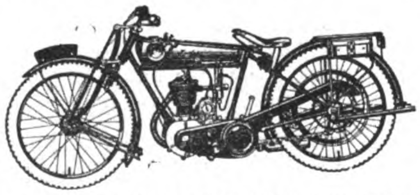
| 4¼ h.p. Flat Twin Sports Combination ... ... | £105 |
| 4¼ h.p. Flat Twin Touring Model ... ... ... | £99 |
| 4¼ h.p. Flat Twin Touring Combination ... | £120.10s. |



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made some 28,400,000 piastres have already been spent on new work. In these last nine years about 2,100 miles have been constructed and thus making the cost about 13,500 piastres per mile of colonial road; from 1912, when it was 8,300 piastres it attained 16,600 piastres in 1920.

Some 250 miles are built annually and as 2,857 miles out of 5,568 are already completed it will require another ten years to complete the present program.

Up to 1919 the local budgets paid for the upkeep of these roads, but now this is provided out of the general budget. In 1920 the 2,500 miles already in service cost 1,600,000 piastres making 640 piastres per mile. As may be expected this rate varies considerably in the various countries of the union; in Cochin-China where the motor traffic is very intense it is as high as 728 piastres, while the military roads of Upper Tonkin cost only 480 piastres per mile.

2. LOCAL ROADS

In 1920, 97 miles of new roads were metalled, and 207 miles simply graded. By the end of that year 3,604 miles had been metalled and 4,085 miles graded out of a total of 10,861 miles. The local budgets provided in that same year a sum of 2,075,760 piastres, of which 785,000 was for new work.

By the end of 1921 another 124 miles of local roads had been metalled, for which a provision of 2,375,000 piastres had been made, 1,100,000 for new work and 1,275,000 for upkeep. To these figures must be added 270,000 piastres in 1920 and 230,000 piastres in 1921 provided out of the general budget.

The average cost per mile of local roads which in 1912 varied between 5,760 and 6,560 piastres was in 1920 about 8,800; the cost per mile of upkeep amounted to 368 piastres.

## MOTOR ROADS IN JAPAN

*(Continued from page 350)*

bituminous macadam road then motor buss services will be inagurated. The Kobe-Osaka road will be built on the same basis and offers equal opportunity.

Of the present roads leading out of the six major cities, those in the neighborhood of Nagoya are the best with the southern roads out of Yokohama leading to Kamakura and Odawara, two very popular resorts and tourists' goals, a good second. It was found during the road survey by the writer that the best streets and roads were those over which, comparatively, traffic was light. In Kyoto and Nagoya, for instance, are many miles of wide, smooth dirt streets, but in both these places the number of motor vehicles are few, due principally to the negligence of distributors, a subject which is treated further in this report.

Aside from the Osaka-Kobe and Yokohama-Tokyo highways, the improvements in roads will most likely follow the present method of levelling and spreading river bed gravel and widening them to the prescribed width. This will encourage motoring, but such roads are not conducive to inter-city freight hauling, a movement, which, at the present time, seems remote, aside from the two sections mentioned where, most certainly, it will develope for great volumes of freight are carried between the cities to the sea, Yokohama being the harbor for Tokyo and Kobe for Osaka.

Summed up official Japan realizes the need of good roads and has started to get them. What is more important, however, is an awakening of the public consciousness on the subject and this can be brought about if an active good roads organization would conduct educational campaigns along the lines successfully followed in the United States. There is a good roads association in Tokyo known as "Doro Kairyo Kwai" with office at Marunouchi, Kojimachi. It is headed by Viscount Y. Shibusawa who is very much interested in all public improvements, and has a membership of about 300. The

secretary is Kakichi Uchida. Unfortunately it is not active and is not supported by the people who would benefit from the good roads movement, namely the road builders, road machinery companies, and automotive men. If the manufacturers represented in Japan could continue to emphasize on their distributers the value of their association with such an organization, benefits would surely follow. Such an organization could serve as the medium for the direction of road publicity in the press. The failure of automotive dealers to realize on this opportunity is an instance of their lack of appreciation of the requirements of progressive automotive distribution. Several of the firms which sell road machinery and materials have brought engineers to the country and they have done valuable work, but the task is so great, the co-ordination of all agencies is required.

## Obstacles to Auto Industry in Japan

WHEN the world hears of something that the Japanese cannot duplicate, and then make to sell at a profit, it has every reason for expressing surprise. So mild astonishment was registered when Y. Yamanaka, of Osaka, said that his people could not profitably manufacture automobiles. Mr. Yamanaka is the only manufacturer of automobiles in Japan. He came to Detroit recently to visit an automobile factory.

In the first place the problem of quantity production arose to confront the oriental maker. Here quantity of output appreciably brought down unit cost, in some instance reducing it to scarcely more than a nominal figure considering what was turned out. In Japan this was not possible unless an enormous sum of money was invested and several years taken to adopt to Japanese conditions some effective American system. Now, even at the low wage of labor, so many men in Japan have to be concentrated upon one job, aud kept on it until it is finished, that the unit represents a prohibitive excess of time and money.

Mr. Yamanaka pointed out that even with the additional import duty of 50 per cent., America could put a car down anywhere in Japan at a price so low that Japanese cars could not possibly compete. The government, instead of encouraging the native manufacturer does the reverse, and further handicaps them by the imposition of excise taxes. If the duty on foreign makes of cars was doubled, and the Japanese excise taxes maintained, imported machines would still have the best of it.

If Japan's market for cars was greater, it was contended, there might still be a chance for the native manufacturer because persistence is a national characteristic, and in time the government would be forced to make tax concessions. But there is little immediate chance of improvement taking place. Tax is imposed on gasoline to such an extent that prospective purchasers of cars are deterred. There are different general and local taxes, which combined with the cost of placing the fuel on the market make the wholesale price about four or five times greater than it is in the United States. Efforts have been made, and are being kept up, to force a lowering of gasoline taxes which now militate against ssles.

Highways and streets in Japan are generally in miserable shape. In the important tourist-visited places fairly good pavements are maintained, but in small towns, and in the country, most of the roads are impassable for the greater part of a year. American cars have the inside track, but their stiffest competition comes from the small European machines the gas consumption of which is claimed to be low. The thing that operates against them, however, is the difficulty of securing service and parts. With the American cars there is an interchangability and a definite service which outweighs all other arguments.—*Detroit Evening News.*

## Bamboo Roads in Burma

IN the Tavoy district, Lower Burma, the rainfall during the monsoon season is exceptionally heavy. In the middle of this season it was necessary to haul wolfram ore over ten miles of jungle road which the bull-cart traffic had reduced to a series of morasses or bogs. The road was first corduroyed which 3-inch and 4-inch saplings and these were covered with a few inches of laterite. In carting the laterite the few good portions of the road were badly cut up and the job was costing about $28.80 per 100 feet.

Bamboos of 2-inch diameter were split into four sections and laid longitudinally at 1-foot centres along the road. Similar quarter sticks were closely woven in sets of two across the longitudinal strips, two over and two under. The alternate longitudinals were held up while the cross pairs were put in and then tapped back into position. The contract for the road, including the rough leveling was let at $5.76 per 100 feet, and 100 coolies could cut and lay 1,000 feet per day. The hard, external part of the bamboo was always laid upward.

To split the bamboo, a rough cross is erected about three feet above the ground and against a firm wooden frame. The end of the bamboo is slightly split twice with a dah, and the four pieces are thrust through the angles of the cross with a good push.

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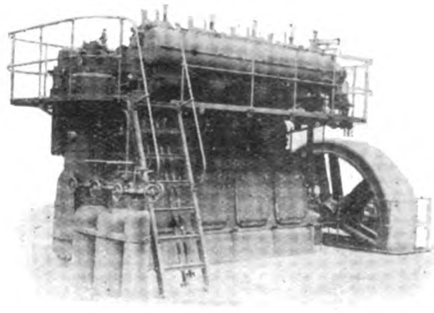

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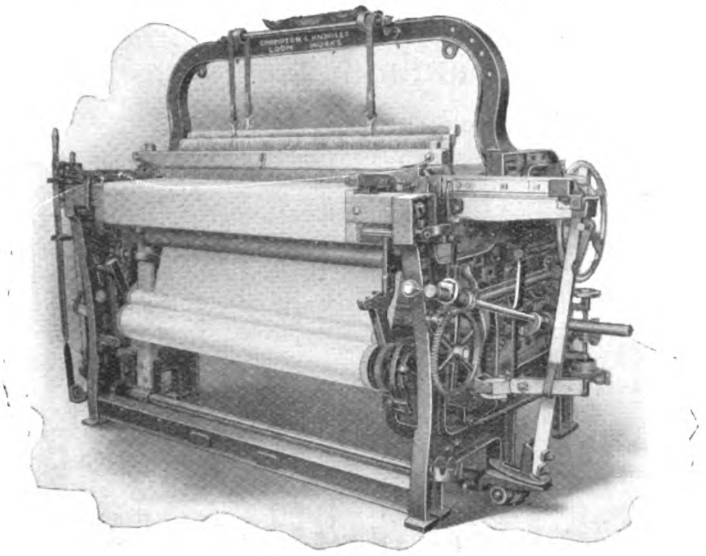


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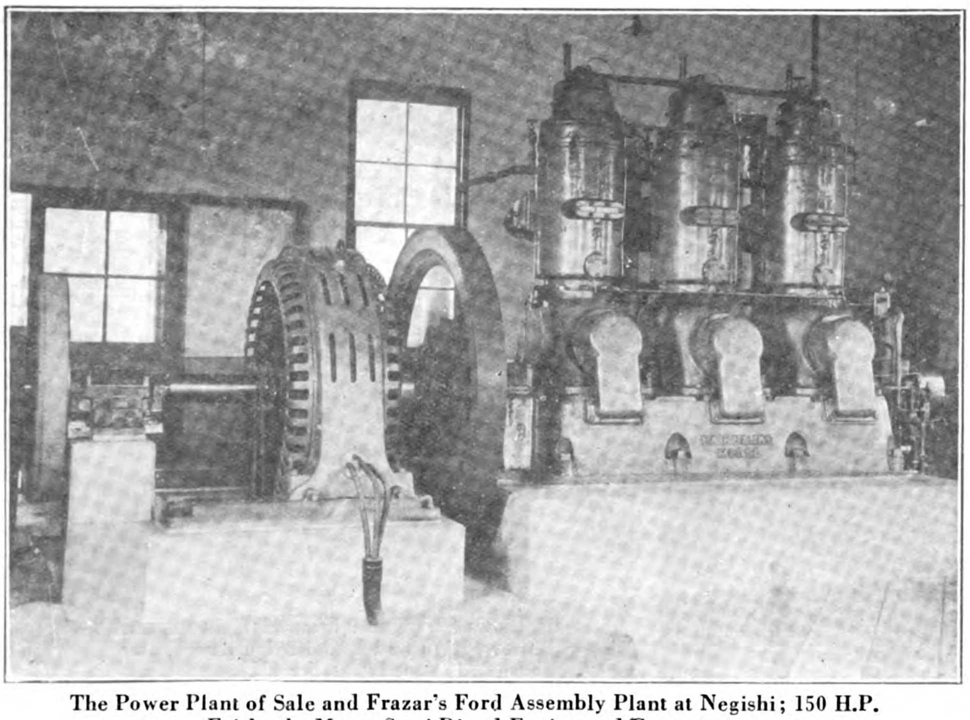


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AFTER LINCHENG, WHAT?

Vol. XIX June, 1923 No. 6

SHANGHAI, PEKING, TOKYO AND MANILA

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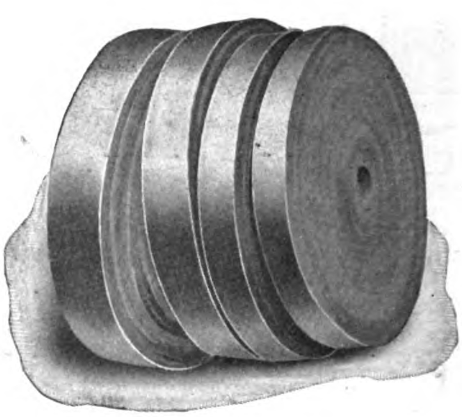

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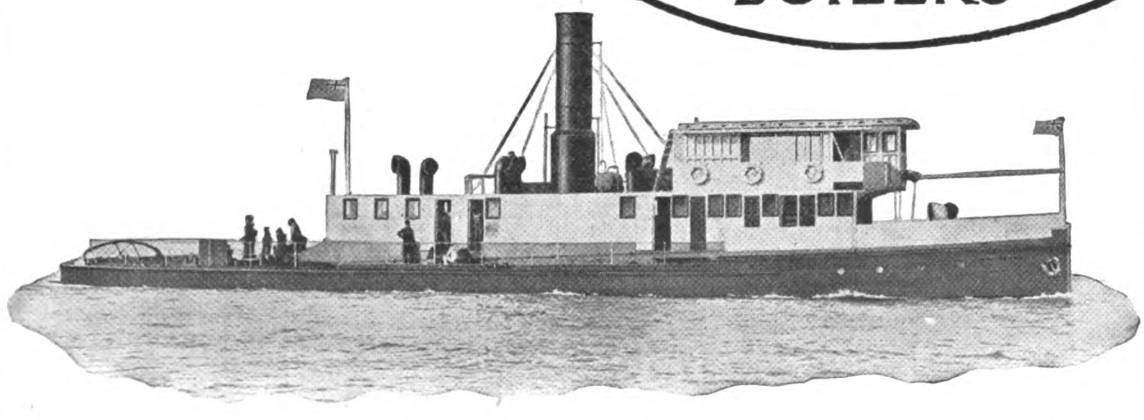

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, JUNE, 1923 No. 6

# After Lincheng, What?

*The North-China Daily News* voices the sentiment of every foreigner in China in asking " What Will Come of Lincheng " ? Down deep in our hearts echoes the answer, Nothing ! Yet something must be done or it will not be long before the gunboats will be rushing to save the lives of surviving foreigners in some interior treaty port. Unless the Chinese are impressed with the fact that they cannot violate the persons of foreigners with impunity, the decline of Western prestige in this country will date from the outrage on the Tientsin-Pukow express, in itself, the culmination of other serious outrages permitted to pass unpunished. Our opinions are so thoroughly in accord with our contemporary that we reproduce this timely editorial in full :

**" By the general tenour of the news from Tsaochuang, the captivity of the foreigners still in bandit hands should not last for many more days. Putting it plainly, the bandits are being bribed by enrollment in the army to release their prisoners and the bribing seems already to have begun. If the Chinese authorities prefer that way of settling the matter, that is their business. The main thing, for the moment, is to get the prisoners freed. But the satisfaction felt at the prospect of this wish being realized is damped by the extremely unsatisfactory state of affairs generally. It will be remembered that the diplomatic body informed the Chinese government that they had decided " to claim heavy progressive indemnities for every twenty-four hours' delay in the liberation of the captives beginning at midnight on May 12." It is clear that this threat frightened nobody in Peking ; and now it is open to question whether even this very feeble waggling of the big stick is not forgotten. Apart from it we have not heard one single definite expression of the diplomatic body's intentions to exact punishment for Lincheng and prevent its recurrence. Increasing apathy pervades the atmosphere. There is very serious danger that, once the captives are free, everybody will be so pleased that nothing more will be done. Be sure the Chinese officials are counting on this.**

**"Important as it is to free the captives, we emphasize at the risk of seeming callous—though we hope no one will accuse us of that —that this is a secondary matter compared with the overwhelming importance of bringing the Chinese ruling classes to a sense of their duty. As has frequently been pointed out, Lincheng is but the culmination of an increasing tendency to do violence to foreigners and their interests. If the wrecking of the Tientsin express goes unpunished, it is certain that we shall have something very much worse to record in a near future. The method actually used by the Chinese authorities to get the prisoners released is a direct encouragement to others to go and do likewise. On this occasion it has been a train wrecked and thirty-five foreigners carried off. Next time it will be some internal treaty port, very likely Hankow or Kiukiang, attacked and a whole community rapt away.**

**" There is much speculation as to who precisely instigated the bandits' outrage at Lincheng. That is certainly an interesting question and, if cleared up, might aid the foreign powers in exacting retribution, supposing they acted on it. What we would emphasize again is that, whoever the instigator, the circumstance itself is so bad and so serious that it calls for the most resolute handling. It springs from the anarchy and multiplication of petty chieftainships which is the curse of China to-day and the method of dealing with it and the utter feebleness of the foreign governments' attitude is a direct incentive to these evils.**

**It is perfectly useless to expect to remedy these conditions by representations to and pressure on Peking. Even if it had the will to improve matters, it has not the power. The root of all trouble is that there is not one government in China but eighteen. That is what the powers have persistently ignored, conspicuously so in the deplorable fatuities of the Washington conference, but also in all their dealings with this country, collectively and individually. This delusion must be knocked out of the minds of the chancelleries of Europe and America, and we look to the diplomatic body, reinforced as they are by the resolutions of the mass meetings in Shanghai and Hankow, to do it. We shall not get better government in China until the provincial authorities are hit at. To do so need not mean the spending of extra money. It merely means, for a commencement, using the foreign troops and naval forces that actually are in China, by parcelling them out among the treaty ports and provincial capitals most accessible by river or rail, with authority to use their power and hold the local magnates personally responsible, if necessary arresting them, in case of disorder and wrong-doing. And we are sure that nothing would so quickly induce the said magnates to become reconciled among themselves for the setting of China's house in order, which is the great desideratum to be sought for in the Lincheng affair. For the foreigner cannot intervene to create a government in China himself ; but he can put such unpleasant pressure on the Chinese officials as will compel them to create it. If Great Britain and America would come together and recognize the situation in China as it is, would frankly face the fact that by herself she will never become united and that a certain measure of coercion and tutelage is not only indispensible but would be welcomed with profound relief by millions of Chinese, would consider with an unbiassed mind whether such a policy might not be pursued with small expenditure, there could be no question that the other powers would heartily agree."**

Every virile foreigner in China irrespective of nationality will endorse these views and the sooner editorial and public opinion crystallyzes along these lines, the better it will be for all. There has been altogether too much gush and flub-dub over China ; too many divergent opinions of what should be done ; too many heroes ; too many negotiators ; too many seekers after publicity : in fact, too many fingers in the pie, to bring about any definite policy or action.

* * *

America and Great Britain, especially the former, must come to a decision as to whether their policies towards China are to be shaped by sentiment or trade, whether our missionary and educational interests are more important than business. This is a blunt way of putting it, but it is well to look the facts square in the face and see where we are heading. It may be said without undue exaggeration that every cent of profit on American trade with China is returned as a free gift for the uplift of its people. The trade returns prove this statement. The value of American exports to China in 1921 was Taels 176,000,000 and imports Taels 89,000,000 (of the latter about 40 per cent. passed through American firms) making a total of Taels 212,000,000 on which we may assume a five per cent. profit (as a matter of fact, most firms lost heavily) or Taels 10,600,000, approximately $7,500,000 gold. It is difficult to ascertain the total expended for the maintenance of missions, educational institutions, hospitals, christian associations, flood

and famine relief, endowments and other charities, but it is fair to take the annual contribution at somewhere near ten million dollars. And to this the thirty odd million gold owed to our bankers and merchants by the Chinese government, the advances for the construction of cotton mills and other enterprises now in default, pile on the losses incurred by the 300 odd American firms who swarmed into China and got stung, the wallop received by the banks on exchange, and it begins to look as though Americans were in business in China solely for the benefit of the Chinese. The maintenance of our charities alone equals the profits accruing from our trade, which in plain words says that our main business in China is to distribute these profits in uplift work, a huge industry in itself requiring a personnel almost as large as that employed in the legitimate machinery of commerce.

It is therefore natural that philanthropists, educators and missionary leaders should exert considerable influence in moulding our policy towards this country. They are prominent in every Far Eastern gathering where their views command attention. It is also fair to say that our millionaires are more interested in their charities and endowments than in trade or Chinese bonds, and it is easier to raise a million for establishing a college or a hospital than a hundred thousand for industrial development. It is quite possible, we have not the figures, that the aggregate property valuation of all missions, educational institutions, hospitals, and allied work exceed that of private American property. The valuation of the lands, buildings and equipment of the Rockefeller medical schools is nearly $8,000,000 gold. This important element has behind it the vast church organizations and if necessary, can exert a political pressure on Washington for the protection of its combined interests that no politician or statesmen would dare to ignore. A strong Chinese policy that would tend to open the eyes of Americans to the real state of China would materially affect the flow of voluntary contributions for general uplift work, undermine our principal industry in China and throw many Americans out of employment. The success of our major national undertaking in this country therefore depends upon the application of a policy of love, forgiveness and toleration of insults and violations of treaty rights. China's future depends entirely upon education and moral leadership and this can only be brought about by Christian universities. Every broad-minded man in the United States conversant with Chinese conditions agrees on this point, so our national policy must be shaped along lines that looks far into the future for any return on our capital outlay in trade profits.

Commenting on this policy, *The Central China Post* of Hankow, recently remarked :

**" the love adventure has been tried, consistently and to the uttermost limit, by a large body of most devoted people but with most disastrous results. We mentioned the other day how 137 Protestant missionaries had been massacred in Shansi in Boxer year, and nearly all of them held the same views. Here is one story :—**

**"During those troubles several families in that province remained unaccounted for. It was hoped they had been able to hide themselves so trustworthy Chinese, well supplied with money, were sent from this port to try and find them and help them out. Two of these messengers, a little way north of the Yellow river, one morning met a cart coming south in which there was one party, consisting of a missionary, his wife and two lady missionaries, who told them to keep on and go after another missing man. A little later, two men on horseback, armed with swords, passed them whom they took to be Boxers in pursuit of the cart. They therefore turned back and had not gone far before they found the bodies of the four missionaries tipped out on the road with their throats cut. It seems that when the Boxers overtook the cart they ordered the missionaries to dismount, and as they refused the murderers climbed into the cart and cut their throats like so many sheep, after which the carter emptied the bodies out."**

**" We knew that missionary. He was a hefty Scotsman who with a stick could easily have driven the Boxers off swords and all, but the principle of love for the Chinese prevented him from making any move in self-defence. The tree is known by its fruits, and how fruits of this kind can be commended is more than we can see."**

That sturdy Scotsman who meekly bared his throat to the slaughter and made no effort to defend the lives of the women under his protection is a true type. Death for their religion is a goal welcomed by many fanatics whose sacrifices are heralded far and wide throughout the churches of Christendom, memorials erected in their honor, their lives and deeds chronicled in a hundred church publications and their martyrdom handed down to posterity.

But these glorious sacrifices are entirely incompatible with the aspirations of those equally sturdy missionaries who look forward to some reward in this world for life work of advancing civilization and their country's interest through commerce. If love is to direct the relations between America and China, then the virile trader must expect the policy to work out in the long run exactly as it did in 1900 and as it is doing right now.

On the other hand, we have the policy of the group so closely allied with Peking that its sense of pure Americanism has become subordinated to its stipends or its dream of Sino-American cooperation. This element has influenced the shaping of American policy towards China for the past several years, contributing largely to the creation of the present intolerable situation by fulsome catering to Chinese opinion.

* * *

There is still another small but very active element which advocates exclusive American intervention in the affairs of China. Typical of their arguments is the nation-wide appeal of Mr. J. B. Powell, one of the Lincheng captives, through the columns of the *Chicago Tribune*, intended also as a personal appeal to President Harding : Mr. Powell says :

" Although we have no direct evidence we all feel in our hearts that all elements which have been fighting the Peking government are secretly using us as a further club to gain their private and selfish ends. Unless something is done we are likely to be held in these mountains for months until the whole country is unified and the politicians and militarists attain their selfish ends."

This undoubtedly, is a true explanation of the forces at work behind the long drawn out negotiatations and quite incompatible with his further deduction that

" without question international forces are a work here, which may throw China's four hundred millions into anarchy or a condition worse than that which now exists in Russia."

" These bandits as well as most of China's armies are armed with munitions supplied largely from the outside by foreign interests antagonistic to America—antagonistic because of our position of wealth, but, of more importance, antagonistic because of our democratic ideals and institutions which they do not like, which they hate, because the American idea of government by the people and for the people is spreading throughout the world and making imperialism a dangerous game everywhere."

" America took the lead in trying to settle China's external troubles at the Washington conference. *She forced Japan to return Shantung.* She has stood for the political, territorial and administrative integrity of China. America can come into China now with clean hands and help the right-minded members of China's population along the paths of advancement and world peace. America has gained the right to step in now and save China from—what ? "

It is difficult to understand just what is meant by international forces working in China to throw the country into anarchy and why most of China's armies should be equipped with arms and munitions by nations antagonistic to America and the spread of democratic ideals. The inference is either that the Soviet or Japan is behind the movement, and if the former, there is ample evidence to substantiate this surmise. There is no ground, however, for implicating Japan simply because some Japanese rifles are found in the hands of the bandits, any more than there is to assume that Italy is stirring up trouble for America because her nationals have sold arms to China, or that Denmark and Sweden are deep in the conspiracy because their manufacturers have supplied Chang Tso-lin with the machinery for the largest arsenal in China. The Japanese rifles may have been legally purchased by the Chinese government for arming its troops. Application of the same logic would also involve Americans who contributed to the supply of arms and munitions by furnishing the machinery for the arsenal at Canton. As long as China maintains several well-equipped arsenals manufacturing munitions and individuals can be found to smuggle military supplies into the country, these infractions of the arms embargo, will continue without reference to America's ideals or position of wealth. The attempt to make it appear that the bandits are armed by foreigners influenced by hatred of America and American institutions is fanatical and far-fetched and only helps to becloud the real issue. Banditry in China has no relation to any outside influence except insofar as it may be connected with the spread of Soviet doctrines and even in this, there is little evidence to connect the two unless we admit that the Soviet teachings are much more wide-spread in China than we have

been led to believe. If such a connection can be proved to exist then the time is not far distant when foreigners in this country may expect the worst and can prepare to pack up and depart while there is yet time. It must not be overlooked that there exist vast stores of rifles and munitions in Siberia, left behind by the various allied nations and which are finding their way into China through gun-runners who are not Russian or Japanese. As a matter of fact, the present chaos and utter disregard for the rights of foreigners has its roots firmly embedded in purely local conditions growing out of the spread of militarism having no relation to international forces. Once we touch upon the working of international forces in China all the great powers become equally involved and it would be just as easy to prove that British and American moral support to Wu Pei-fu or Sun Yat-sen is as much responsible for unsettled political conditions as alleged Japanese support to Chang Tso-lin or Tuan Chi-jui. Foreign meddling in the internal affairs of China which led to the original anti-Japanese movement and boycott, the ousting of Tuan Chi-jui and the Chang Tso-lin cabinets, culminating in another anti-Japanese campaign and boycott engineered from Peking, is as much to blame for the present deplorable situation as any story that might be concocted to prove that any other power or powers were at the bottom of the Lincheng outrage.

Public opinion throughout the world and in China can never be brought to an intelligent understanding of the real situation so long as innuendo, baseless accusations, distortion and misrepresentation of facts are permitted to pass as news. Nor can anything be accomplished so long as a campaign is carried on to make America the sole guardian of China, which, because of our lack of administrators familiar with the country, its peoples, their habits and customs, would resolve itself into a close corporation directed or advised by the advocates of the policy of love who for the past eight years have urged our taking over China's foreign obligations to the allies in part payment of their debt to us and defending her by force of arms. Under the guidance of this group, it would not be long before the United States would be railroaded into a war with Japan or some other power.

Nor can anything be accomplished by exclusive Anglo-American or Anglo-French American co-operation. The people of the United States would never consent to doing in Asia what they refused to do in Mexico, nor will the other powers sit quietly by and watch the extension of our Monroe doctrine across the Pacific by exclusive American intervention in the affairs of China, unless they were anxious to see us involved to an extent that we would become convinced that our place was at home—in Mexico and other Latin American countries which have defied Europe with impunity under the protecting wing of the Monroe doctrine. If the powers are really desirous of teaching us such a lesson, we may then conceive that they might acquiesce in our exclusive intervention in the affairs of China, or, if they desired to make us "lose face" with the Chinese, this is exactly the way they would go about it. For, it stands to reason that any one power which might send its troops to China and assume direction of the government in order to stabilize conditions, would be subjected to the same grilling propaganda as was formerly directed against Japan, when it was thought she might dominate the country. For the first few months perhaps, foreign opinion would warmly support exclusive American control, but as soon as the danger is past and it comes to reconstruction, every other national interest would have the knife as deep into us as they had it into Japan.

However, we will never get anywhere with all these conflicting opinions. In order to arrive at a definite program of sufficient efficacy some concrete idea such as proposed by the *North-China Daily News* must be accepted by all foreign interests as a basis for unanimous support. The handful of American and British troops now stationed throughout China is wholly inadequate to inspire the war-lords with respect for the object of their presence in the accessible treaty ports and provincial capitals. If a show of force is deemed essential to compel the *tuchuns* to compromise on a representative government, it will require more men than the scanty forces now stationed in North China. International intervention along these lines has never been successful wherever applied, and it would not be a success in China. The first thing to establish in China is a government by unification and then to do everything possible to help that government to function through constructive loans advanced by the consortium.

Dr. Sun Yat-sen may or may not be the man to lead a united China, but aside altogether from any question of his fitness, he is right when he says that the first step towards unification is the withdrawal of foreign recognition and support to the puppets of Wu Pei-fu. With the severance of diplomatic relations with Peking, it will not take long for the *tuchuns* to find some basis of compromise that will lead to a unified government that the powers can deal with. Until we have such a government all talk of reprisals, progressive indemnities and coercive measures is meaningless. America, Great Britain, France and Japan acting together in complete harmony can restore normal conditions in China. It cannot be done by any one foreign power or any combination of powers excluding Japan or by boosting any one war-lord because of his friendship for America and Great Britain or his leanings toward Japan. Continued recognition and support to Wu Pei-fu means an indefinite prolongation of civil war in China, the enrollment of new armies, the spread of banditry and further loss of foreign lives. When outrages upon foreigners are permitted to occur in the territory overrun by Wu's crack divisions and no attempt is made to suppress the bandit plague, can we hope for better conditions as other provinces are invaded and occupied by the same undisciplined hordes ? If the foreign powers continue to recognize and support a faction whose dictator boasts that he will not rest until the country is unified by the sword, then all we have to say is that any American or Briton who takes his chance in the interior after Lincheng, does so with his eyes full open. If he pays the penalty, he will go to his death with the knowledge that he is a victim of the policy of love which has placed a halo around the head of the Wu Pei-fu and acquiesces in any outrages committed under his jurisdiction as necessary to the triumph of the "Savior of China." Let there be an end to international jealousies and a coming together of all powers in some constructive program which will compel unification without further civil strife. Let the Chinese settle their political differences in their own way and compromise on a leader and then let foreigners keep their hands off while a new system of government is being hammered into shape. This can only be brought about by strict neutrality and withdrawal of support and recognition to any one faction.

# The Silence of the Samurai

## A Contrast

IT was to be expected that the dyed-in-the-wool anti-Japanese element would seek to throw the blame for the Lincheng outrage upon Japan, either directly, or indirectly, through the Anfu party or Chang Tso-lin's agents alleged to be in her pay. The original story from Pao Tsu-ku that the bandits were mainly armed with rifles bearing Japanese marks provided the key-note for the flood of stories which followed. No Japanese were aboard the train when it was captured : *ergo*, the Japanese were warned beforehand by their consuls ; the Japanese militarists in league with the Anfu clique instigated the outrage in order to discredit the Wu Pei-fu government : Liang Shih-yi and Yeh Kung-cho from the safe confines of Hongkong—enemies of the present Peking cabinet and friendly to Japan—prepared the plot : international forces (meaning Japan) are at work to plunge China into chaos and precipitate intervention : Japan's seeming indifference to the fate of the prisoners

is evidence that she has something up her sleeve : America is getting too strong in China, hence Japan is arming the bandits in order to undermine American influence, etc. etc. etc.

Let us admit for the sake of argument (although there is not the slightest evidence on which to base the assumption) that some Japanese adventurers may have been mixed up in some way with the Lincheng affair. That does not implicate the Japanese government or the Japanese militarists any more than the American government can be held responsible for the acts of its citizens found participating in nearly every Latin-American revolution as leaders, soldiers, gun-runners or sitting in the background as financiers. As a matter of fact, American filibustering and meddling with the internal affairs of Latin-America is accepted as quite the proper thing. Historical works, novels and moving pictures galore immortalize these high-minded soldiers of fortune spreading the American idea of fair play and political principles. In each and every case they are heroes.

At the present time, American, British, Japanese and other foreign soldiers of fortune are to be found in the armies of Wu Pei-fu, Chang Tso-lin and Sun Yat-sen (only recently one of Chang's emmissaries was in Manila on a recruiting mission) but they are there in the full exercise of their individual rights as private citizens over whose actions their governments have absolutely no control. Even if Japanese adventurers are found in the ranks of the Shantung and Honan bandits and these gentry are armed in part with Japanese-made rifles, the Japanese government or its military authorities cannot be held responsible any more than the American government can be called to account for the activities of its citizens prominent in nearly every Latin-American upheaval. Has not the Chinese government purchased large quantities of rifles from Japan in the past decade? Who will say that the Japanese arms carried by the Linchang bandits were not part of these official importations, or who will dare assert that contraband arms traffic is an exclusive monopoly of any one set of nationals? Unless our information is grossly misleading, the most recent gun-running activities were carried out by Americans.

Many bad American *hombres* are enrolled in the outlaw gangs of Mexico: there are equally bad subjects of Japan to be found amongst the Hunghutzes that scourge Manchuria and Mongolia, though it may well be, that some of these men have been detailed by the Japanese army authorities to this dangerous life. We have personal knowledge of Americans who enlisted in Latin-American bandit or revolutionary bands—there is no difference between them—in order that accurate information of their movements and plans might be communicated to our military intelligence system. These things are done, but the man detailed to such hazardous work must accept the consequences without calling on his government for protection if captured. Before the law he is a bandit. If caught, he pays the penalty for his patriotism, exactly the same as a military intelligence officer when captured by the enemy in war-time.

However, Japan is not interested in stirring up strife in China or in taking sides with any one faction or of bringing about foreign armed intervention. Her actions have proved this. She honestly desires and is willing to sacrifice much for peace, harmony, co-operation and friendly trade relations with her big neighbor, and to prove her sincerity is exhibiting a patience no western people are capable of under such severe provocation. Japan has her Coltman cases by the score in Manchuria ; she has seen her people murdered, plundered and carried off for ransom ; her officials insulted and shot down by the Chinese authorities and the Hunghustzes ; in fact, she has passed through exactly the same experience in Manchuria and Mongolia that America did in Mexico, and aside from the parallel case where she sent her troops into Chientao, has refrained from any punitive expedition which might be interpreted as a cloak to hide imperialistic designs. In the aggregate, Japanese have suffered more at the hands of the Chinese than all other foreigners combined and should her nationals set up the same clamor for armed intervention heard on all sides from Americans and Britons over the Lincheng incident, she would be equally justified in acting on her own initiative by dispatching an army to occupy treaty ports and provincial capitals until indemnities are exacted and guarantees forthcoming that her subjects will be protected in their treaty rights. If the occupation of Northern Saghalien by Japanese troops pending a settlement of the Nicolaievsk massacre is excusable, then events could be made to equally justify similar action in this country.

Japan has many grievances against China but even under the most powerful incentives, is refraining from any act which might develop into armed intervention. How long her patience will hold is problematical, but for the present she staunchly upholds the principle of non-intervention, lending the weight of her influence against sending foreign troops into Shantung to liberate the Lincheng captives. Japan is adhering strictly to the example set by the United States in her treatment of Mexico, refusing to use force on a weaker neighbor whose government has been destroyed and usurped by bandits and military dictators. Whether such a policy is justified or not is difficult to say, but as far as America is concerned, instead of creating an enemy of her neighbor and incurring the suspicion of every Latin-American country, we retain their friendship and confidence. It required a strong will to withstand the powerful pressure of an outraged public opinion clamoring for punitive expeditions, seizure of ports and custom houses as guarantees that American lives and properties would be respected; but rightly or wrongly, the administration pursued its policy of watchful waiting during a period of world upheaval and now that a stable government is again in power, Mexico will be called upon to square accounts in a peaceful manner. The United States has not lost the friendship of Latin-America. Our example during those years of extreme provocation acted as a deterrent upon Japan, and had we gone into Mexico on the wave of popular clamor, the old Japanese military party would have found sufficient pretexts for applying similar pressure upon China. China is intact to-day because President Wilson laid down a precedent in international morality that Japan closely followed and with a change of policy and cabinets, Japan is now determined by all peaceful means consistent with her honor and dignity to regain the confidence of China.

To Japan's many grievances against China is now added a violent and wholly irrational boycott set in motion by the students over the Kwantung lease. Starting in Peking with the connivance of the authorities, backed by Wu Pei-fu who instructed the *tuchun* of Hupeh not to oppose " the will of the people," the movement has made rapid headway in the upper Yangtze ports. At Ichang, the students attempted to prevent the unloading of freight from a Japanese steamer, calling for the landing of marines from a Japanese gunboat. The same scenes were enacted in Shasi while in Hankow every method of insulting the Japanese was adopted. In carrying out the same tactics in Changsha the marines from a Japanese warship were landed to protect their nationals. Assailed by a shower of stones the marines fired into the crowd killing three and wounding others. The Peking government which made no effort to interfere with the " will of the people " immediately lodged a protest with Tokyo demanding apologies and indemnities. So here we have another major incident between China and Japan on a par with Lincheng. If the latter calls for exclusive American and British intervention, Changsha may likewise call for separate action on the part of Japan.

Japan has meekly submitted for the past several years to the most bitter and unfair propaganda the world has ever witnessed, a propaganda directed and paid for by the Peking government having for its object the discrediting and isolation of Japan and of inciting hostilities with America. The original Japanese boycott with its aftermath of anti-Japanese activities ; the campaign against the Anglo-Japanese alliance ; the recent movement and boycott can all be traced to the initiative and direction of individuals in the pay of the Peking government. During the past month the British government has protested vigorously to Moscow and threatened reprisals if the Bolschevist propaganda in Afghanistan is not discontinued forthwith. We have yet to learn that Japan has presented any official protest to Peking against a propaganda carried on with its full approval by paid advisers or that she has threatened reprisals.

At the bottom of the present boycott and student agitation is Japan's refusal to surrender the Liaotung peninsula at the expiration of the original lease to Russia expiring in March of this year, standing on the validity of the 1915 tresty which China denounces as null and void. In answer to China's note demanding the return of the territory, instead of ignoring its contents, Japan explained her position at considerable length, intentionally refraining from opening old sores by digging up past history which would injure China in the eyes of the world.

Japan made no mention in her reply to the existence of China's secret alliance of 1896 with Russia which brought on the war of 1904-05 : she refrained from inviting attention to the weighty fact

that China was a full ally of Russia during the progress of the war: that the terms of the alliance were maintained in such profound secrecy that at Portsmouth China escaped paying her full share of the indemnity and even had her sovereignty restored over the lost three eastern provinces. Japan did not mention the terrible sacrifice she was compelled to make for China's perfidy or the subsequent burdens imposed upon her people in order to be constantly prepared to meet Russia's program for a war of revenge. Japan did not remind China that she came out of the war as the real beneficiary, in fact, with great self-control the Japanese government declined to make public her full case against China. Whatever the reason for this silence, Japan once more placed on record her desire to remain on cordial terms with her neighbor. Other powers bent on aggression, with much less provocation would have accepted China's note as a challenge, severed diplomatic relations forthwith and prepared for hostilities. Had Japan done this and placed her full case before the world, going back to the causes which compelled her to re-enter Kwantung, and the price she paid for China's intrigues with Russia, public opinion would have supported and applauded her position.

Maintained in complete ignorance of these basic facts, the Chinese could not recognize the magnanimity of Japan's conduct and initiated another boycott in retaliation. Curiously enough, however, it is a boycott which works one way only. Chinese merchants refuse to purchase or display Japanese goods but are only glad to sell their products to Japan. If Japan should retaliate by boycotting Chinese raw materials and purchase her requirements in other markets, the shoe would be on the other foot. Perhaps this attitude of China is one reason why Japan is anxious to resume trade relations with Russia which may lead to other far-reaching understandings in regard to their political rights in Eastern Asia.

The attitude of Japan towards China since the Paris peace conference has been consistent, open, honorable and sympathetic. She has sacrificed her advantages and surrendered her special privileges, standing squarely on the doctrine of equal opportunity and respect for the sovereignty of China, while Russia has again annexed Mongolia, closed the door to other nations and is fortifying her position against another forward movement. Not a word is heard about Russian aggression. Chinese and Russians fraternize, inter-marry and are great comrades. Yet after all that has gone before, China asks Japan to get out of Kwantung and surrender the one strategic guarantee for their mutual safety in these regions. Because Japan declines to be moved by sentiment and insists upon protecting her vital interests, the boycott machinery is set in motion to destroy her trade and make impossible the presence of her nationals in the interior. The fat is now in the fire over the Changsha incident, yet we hear no roar for armed intervention from Japanese subjects, no demands that Japan take upon herself the exclusive task of restoring order or coercing the Peking government. There is nothing but the silence of the Samurai, the patience of a proud spirited fighting people secure in their strength and so sure of the justice of their position that they can afford to wait and watch in the certainty that time will justify their policies and convince the Chinese of the error of their ways.

# The Tail of the Dog

## Sidelights on the Origin and Impulses Behind the Opposition in China to American Co-operation with Japan

### *Responsibility for China's Reckless Disregard for Foreign Treaty Rights*

*Americans shall not co-operate with Japan: Americans shall not lend money to Japan: Americans at home shall not enter into any arrangement with Japanese that might conflict with the business of Americans in China.*

Adherance to these commandments has been a fundamental essential to the good standing of Americans with their compatriots in China. If by any chance an American could be found who honestly held opposite views, or worse still, had the temerity to actually violate this law, he was singled out for punishment through business boycotts and libellous aspersions on his character and patriotism. It was easy enough under the last administration to establish and consolidate the rule of this minority and intimidate the majority into endorsing its opinions; the real anti-Japanese leaders were at that time placed in high positions and any fifty per cent. hyphenate could join in the procession and abuse the "traitors" who refused to tag along and engage in the merry pastime of throwing bricks at the Japanese. The tail then thought it was wagging the dog and the "Jap-slappers" screamed with glee at the wonderful exhibition of their political power. But the dog grew tired of being goaded into a fight with Japan. The anti-Japanese statesmen of the Wilson regimé gave place to a new trinity of brains which insisted upon doing its own thinking and communicating its will to the caudal appendage. The tail no longer moves the dog. Independent Americans at home have rebelled against the system of intimidation directed from Peking and Shanghai demanding unconditional allegiance to China in all international questions, thrown overboard the professional agitators and paid trouble-makers and put an end to their favorite indoor sport of hammering Japan.

One prominent Far Eastern society noted in the past for its anti-Japanese propaganda has emancipated itself from the domination of the Chinafied-American clique and intends to run its affairs in the future on a solid American platform. The tables are being turned. The war-yappers of three years ago are now charged with being unpatriotic. Congressman Leonidas Dyer has delivered another speech, this time before the foreign trade board of the Seattle chamber of commerce in which he scathingly denounced those American papers and Americans showing an unfriendly attitude towards Japan, as "*traitors to the United States.*" Although there have been signs that these rumblings had been heard in China, recent occurrences indicate that the tail still cherishes the illusion that it retains its power to wag the dog.

This anomalous situation was accentuated by the commotion raised in China over the National City Bank loan to the Japanese Oriental Development Company. The interpretation placed on the American motives in negotiating the loan by the leading foreign mouthpiece of the Peking authorities, constituted a direct insult to the American government and our bankers, and, taken in connection with the equally grave accusation against the American group, and by innuendo, the state department, contained in a Shanghai newspaper comment on the same loan, should be of sufficient importance to lead thoughtful Americans to inquire into the origins and motives of a campaign, which, on analysis, tends towards the monopolization of American financial co-operation in the Far East in just one direction. Instead of any motion being made to condemn these aspersions on the good-faith of the American government or its financial instruments in carrying out its policy in China, we find Americans endorsing the insult in resolutions strengthening the hands of the professional trouble-makers by reiterating the doctrine that all American loans should be made through purely American firms and carry the proviso that all materials be purchased in America. This basic doctrine already guides our state department and financiers in every case where the principle can be safely applied. In view, however, of the tendency of our bankers to follow the pre-war precedent of France in lending money to foreign governments and enterprises without adequate protection to the basic industries of the nation, the reiteration of the principle at this time was not wholly unwarranted. Such resolutions may not be directly aimed at the National City Bank, but the negotiation of the Oriental Development loan forced their passage with the hope it would be taken as a warning against the flotation of other similar loans for the development of Japanese enterprises on the Asiatic mainland.

The American papers of April 28 corroborate our own infor-

mation that the protests against American loans to Japanese companies originated in the American chamber of commerce at Harbin and although it is understood that such resolutions are not for publication, we find they were telegraphed through the associated press service to the United States. The Harbin chamber not only remonstrated against the National City loan to the Oriental Development Company, but cabled a further protest to Washington against the granting of a $10,000,000 loan to the South Manchuria Railway Company because it would "be inimical to the open door in Manchuria and Mongolia." We make just one observation on this attitude. The protest of the Harbin American chamber of commerce was telegraphed to the American press on April 27. On April 29, the leading newspapers in the country printed the official summary of the protocol signed on February 22 between the representatives of Moscow and Urga, which for all practical purposes annexes Outer Mongolia to Moscow, and hands over to Russians a monopoly of its trade. Yet Americans doing business in Harbin raged, tore their hair and invited their compatriots in other parts of China to rage with them over an American loan to the Japanese which *might* be inimical to the open door, while their Bolshevist friends kick them out of Mongolia bag and baggage. Americans in China lose sight of the fact that international recognition of Mongolia as an integral part of the Chinese republic is one of the cardinal principles rigorously imposed in the consortium pact in order to exclude Japan from any special or preferential rights in these regions. Under these conditions, or until Americans in Harbin and elsewhere in China, protest against the dismemberment of China by Russian occupation of any part of Mongolia, they are exposing themselves to the grave charge of inciting hatred against Japan and of aiding and abetting a movement which in the end will place Russia in a favorable position to attack Japan on her unguarded flank and pave the way for the complete realization of the Soviet dream in Eastern Asia. Not a word was heard about the implied insult to the state department or our financiers ; not a thought given to recent treaties or understandings which brings Japan in line with America on all questions affecting China ; not a note of warning on the direful consequences of Russia's re-occupation of Mongolia and the possibility of another war in that quarter of the world in which Japan will have to fight for her national existence ; no recollection that British loans to Japan established her position in Manchuria by the reconstruction of the South Manchuria Railway; no recognition of the fact that it was Japanese money, brains and enterprise which developed Manchuria and made it the foremost market for American materials in Asia : all these are overlooked in a blind, unreasoning antagonism to Japan and a sentimental friendship for the Soviet, which, when the times arrives to show its hand, will reward Americans in the same manner as it has treated other traders who have consented to be its catspaws. This may be good Americanism, but it is out of date.

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The stream of gold flowing into the United States from abroad added to the huge surplus derived from home investments, sooner or later, must create a situation where bond-buyers will be less and less influenced by patriotic impulses. There is little patriotism at any time to capital in the mass when seeking profits, and the natural tendency in the future will be towards negotiating foreign loans or purchasing the bonds of foreign enterprises strictly on their merits as income producers. It will be as difficult in America as it formerly was in England and France to enforce the purchase of materials in a loan agreement which otherwise might be a most desirable investment. Experience teaches us that without stringent governmental supervision over foreign loans, the investor will react favorably towards those bonds which gives the highest guaranteed returns. It is not essential that these guarantees be endorsed by the state department or that the loan itself receive its sanction, as experience has taught the American investor that official support to a foreign loan carries no obligation on the part of the government to protect his investment.

This tendency of human nature, both in England and France, led to a very formidable movement on the part of the manufacturers in both countries to have inserted in all future foreign industrial and development loans, a clause providing for preference to British and French materials. The latter, especially, were exceedingly wroth over the fact that the Chinese railways had been financed up to fifty per cent. and over by French bondholders, while the industries of the nation had not benefited one *sou* by the purchase of their products. It was not that the French bankers were unpatriotic, but that France itself had reached that pinnacle of prosperity where it became difficult to reinvest the annual increment that rolled into her coffers from all parts of the world in enterprises that would benefit her manufacturing industries. To such an extent was it necessary for France to find profitable outlets for her surplus capital, that banking superceded manufacturing as the chief industry of the nation. Under such conditions, it was not always judicious to hold out for the purchase of French materials and defeat a profitable loan transaction for the benefit of the major national industry.

The same conditions may be said to exist in the United States. It is now most difficult to profitably reinvest all our great wealth at home and with the yearly accumulation of capital America will be handicapped to find acceptable outlets abroad if every loan agreement is to embrace provisions for the purchase of American equipment. Furthermore, if other nations are to pay their war and other debts in gold and in each new accommodation obliged to purchase American materials, their power of recuperation and ability to repay will become more and more circumscribed. The principle that American loans shall be made exclusively through American firms and carry with them the purchase of our materials, is fundamentally sound, but extremely difficult to apply. Insistence upon this point must inevitably lead to connivance on the part of bond-buyers with the borrowers to evade the principle and if governmental supervision becomes so strict as to keep such issues off the open market, the loans will be made by private subscription and without governmental support. If the bonds cannot be purchased in the American market they will be subscribed for and held abroad by the agents of the investors. In other words, we cannot have our cake and eat it too ; we cannot garner the profits coming and going. If the accumulation of gold becomes so great that it cannot find profitable employment at home, it must be sent abroad ; in which case, occasions will arise where such investments must stand squarely on their own merits without provisions for purchasing American equipment and without the official support of the government.

In backward or non-manufacturing countries, the principle should be applied as far as possible, but at the same time, we should first make certain that our government will actively protect the bond-holder in case of default. In the case of China, there is no guarantee to the American investor that his government will support him in taking forcible steps to foreclose on the security in the event of default or repudiation while the extension of this policy to other nations has acted as a deterrent in protecting their Chinese investments. One of the principal appeals of the consortium to American bankers is the implied assurance that its loans to China will be guaranteed by a combination of four powers : eliminate this international guarantee and there is no inducement for the American investor to purchase Chinese government bonds. American money will not flow into China under present conditions unless sufficiently protected, hence, there is every good reason why the investor should subscribe to a bond fully guaranteed as to principal and interest by the Japanese, British, or any other government, a guarantee that his own government cannot be expected to give. Once we accept the signature of Japan to a solemn treaty affirming that she has no special rights in China, that she stands squarely on the principle of equal opportunity and respect for the integrity and sovereignty of this country, a loan for the development of Manchuria guaranteed by the Japanese government, becomes one of the most desirable investments that could be offered to the public. The policy of American loans to China through exclusive American firms or through the consortium is apparently losing favor even in official American circles, as we are informed through the Asiatic News Agency under date of June 1, that the American commercial attaché at Peking has invited the Chinese bankers' association and prominent business-men to send representatives to the United States to establish connections with American bankers and business-men who are interested in the development of China's resources. This invitation, we are informed, is now under the careful consideration of the Chinese bankers, who have been led to believe that there are twenty or thirty million gold dollars available from American investors for the successful development of agricultural and industrial resources of the three Manchurian provinces as well as in certain parts of China proper through Sino-American or Sino-American-Japanese co-operation in the future. "Manchuria is

Chinese territory, but it is believed no important industry can be successfully developed there without Japanese co-operation." No matter what may be behind this piece of news, it indicates that the commerce department does not endorse the exclusive principle of American loans through American concerns. If such a course is desirable, then the question of guarantees remains as strong as ever, as Sino-American co-operation for the development of Manchuria will carry little weight with the investor unless participation is extended to Japan. This triangular working arrangement is a very worthy and sensible one.

It will be seen, therefore, that although the principle of American loans through American firms accompanied with suitable guarantees is fundamentally sound, there exist conditions which militate against its application in all instances, and in view of the sentiment against co-operation with Japan, Americans should be extremely careful to avoid converting the doctrine into a unilateral working agreement which deprives all countries other than Great Britain of the benefit arising from our co-operation.

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For this is exactly how the doctrine is working out in its application to China. American co-operation with Japan is loudly condemned by the policy-makers of Peking and Shanghai, yet a little investigation will disclose that the opposition in large part can be traced to Americans so closely identified with British enterprises that it is difficult to determine where the interests of one begins and the other ends. In making this statement we do not wish to be interpreted as being unfriendly to Anglo-American co-operation. Far from it. We hold that the best interests of both peoples and of the world at large will be materially benefitted by the closest understanding between America and Great Britain. Co-operation between these two great nations is the natural outcome to the ties of blood, language and ideals which bind them together, and though at times their material interests may come into conflict, in the end both people can be depended upon to settle their differences with a hearty hand shake. Anglo-American co-operation has been brought to its present working perfection through close commercial relations and joint business responsibilities. It is only by doing business with a man that we learn to understand, respect and make a friend of him.

America and Great Britain, the one a republic and the other an empire, can never arrive at a complete understanding on all world issues. The policies of both governments are based on diametrically opposed basic conditions and not until America reaches that stage in her national development where she must rely on foreign markets for her national existence, colonies for her surplus population and fields for the profitable investment of her surplus capital, will she be able to see eye to eye with Great Britain on larger world issues. British foreign policy is deeply rooted in the dire necessity of the nation to find markets for its manufactured products in order to assure its food supply, a necessity which precludes any undue manifestation of sentiment in dealing with backward peoples: America, self-sufficient and self-contained, faces no such vital problems and can view world affairs from a philanthropic standpoint and make concessions to ideals that would spell disaster for Great Britain. It will be many years before the masses of America fully appreciate and sympathize with the vital problems confronting the British in their struggle for existence. Notwithstanding this fundamental difference in their outlook on world affairs, business relations between the two peoples have become so intimate that the most cordial understanding and co-operation exists, but there are and always will be, occasions when the material interests of both nations will clash. It is to be hoped that such competition will always be friendly and the loser take his medicine like a good sport, and while this much to be desired result is possible at home amongst broad-minded leaders, it is difficult to expect it to prevail on the firing line of the great struggle for trade supremacy in Eastern Asia, where the merchants of both nations are in keen competition for the advancement of their respective national interests. Politically, Anglo-American co-operation in China is highly desirable and to a large extent this is also true of finance and business, but it is unwise to attempt to convert the principle into a doctrine which discriminates against other nations at a time when the whole world looks to America for financial relief.

Anglo-American business co-operation in China is of such long standing that it cannot be uprooted even if such a movement was launched. American manufacturers in the past have been compelled to rely largely upon foreign concerns to act as their agents in this country, and even to-day, there are many British concerns successfully representing American manufacturers and loyally pushing the sale of their products. The limited number of purely American concerns in China equipped to represent American machinery manufacturers without taking up competing lines, still makes it necessary for foreign firms to handle our products. Such co-operation is most desirable and although it may not meet with unanimous American approval, existing conditions will compel the continuance of such methods until American manufacturers have their own offices and representatives on the ground. Although such co-operation in the past has in a large measure been Anglo-American, there are instances where Japanese firms have ably represented and pushed the sale of American products. If we take the case of the Mitsui Bussan Kaisha, representing the American Locomotive Company and other American railway specialties, it must be acknowledged that their success has been phenomenal, as every Japanese built or controlled railway in China is equipped throughout with American materials; the Japanese doing for our manufacturers what we were never able to do for ourselves. If Anglo-American co-operation in China guaged by the amount of business done, is so desirable, then the record set by Mitsui & Company is an unanswerable argument for closer Japanese-American co-operation, as their sales in American railway materials alone overtop in value the business of all other foreign agents of American manufacturers. Without advancing an argument against British representation of American manufacturers, it is our duty to point out that in the major lines of manufactured products, notably in the engineering trade, the British are our keenest and most formidable rivals, and in the past, have invariably insisted upon their own materials being specified and purchased for any railway or industrial enterprise carried out with their money. It is safe to say that American materials will never be purchased to equip any undertaking financed by the British. This is as it should be. Britain needs every export opportunity she can create; it is vital to her economic life.

On the other hand, experience has proven that in Japan, Korea, Formosa, Shantung, Manchuria, and in other parts of China where the Japanese have gone, they invariably favor American equipment, and although the orders may not be placed through American trading firms on the ground, our manufacturers reap the profits from the orders placed through Japanese firms in New York. In this respect, the Japanese have done more to advance American engineering practice in China and swell the value and volume of our imports than any other nation, yet we have never loaned them one cent for development purposes. In fact, our success is due in the first instance to a British loan to Japan for the South Manchuria Railway which they expended in the United States. At least $75,000,000 (gold) has been since expended by the South Manchuria Railway and its allied industrial concerns for American materials, equivalent to the total value of all foreign equipment supplied in the construction of Chinese government railways, in return for which, other nations had to furnish loans aggregating $150,000,000 gold. In other words, without advancing one cent, American manufacturers have benefitted through Japanese purchases of their products in Manchuria alone to the same extent as their European competitors who lent the funds to China to create a market for their products. What is true in Manchuria, is true in Korea, where the trunk railway has been Americanized and industries equipped with American machinery. It was true in Shantung under Japanese occupation for out of $10,000,000 expended for railway material, about $4,000,000 went for American equipment. Had the Japanese finished the construction of the Kiangsi Railway, it would also have been equipped throughout according to American practice.

It is natural that American trading firms in China should view this situation with some concern, but investigation will doubtless reveal that in the majority of these cases, the Japanese have not unduly interfered with existing agency arrangements. Confining our remarks to the engineering trade, it is a physical impossibility for the limited number of American firms in China equipped to handle engineering business, to represent all the competing manufacturers at home. As it is, many of our foremost manufacturers are forced to remain out of the field, because of the great difficulty

experienced in finding suitable representatives. If these manufacturers desire to enter the market they must either open their own office or entrust their interests to a foreign firm. Right here arises a very pertinent question. In view of what Japanese have already accomplished for American machinery manufacturers in China, and bearing in mind that there is little hope for the sale of our products to British financed undertakings, is it fair to single out the Japanese for discrimination and lay down and enforce the principle that only European firms can be trusted to handle American products in the absence of suitable American representation ? Unreasoning hostility and deep rooted prejudice may lead some Americans to answer in the affirmative, but such views will never be endorsed by the older and wiser heads directing the affairs of the nation. THE FAR EASTERN REVIEW upholds the doctrine that American goods in any country should, as far as possible, be sold through American firms, but until such time as all our manufacturers are adequately represented in China by Americans, many of them must do business through other channels, and we hold that is highly discourteous and conducive to serious misunderstandings if we attempt to discriminate as to the nationality of such salesmen.

It is axiomatic that American goods can be best marketed in China through American organizations in the field, staffed with an American personnel, and we agree heartily with the principle that our manufacturers and merchants should send their big men to China rather than the men they can most easily spare, but we hold that no boom trade campaign can ever accomplish this much-to-be-desired result. As will be referred to later on, it was this regrettable handling of one of the most vital policies for the advancement of American trade in China, which brought ruin to the large number of American firms who swarmed into this country at the call of the booster and precipitated a general financial catastrophe from which China firms have never recovered. The result is that many of our manufacturers are now without proper representation, and unless they utilize foreign firms they must stay out of the market or open their own office.

A good rule should work both ways and if American loans and American products are to be made and sold through exclusive American representation, then trade with the United States should be reciprocal. Exports of Chinese products to America for the first three months of 1923 show that only 35 per cent. of the total valuation passed through American firms, while 48½ per cent. of the total was carried in American vessels. If all our exports to China are sold through American firms then all our imports should pass through the same channels, for the ruling to be ideal. The above figures show that we are a long way from this goal, and if the same proportion of the total exists in our exportations to China, it is certainly most unwise to lay down any principles that may invoke reprisals and damage our growing trade with this part of the world.

* * *

Anglo-American co-operation in China received its impetus during the war when Japanese loan activities in Peking became so alarming that this alliance assumed a political character in the organization of an association whose activities were marked by the most violent anti-Japanese propaganda. As this movement had the endorsement of British and American officials, its program was accepted and carried out by the nationals of both countries as a patriotic duty. Notwithstanding, however, that conditions have since changed and Japan is now working in complete accord and harmony with America and Britain for the solution of Pacific and Far Eastern problems, the ill-feeling engendered three and four years ago still smoulders and the same leaders continue to influence American and foreign opinion against accepting Japan as a working partner. The anti-Japanese campaign in America is dead and cannot be resurrected. Only in China is the agitation against co-operation with Japan still being carried on, and, as we have indicated, the leaders of this movement are Americans so closely identified with other national interests, that it gives rise to the suspicion that the doctrine of co-operation is one which can be applied only in one direction.

We do not wish to imply by this that official British sentiment or their important financial or commercial firms are responsible for this anti-Japanese attitude, though it is easy to prove in specific instances that British publicists in the employ of the Chinese government encourage the movement by their continued opposition to Japan. Neither do we wish to enter into personalities and question or challenge the motives of or wound the susceptibilities of Anglo-American leaders of American opinion and trade. We simply desire to invite attention to and emphasize that the principle of American co-operation is being distorted in its application into a discriminatory doctrine, most unfair and un-American in its one-sided operation.

Our observations convince us that these Americans so closely allied with British enterprises are foremost in advocating the doctrine of American loans to China exclusively through American firms, but it is safe to assume that the restriction is not intended to cover or interfere with their own operations. This statement is not made to impugn the good faith of these international traders but to prove that their attitude tends to defeat American co-operation with any nation other than Great Britain, and when, as is the case at present, Japan is singled out for discrimination, their position becomes opposed to all ethics of international goodwill and to the higher interests of their own country.

If Americans with close British affiliations are accepted as guiding spirits in the American business community in China, there is no good reason why equally patriotic citizens representing American manufacturers through the medium of other foreign firms, should not also be elected to head our national business and other associations. If success in the sale of American products is the measure of an American's qualification to direct American business associations in this country, there is no good reason why the representative of the American Locomotive Company working through the great Japanese firm of Mitsui, is not equally entitled to weild the same influence as an American working through or in partnership with a British, French, Chinese or Patagonian concern.

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Working in close harmony with the most important leaders of American finance and industry, THE FAR EASTERN REVIEW has contributed as far as possible to a better understanding with Japan in order to avert hostilities and bring about co-operation through the consortium for the development of China. It was realized that the same spirit of friendly co-operation characterizing our business relations with Great Britain if extended to Japan would contribute more towards the cause of peace and good understanding in the Pacific and the expansion of American trade in the Far East generally, than any other single program, a sentiment that was heartily endorsed and accepted by the big business-man of Japan. The same close business associations which bind together America and Great Britain in ties which make impossible any serious break in their relations, if applied to Japan will bring about the same beneficial results.

It was also sensed that American money would never be invested in China in large sums while disorder prevailed and guarantees were lacking, or while there was a possibility of war between China and Japan. It was believed that the basic condition to the floating of any large American loan for the development of China was an amicable adjustment of her outstanding questions with Japan in order to clear the way for an era of perfect peace in the Orient. THE FAR EASTERN REVIEW has accepted these ideas as a cardinal feature of American policy, but in presenting them, we have met at every turn the uncompromising opposition of a group so deeply committed to Anglo-American co-operation or so closely wedded to the Chinese that it can no longer approach these broad questions from a disinterested American viewpoint.

To such an extent has this *liaison* been carried, that American initiative in support of American policies has been practically eliminated in the so-called exponents of American opinion in China. Evidence in support of this statement is seen in the following editorial note preceding an article on the American loan to the Japanese Oriental Development Company published in a local American organ and which we commented on in our May number:—

" *Note.—This article from the Commercial and Financial Chronicial of New York gives full details regarding the loan of the National City Bank of New York to the Japanese Oriental Development Corporation which has attracted so much attention in Chinese and foreign circles in China and in several cases has produced condemnatory resolutions on the part of both Chinese and foreign chambers of commerce. The apprehension is due to the fear in China that this loan is the beginning of a financial policy on the part of (a) certain American banking group to lend money to Japan for purposes of*

*furthering Japanese imperialistic projects on the continent of Asia. Considerable apprehension has also been aroused in American commercial circles for fear that this policy might be detrimental to American commercial interests in China.*"

It is difficult to believe that any hundred per cent. American with a full knowledge of recent history, could be sincerely apprehensive that the American group in the consortium working at all times in full accord with the state department, would lend money to Japan for the purpose of furthering her imperialistic projects on the continent of Asia, especially at this date when Japan has surrendered her special advantages and is co-operating with the United States for the carrying out of principles incorporated into the Washington treaties. The expression of such a thought however disguised, constitutes an insult to the intelligence and good-faith of the state department and our banking group and when read by young Chinese students is accepted as proof of American double-dealing. When Chinese confidence in the good-faith of America is destroyed by the circulation of such baseless accusations, we must not be surprised if an impetus is given to the present anti-foreign movement throughout all parts of this country.

We are patriotic enough to believe that after the events of the past four years our financiers and statesmen can be depended upon to fully protect Chinese interests and adhere faithfully to the provisions of the Washington treaties, and we have equal faith in the sincerity of the present Japanese government to live up to its solemn committments. If Americans in China are to be apprehensive that the acts of their own government and financiers will prove detrimental to American commercial interests in this country, then the facts herein disclosed may influence Americans at home to be equally suspicious of the motives which doubts their sincerity and judgement. If these attacks upon the integrity of Americans who hold views opposed to those of the wholly Chinafied-Anglo-American group continue, the time may well arrive when our leaders may have something to say in their own behalf.

These aspersions upon the loyalty of Americans who differ with the dominant faction in China would not be tolerated in the United States and their employment provides additional evidence of its close understanding with the Peking publicity system.

We have before us an editorial entitled "The Consortium and Manchuria" from the *Far Eastern Times* of May 15, a Peking newspaper directed by one of the British high advisers to the Chinese government, the same gentleman who played upon American sentiment and drew up the secret alliance and plan of campaign that was to hold the gulf of Chihli and the approaches to Peking pending *American mobilization* in the war that was to have been precipitated between America and Japan: the same gentleman who publicly accused J. P. Morgan & Company with sharp practice in purchasing the German Hukwang bonds after China declared war upon Germany, and in attempting to blackmail the Chinese government into recognizing and paying the interest on these bonds as a condition to any loan from the consortium. The editorial in question is another undignified attack on the good faith of the American group and the state department in the matter of the National City loan to the Oriental Development Company, accusing Mr. Lamont of having entered into a "gentleman's agreement" in which the Japanese group retains its special position in Manchuria and the American group is keeping out, a secret understanding "in which one side saves its face at the expense of a little prevarication whilst the other saves some tangible asset at a like cost."

The writer bases his accusation on the fact that the Japanese are paying an extra one per cent. interest to the American bankers over and above the 5½ per cent. basis of the long-term Japanese obligations floated in England. No consideration is given to the present state of the international money market and the peculiar conditions surrounding the flotation of any loan at this time in the United States. Now, it is altogether possible that the Japanese may have desired to float this loan in America and were willing to pay a higher interest rate for the purpose of encouraging further co-operation and breaking down the wall of prejudice erected by the propagandists of the Peking government. Had the Japanese government guaranteed the Oriental Development loan as to principal and interest and excluded foreign participation, then indeed there might be some ground for the suspicion that the proceeds were to be employed for the furtherance of imperialistic projects. The mere fact that it was issued in the United States bringing Americans into full partnership in the purposes of the loan, would indicate a most cordial desire to have us co-operate with them, an assurance to China that her interests will be fully safeguarded. To assume otherwise, is a gross slur on American goodfaith and a calumny against Japan.

This wholly unwarranted attack on the integrity of the American group, reflecting as it does on the honor of the state department, can only be considered in the light of a gratuitous insult to the United States.

When it is known that advisers to the Peking government are directing the campaign to destroy the consortium and Chinafied-Americans support the propaganda to discredit its American chairman and Peking representative, it is about time that real Americans sat up and took notice. The underhand attacks upon Mr. Frederick W. Stevens has probably resulted in the loss of one of the best qualified Americans ever selected to direct our financial transactions with the Chinese. There is little hope that he can be induced to return to a post where he cannot rely upon the trust and confidence of his own countrymen. When Americans acquiesce in these attacks on the honor of their government and the integrity of their financiers, they are making it more and more difficult to obtain the much needed funds for the rehabilitation and reconstruction of China, for it is hardly to be expected that the American group will be over-anxious to lend money to a government whose advisers and propagandists are constantly impugning its motives and business honor. Incidentally this is the thanks the American government receives for its continued recognition of the Wu Pei-fu cabinets.

* * *

We might go further and assert that the present deplorable condition in China is traceable largely to the stubborn opposition of the same Chinafied-American group to the publication of the facts surrounding the true state of affairs. Had the American people been told the truth in time, the outcome of the Washington conference would have been a different story as far as concessions to China were concerned. We speak with accurate knowledge when we say that severe pressure was brought to bear upon American writers who attempted to present the facts.

The concealment and distortion of facts concerning China amidst the welter of sentimental gush spread broadcast during a whirlwind campaign for Chinese-American co-operation and the enactment of the China trade act, created the atmosphere at Washington which resulted in concessions which are now recognized as being mainly responsible for the present utter disregard for foreign rights in this country.

Every movement initiated under the leadership of this group has brought disaster to foreign interests in China. Its activities in 1919 and 1920 were in such close harmony with the propaganda for bringing about a "show-down" with Japan that for all practical purposes their aims were identical. Nobody was fooled as to the meaning of the phrase so glibly bandied about; if it meant anything at all, it meant the creation of a situation where the United States would have to challenge Japan on behalf of China.

The same group is responsible for the campaign which terminated the Anglo-Japanese alliance exposing India to the menace of Bolshevism and making Britain's lot ten times harder to bear through the elimination of Japan as a factor in preserving the peace of Asia. Americans and Britons alike accepted the specious arguments of the group and in a frenzy of suspicion and hysteria, the Anglo-Japanese pact went into the discard. The result? Peace is assured in the Pacific, the integrity of China is guaranteed through the Washington treaties, but Britain in India once more faces alone the menace from the slow unceasing advance of Russia.

Freed from the pressure of Japan, the only power on earth feared by Russia, the Soviet is now pushing forward its plans to dominate India until the British government has threatened Moscow with reprisals if its propaganda in Afghanistan is not discontinued forthwith. It is only a few months since Soviet diplomacy and intrigues in Turkey brought disaster to Great Britain in the Near East and it was a foregone conclusion that Lenin would follow up the victory by striking at Britain's vulnerable bulwark in Afghanistan.

Britain is now concerned over the safety of her Asiatic empire; Mongolia is annexed to Moscow; the Soviet is strengthening its position in China and the only force in Asia which might serve as a barrier to further advances has been discredited through the propaganda of the group working from Peking and Shanghai. When the Russians are once more hammering at the gates of Herat

and the thin Red Line is strung out in battle array along the northern borders of India, Britain can then thank those of her sons whose allegiance to China brought this calamity upon the empire by eliminating Japan from a partnership that would have operated as a check on Moscow. Unless all signs fail, the time is not far distant when the British will regret the day they listened to the siren song of Peking.

The hip-hip-hurrah campaign to induce American firms to open offices in China in order to capture its trade by sheer weight of numbers was inspired by the same group. The abnormal influx of inexperienced foreign firms ignorant of Chinese business methods precipitated the catastrophe of 1920 whose aftermath is still sending old established foreign firms into bankruptcy and the hands of receivers. Since referring to this phase of the situation in our May number, another old American firm has gone into the hands of the receiver. When the toll is complete it will stand as a solemn warning to all Americans against being swept off their feet by a group of "griffins" working in harmony with Chinese official departments.

"Co-operation with the Chinese" became the slogan of the day and in nearly every case where it was brought about, the deluded foreigners have since withdrawn or are now bemoaning their losses. Behind the really admirable points of the China trade act was the desire to get native money into these fifty-fifty Sino-American enterprises through the bait of tax exemption, but as yet only two companies have taken advantage of the new legislation. The hoped-for benefits arising from Chinese-American co-operation have failed to materialize, a dream of the dim and distant future. There is no single instance of a successful business between Chinese and American partners and there never will be so long as the native conception of commercial morality adheres to old established customs of squeeze, commissions, nepotism and utter disregard on the part of native directors of stock companies to the rights of the shareholders.

On the wave of sentiment set in motion by this group, Americans were exhorted to "invest in China." They were told that her credit was so good that no security was required for loans : that she was so solvent she could pay spot cash for everything she purchased. The Americans accepted the statements at their face value, loaned their millions to Peking, extended immense credits to the government for railway materials and financed their cotton mills and other industrial undertakings. They are now sitting on the doorstep of the treasury at Peking—whistling for their money.

This same group has stood solidly behind the Peking military oligarchy and moved heaven and earth through propaganda to oust the Anfu party and eliminate Chang Tso-lin's influence in the government in order to boost the cause of Wu Pei-fu, its chosen instrument to restore law, order and unity to China. Wu Pei-fu was painted in glowing colors as the "Hope of China," but Chinese and foreigners interested in the country are still *hoping* that he may live up to his reputation and put down the bandits who ravage his own front yard.

In order that the gullible American public should hear nothing but pleasant fairy tales about the wonderful qualities of the Chinese and the inexhaustible riches of the new "eldorado," an intense propaganda was launched to rush through the program for Anglo-American domination of the government. To accomplish this, the news from China was distorted, falsified and befouled at its source by the inner ring directing the movement, and the public at home maintained in ignorance of basic facts and conditions which would have opened its eyes in time to the true state of affairs.

The result is seen in the concessions to China at the Washington conference ; in the present breakdown of all government in the country and the usurpation of authority by the "bandits," another euphonism to conceal the truth and save the face of the spoiled children of the powers masquerading as a government at Peking. Bandits ? There are no bandits. There exist hordes of unpaid soldiery swarming over the country, looting, burning and ravishing in order to collect the pay which goes into the pockets of the greater robbers recognized by the powers as responsible leaders of the government. The *tuchuns* and the metropolitan officials rob the people and the foreigners with impunity. They have amassed nearly a billion dollars since the merry game commenced and have it safely deposited or drawing interest outside the jurisdiction of the Chinese government, safe from confiscation or capture in the vaults of foreign banks. The unpaid soldiers are simply emulating the example set them by their the real bandits who pose as and are recognized by the powers as the government of China. Wrecking a train, holding the foreign passengers for ransom and imposing terms on the legations is quite in harmony with the methods employed by the *tuchuns* in blackmailing the foreigner in other ways and by enforcing illegal taxation in violation of treaties. The result is the same. The money is extorted and the foreigner pays. That is all.

When the *tuchun* or war-lord cannot pay his troops he sets them adrift to live off the country, or dispatches them on expeditions against other provinces in order to be relieved of their importunities for pay. Wu Pei-fu is doing exactly this in sending his rabble armies to fight Kwantung. The natives of Hankow, Kiukiang and way ports on the journey tremble before every fresh detachment that passes south where victory holds out the one prospect of pay or loot. There *are* bandits in China, but ninety-nine per cent. of these gentry are the cast-off soldiers of the *tuchuns* who pocket their pay and kick them out to seek their livelihood as best they can. The result is before us.

All this is the logical aftermath to the welter of sentimental propaganda spread broadcast by the Chinafied foreign clique. This group vigorously opposed any inkling of the truth reaching the home-land until circumstances compelled it in self-defense to denounce the government. Then, and only then, did its members let out a roar. But the roar came too late. They cannot escape from their full share of responsibility for the present deplorable conditions in China with its ever present menace to foreign interests. The time has arrived when Americans in China—even the British—must squarely face the facts of a situation due in large part to the activities of this group, which, if permitted to continue, can only lead to the final triumph of Moscow and their own gradual elimination in the political and commercial life of China and the Far East. It is high time these wholly Chinafied-Americans and Anglo-Americans should see the folly of persevering in their petty attitude towards Japan and either swing into line with popular opinion at home or step aside and permit some hundred percent. citizens free from entangling business and political alliances to carry on. Their leadership has pushed American and foreign interests in China to the brink of the precipice and if they are not checked will plunge us all into the yawning abyss below.

G. B. R.

# Safe and Sane

IT is always refreshing to read the reports of the Chartered Bank of India, Australia and China, as invariably they contain words of wisdom which seem to have no place in the general commercial propaganda spread broadcast from the Far East in order to encourage fresh invasions of new firms in on overcrowded market. Sir Montagu Cornish Turner, in presenting the last annual report of the bank to the shareholders on April 4th, ulto, said that at no single point in the sphere of the bank's operations have we witnessed a great spurt in business, no indication of the real revival in trade which we are hoping for so keenly as the solution of many of our difficulties—social, commercial and political. On the other hand, international trade has not been entirely dead, and we might reasonably say has shown an improvement on the position of 1921. We can say, for instance, that the effect of the terrific slump in prices of commodities is gradually working itself out ; that the top-heavy load of unsold or rejected goods in India, China and the East generally has been very appreciably lightened, though at heavy cost, and that we see rays of encouraging sunshine in place of the depressing dark clouds which encircled our horizon and obscured our vision some 12 months ago. All that is to the good. A spirit, a rightful spirit, of caution prevails at the present time, and should be encouraged. Operators must work cautiously and absolutely refrain from overloading Eastern markets with unrequired goods. We have no fear for the future. Once peace is assured—we cannot believe that the present chaos will be allowed to continue indefinitely—and the purchasing power of the consumer has been restored we can reasonably expect an active trade between East and West.

# Government Support to American Publications in China

## A Proper Use for the Boxer Indemnity

AT the risk of inviting an examination into our sanity, we feel impelled to endorse the idea advanced by the *Central China Post* in discussing the disposition of the Boxer indemnity which all the great powers are now hastening to return to China. American opinion holds firmly to the belief that the only solution to China's troubles lies in education through the endowment of Christian colleges : the British, more practical, want their share of the indemnity employed to train textile and industrial experts while the French favor educating Chinese workmen into skilled mechanics who will develop a preference for French tools. Japan also entertains practical ideas on returning her share of the indemnity but will reserve action until there is a stable government to deal with.

In commenting on this universal desire to purchase the friendship of the Chinese, the *Central China Post* says :

**" After all, what China needs is not the provision of a limited number of foreign-trained specialists, but the illumination of the masses, and this the press alone is capable of accomplishing within a reasonable measure of time. Most governments recognize the importance of the press. It is the tail which wags the public dog and, in their own interests, many governments take care to feed the dog—or rather to nourish the tail that it may feed the dog on the pablum considered fittest for it. 'The China Year Book' gives a list of 135 newspapers in Peking alone, all of which are said to be subsidised."**

**" But as a rule the British out East have nothing but ugly looks for their press. If a newsman applies at the legation or a consulate for information about some matter of public interest the chances are he will not get it. If some matter of public interest is being discussed in a municipal council, special pains will be taken to keep the matter out of the papers, and if it is only an ordinary chamber which has some public matter in hand the meeting is held in private."**

**" Yet newspaper men are hard workers ; their hours are long and the pay is poor. They get more kicks than ha'pence, and there is little to be gained in the game, but they still carry on. However :—**

*There's a good time coming boys,*
*Wait a little longer.*

**" We shall be all right when we have pocketed the Boxer indemnity."**

This is the sanest editorial we have read on the disposition of the Boxer indemnity. If the Chinese are to be educated, developed into engineers, textile experts and skilled mechanics and brought to a stage where they can govern themselves and operate industries along western lines, then the press must be employed as an important instrument in this uplift campaign.

Speaking for an American publication which has carried the brunt of the fight for the past twenty years for the defense of American ideals and the expansion of our trade in the Far East, we have aided, abetted, encouraged, boosted, propaganded and contributed in cash to help forward the cause of education in China through the standardized mediums of learning yet in all these years we have never heard any mention of reciprocity.

Never a thought has been given to the urgent need of an independent American organ that would supplement the work of the colleges, missionaries, Y.M.C.A's, the factories, railways, mines and other instruments for the regeneration of China and the development of its markets for American products. Americans are keen on having organs for the advancement of their special interests, but our experience (and that of every other American publication in China) tells us that unless these publications are international in their scope and receive the bulk of their support from foreign advertising they go out of business.

The American government has no funds for publicity, or means of extending material support to a national organ for the defence of its policies and trade interests or to assist in the great work of educating the Chinese. Its officials expect at all times the most loyal endorsement of their opinions and when this is not forthcoming there are plenty of narrow-minded subordinates who go out of their way to condemn as un-American and destroy the value of the medium which holds independent views. There are, to be sure, a few broad-visioned American manufacturers who realize the urgent necessity of supporting a national publication in China, but sad to say, they are a very small minority. The American government created a consortium for the financing of China, the greatest combination of international finance ever brought into existence for carrying out an altruistic program, yet its policy has been attacked, its good faith impugned and its motives villified by the paid agents of its beneficiary. There is Chinese and other foreign money in abundance for propaganda designed to discredit America in China but not one cent to defend her. Why not use the Boxer indemnity to counteract this propaganda and educate the Chinese along lines which will convince them of our sincerity ? This is an immediate necessity, and can be done only through the press.

If American officials, philanthropists and business-men, had given the same attention and support to this phase of Chinese uplift work as they have to its purely pedagogic side, national interests in this country would have been more advanced at this time than they are. If this had been done, Americans would not now be compelled to witness the humiliating spectacle of its so-called " official organs " and exponents of national ideals passing under control of foreigners or compelled to seek a precarious existence by catering to Chinese official sentiment and endorsing insults to their own government and financiers.

Had a Simon-pure, hundred per cent. American publication in China been conceded a measure of official support and confidence which would have made it independent of the dominant Chinafied-Anglo-American group directing American opinions and policies and penalizing and ostracizing those who dared to tell the truth, President Harding and Secretary Hughes would not be repenting of having pressed the powers into making concessions at Washington now universally denounced as unmerited and premature. Nobody likes to confess mistakes, but it is well to place on record that these mistakes are traceable largely to the pressure applied to American publications in China by those whose interests were best served in keeping the people at home in ignorance. At the precise time when the American people and government needed the facts, the full weight of its official machinery working through and in harmony with the hyphenated group in China, was employed to destroy the value of the one American publication which refused to be dictated to in these matters.

However, there is a future, and if American editors and publishers, in combination with their chambers of commerce, merchants, manufacturers and financial associations would work together for the advancement of their special educational interests in China through the allocation of a part of the Boxer indemnity for publicity purposes, the dream of the *Central China Post* may yet come true.

G. B. R.

# Japan's Policy Towards China

IF the newspapers of China would give as much attention to the statements of Japan's real leaders as they do to the out-of-date propaganda disseminated by the agents of the Peking government and the anti-Japanese-American die-hards, it would not take long for the masses to learn that Japan's greatest desire is to be their friend. Japan has convinced America that her new policies are sincere and if given a fair hearing will also be able to convince the Chinese. There are many foreigners in China whose usefulness will be terminated when China and Japan settle their differences and become friends. There are many foreigners who are also intensely jealous of any Sino-Japanese co-operation in business or industry feeling somehow that the closer the ties between the two countries, the harder it will be for them to compete. It is to the interest of this element and a certain section of China's politicians to divert attention from mis-government in this country by accusing Japan of fomenting disorder and civil strife to further her so-called schemes of aggression. All this is old-stuff, handed out to ignorant Chinese and the worse than ignorant foreigners who like to see it in print.

It would be well for everybody if the Chinese could be told from time to time what some of the real leaders of Japan have to say about their national policy and feelings towards China. We have just read the speech delivered before the United States chamber of commerce on May 8, by Mr. Raita Fujiyama, president of the Tokyo chamber of commerce, and the national federation of chambers of commerce of Japan. Mr. Fujiyama, amongst other things, is the president of the Japan Sugar Manufacturing Company, Ltd., prominent in many other important companies, and a leader of the new movement for co-operation between his country, America and China. His appeal for closer relationship between America and Japan in which he tells the Americans his country's real policy towards China can be accepted as official.

"Business men," he told his American audience, "as well as the statesmen of America and Japan, should acquaint themselves with a knowledge of each other's history and economic conditions if future misunderstandings are to be avoided. They should have a sympathetic understanding of each other's hopes and ambitions and only through such knowledge and understanding will we find it possible to maintain peace and promote our mutual interests as partners in the Pacific.

"Our old time militarists and bureaucrats in Japan are dying, and those that remain have been shorn of their power. The people of Japan to-day are awakened politically; they realize fully the danger of entrusting political power to militarists and bureaucrats; they want their government to be administered in accordance with the policy that they desire. What then, is the national policy desired by them?

"It is nothing but a policy of industrial and economic development. The foundation of commerce is industry. Japan must adopt a policy that will develop her industries and must concentrate her energies on attaining the means of subsistence for a population which is increasing by 500,000 or more a year.

"Japan's industrial problem is not only the problem of markets for her products, but the problem of securing raw materials for her factories. Our interest in China is that of being able to secure from her the raw materials necessary to our existence. It is neither necessary nor desirable that we should attain these ends by military means. Indeed, it is to our greater advantage to secure and maintain a peaceful commercial co-operation, through which we may be supplied with those things we need, and secure a market for the articles which we manufacture.

"Our intentions toward China are to establish a policy, not of aggression, but of economic co-operation. Unfortunately, this has not been well understood in America.

"Now, business men of America, it is to your intelligent economic co-operation with Japan that my country is greatly indebted in attaining her present industrial development and her present prosperity in business. And to-day on this great occasion, I, as president of the national federation of the chambers of commerce of Japan, take the opportunity of thanking you for the splendid help and co-operation that you have rendered us as our partner in the Pacific.

"Someone has said that commerce, like a delicate plant, grows only in the genial atmosphere of peace and solidarity. It is also true that the mutual understandings, trust and friendships established through commercial intercourse will build firm the foundations of lasting peace as no other relationships can do. A commercial inter-dependence on established mutual confidence can be depended upon to build up a friendship and brotherly love which will outlaw war and national aggrandisement.

"It is my earnest wish to see the business men of this country and of Japan, apart from politics played by unprincipled politicians, bring about a complete understanding of each other's hopes and ambitions and establish firm business co-operation between America and Japan."

The above extracts from this splendid exposition of Japan's policies and appeal for better understanding certainly carried weight with the business-men of America, yet just about the time it was being made, American chambers of commerce in China were protesting against such co-operation for fear that it might be inimical to the open door and provide Japan with the means to advance her imperialistic designs!

The professional anti-Japanese element in China will exclaim: "Fujiyama is pulling the wool over America's eyes: the real rulers of Japan are the militarists who are using the business-men to lull the suspicions of the United States while they plot and push forward imperialistic plans." So it is well to listen to what one of the actual rulers of liberal Japan has to say about her policies. Next to the present premier, the former occupant of the post and leader of the Seiyukai (the majority political party in the diet), Viscount Korekiyo Takahashi is the biggest man in Japan to-day. He recently contributed a series of three articles to the *Philadelphia Public Ledger* in which he explains to the American people Japan's vital problems arising out of a rapid increase in population and the necessity of providing for their existence through a supply of raw materials that will enable them to work, sell the produce of their toil abroad and subsist. With the doors of all white nations closed against the entrance of Japanese immigrants the question of the future of the race looms large in evolving a peaceful national policy of development. Viscount Takahashi says about this:

> "The freedom of migration is of immense importance to the future of Japan. The population of this country is increasing yearly at the rate of 750,000. It is computed that in about fifty years the present population will be doubled and by 1960 it will reach 100,000,000. In point of density, the Japanese population ranks fourth in the world, and the results of the census taken in October, 1920, indicate that on the average 2,239 people live within the area of a square mile. Notwithstanding this, Japanese colonization and migration projects fail on account of national idiosyncrasies and other obstacles. The average number of the Japanese going abroad to settle in foreign lands does not exceed 50,000 or 60,000 annually; and this number is too small to have any substantial effect toward relieving the population situation. The rapid increase of the population renders the unemployment problem more acute and complex and adds to the social unrest. In order to put an effective check on the growth of this tendency it is an absolute necessity that a food policy should be firmly established and the freedom of the movement of the population secured."

Freedom of emigration is denied to the Japanese for the present, so in order to establish a firm food policy, the doctrine of the open door to the whole world is as basic and vital to Jopan's existence as the same principle is to the United States for other good reasons. Continuing, Viscount Takahasi says:

> "The radical principle of Japan's foreign policy must be to secure the open door of the whole world. Special care must be used for basing all of Japan's assertions on the equality of opportunity. Should she make the mistake of demanding concessions or special rights or interests to the exclusion of others, her policy necessarily will meet with many insuperable obstacles. Such a policy is hardly in keeping with the spirit of the new age.
>
> "While keeping the open door of the whole world as her final aim, Japan must direct her first attention to the general opening of the door in China, Russia and around the Pacific, as her geographical position requires it.
>
> "The open door in China is, as already stated, recognized by the powers. In actual practice, however, this principle has not been fully observed owing to the existence of the various spheres of influences and protection of special interests. At the Washington conference, however, this principle was once again affirmed, and it bids fair now to be put into actual operation. What is important at present is to make China abandon her policy of closing the door and revoke the corn law and the mining regulations. Efforts must then be made in the direction of attaining co-existence and co-prosperity by economic co-operation between Japan and China, Japan supplying China with capital and technical knowedge in return for a plentiful supply of raw mate-

rials which we should expect to receive. By these means it is to be hoped that the problems of population and raw materials may be brought much nearer solution. In order to carry out this economic policy Japan must adopt toward China an absolutely pacific policy, always maintaining an attitude of impartiality toward the various factions in that country."

Could anything be clearer ? Co-operation with China is admitted by the leader of the dominant political party as the pressing need of Japan, the cardinal point in her new national program. It is difficult to go behind these convincing statements which tell us that Japan's business-men, statesmen and thinkers are unanimous in their views on the future of the nation and are working in complete unison for the peaceful solution of vital problems along lines which will bring security to China and increased trade and prosperity to every other nation interested in her development. Confronted with the solution of these vital problems of existence, dependent to a large extent upon China for food and raw materials, for the right to exist, it is folly to believe at this date that Japan harbors imperialistic designs upon her neighbor that would jeopardize her future welfare. It is worse than folly, it is criminal, to circulate stories that she is intriguing to prolong the present chaos in China by instigating bandit raids on towns or trains when her immediate prosperity depends to such a large extent upon the restoration of order and the establishment of a unified government in this country.

# Illegal Taxation in China

WHILE the bandits are holding up the individual foreigner, the *tuchuns* are exacting illegal tribute from whatever commodity they can squeeze it from. The province of Chekiang has now put an additional twenty per cent. *advalorem* tax on cigarettes, a flagrant violation of treaties which has called forth a vehement protest from foreign tobacco firms on the ground, supported at home by the full weight of the tobacco merchants' association. The formal protest submitted to the state department and with the bureau of foreign and domestic commerce by Mr. Charles Dushkind, counsel and managing director of the American tobacco merchants' association, is to be one of the most important matters for consideration at the tobacco men's national convention to be held in Washington, May 16 and 17. The present treaties stipulate a five per cent. *advalorem* duty with the prospect of the additional 2½ per cent. surtax provided for in the Washington treaties, and as these treaties are with the central government no provincial authority has the right to impose additional taxes. The central government at Peking has established a wine and tobacco bureau which collects the consumption tax on these commodities and two years ago the cigarette companies entered nto an eight-year agreement with the officials of this bureau to pay additional taxes on their products over and above the duties fixed by treaties, the method of payment, method of determining the payment and other details connected with the collection. The attitude of the provincial authorities of Chekiang therefore constitute a gross breach of the treaties and an injustice to American and foreign importers of cigarettes. The authorities of Hupeh have followed the lead of Chekiang and levied a similar tax and the raid on the cigarette revenues is being extended to the other independent" governments which make up the congery of China's feudal states. In the protest to Secretary Hughes, the tobacco merchants' association says :

" On behalf of the tobacco industry, including tobacco growers, manufacturers, dealers and exporters, we most earnestly petition your honor to take all needful steps to secure the abrogation of the decree or legislation recently passed or promulgated by the local authorities of the province of Chekiang, China, levying an *advalorem* tax of 20 per cent. on cigarettes.

" It is our genuine conviction that the imposition of such tax, by any of the provinces of China, constitutes a distinct violation of the treaties and understandings with the Peking government, and we respectfully submit that this is not only a matter of concern to American tobacco growers and exporters but also to all other industries interested in Chinese markets, for if this action of the Chekiang authorities should be permitted to stand unchallenged a similar situation affecting many of the American industries are likely to follow, not only in Chekiang but in the other provinces of China as well.

" It is to be noted that this tax is levied in treaty ports, as well as in other parts of the province.

" We beg leave, therefore, to register our earnest protest against this unauthorized tax levy and sincerely trust that you may deem it proper to take this matter up with the Chinese government with a view to securing repeal of this tax measure."

" Collection of this tax, in addition to being a flagrant violation of assurances and treaty rights granted by the Peking government, tends to confirm the doubt which seems to be entertained as to whether the Peking government can control the acts of local authorities throughout the various provinces of China."

In response to the protest of the American and British legations, the united chamber of commerce of Ningpo has wired the Chinese foreign office that the special cigarette tax has nothing to do with the business of the British-American Tobacco Company because it has been collected on the Chinese buyers and not from the foreign sellers, not to mention the fact there are other sellers in the markets than the said British-American Company. Furthermore, the proceeds of the special tax will be employed for the construction of national roads for Chekiang so that after their completion, both foreign and native businessmen will be benefited in the transportation of their goods for sale. On account of this, the Chekiang authorities do not think the special tax will affect the interests of foreign traders so they are going to continue it. So there you are. A flat declaration of independence on the part of Chekiang, refusing to be bound by the treaties. What will the powers do about it ?

# A Splendid Achievement

NOTHING that has occurred under General Wood's administration of the Philippines so eloquently proclaims the utter incompetency of the Harrison *regimé* as the disclosures contained in the 1922 report of the Manila Railway Company : nothing that has yet been brought forward so conclusively corroborates the findings of the Wood-Forbes mission recommending the urgent necessity of a complete reversal of policy in order to save the islands from industrial ruin and bankruptcy. The report of the railway will stand as a most forceful argument against state ownership or political control in future discussions of this much debated question, another proof, if such proof be needed, that the political control of public utilities in backward countries will always be employed by politicians to find jobs for their henchmen and relatives and to foster graft and extravagance in purchasing supplies.

It is doubly gratifying to Americans who gave the best of their lives and experience under the republican administrations for the advancement of the islands, that one of their old colleagues who contributed so largely to their wonderful progress from the time we took possession, should have been the instrument chosen by General Wood to illustrate by practical methods the wide gulf which separatted the two governments. No executive was better fitted for the post of general manager of the Manila Railway than Colonel Henry B. McCoy, who, ever since he landed at the head of the first Colorado volunteers and raised the first American flag over the city of Manila, has stood for all that was best in American political ideals.

Resigning from the army to enter the Philippine government service he was appointed deputy collector of customs in 1901, retaining that position until 1910 when he was made collector, resigning only when the advent of the Harrison administration made impossible the further retention of the republican appointees to the higher posts in the government. His efficiency as an executive and public official for which he was noted in the direction of the insular customs has not deterioriated in the ten years he has since devoted to private business, and his brilliant success in the first year of his management of the Manila Railway must be accepted as a further tribute not only to his personal fitness but to the efficiency of a group who were made to walk the political plank in 1913 and see their work of years handed over to incompetents who in eight short years, and during the unprecedented prosperity of the great war, brought the islands to the verge of bankruptcy, from which it was only saved by the prompt and energetic methods of the new administration.

Once more we have in the success of Colonel McCoy, a further evidence of the executive abilities of General Leonard Wood. The first essential to greatness is the ability to select able lieutenants and stand by them while they accomplish their tasks. Wood's record in Cuba was due to his wise and careful selection of the proper men for the job, and in this case in the Philippines he has lived up to his reputation.

# Standardization and the Urgent Need of Its Application to the Electric Power Supply Industry in China

*Paper Read before the Engineering Society of China by E. A. Mills, Assoc., M. Inst. C.E., A.M.I.E.E., A.M.I.Mech.E.*

THE industry in this country being in its very early infancy compared with that of most countries presents a unique opportunity for taking advantage of the pioneer work done in other countries to ensure its development on sound economical lines.

The development of a power system may be likened to the development of the railways of a country and it is just as impossible to secure economical power generation and supply by each individual plant working independently as it would be to have an efficient railway system if each installation owned its own lines and fixed the gauge and other important details without consideration for the country as a whole. Similarly for the power supply industry it is not economical or sound to lay out systems at various frequencies because as development proceeds sooner or later interconnection will be necessary and it is not possible to interlink two systems of different frequency without adopting some form of rotating frequency changer.

Electric power supply is destined to be one of the most important problems of the future and will eventually become the key industry to all other industries. For this reason it is necessary to emphasize the importance of adopting standardisation not only in the power station and distribution system but in the consumer's premises whether large or small. Without exception the difficulties to be met are probably greater in China than in any other country in the world. Her environment has handicapped her development. Hemmed in to north, west and south by mountain ranges and deserts and having for her neighbors immediately beyond these barriers only the more backward peoples of the earth, she has been out of touch with the rest of the world. It is only her eastern coast that is washed by the ocean and this is her most remote boundary from other civilizations, but at the same time it must serve as her only inlet from the rest of the world. Having these disadvantages and not being primarily an engineering nation practically all her machinery and electrical apparatus is imported, consequently uniformity is not the natural tendency, and until standardisation is universally adopted by all the manufacturing nations of the world it is essential that those engineers who are responsible for the expansion of the industry in China guide its progress so that the maximum efficiency will always result, and to obtain this it is necessary to take a long view and keep in mind the magnitude to which it may ultimately reach.

*Unified System of Supply.*—It has been proved both theoretically and practically that no advantage is to be obtained by generating either a single or two-phase supply in preference to a three-phase supply. If for any purpose one of the two first named methods of supply are required these can be readily obtained by transformation from a three-phase circuit.

There is little excuse for more than one frequency and its value should be either 50 or 60 cycles. Frequencies of other values are in use, such as 25 and 40 cycles, but extensions of these should be discouraged. True economic principles are not presented by adopting a system of distribution for some installation that would make it impossible to connect either in emergencies or ultimately for good with some other source of power except through expensive and inefficient frequency changers with all their disadvantages. One standard frequency will enable interconnection of systems, a very essential requirement from an economical point of view.

The primary advantage of interconnection lies in the fact that the combined load may be carried with a materially smaller amount of installed generating capacity and at the same time with higher efficiency. The saving possible as a result of diversity in maximum load between separate systems even when the loads are of a generally similar character is greater than is ordinarily realized. A similar saving will result from the relatively smaller amount of generating capacity required for reserve purposes.

Fifteen to twenty per cent. increased load may be carried as the result of interconnection. The exact figure depends on how far interconnection is carried and will naturally be greater if extended to wider limits. The saving in capital expenditure is highly important, as this has a very direct bearing on the selling price and the higher load factor upon the generating stations will enable more efficient use of fuel.

Interconnection over a wide area will alone make feasible the increased sizes of stations and of individual units which constitute so essential an element in working out the economies in expenditure and in fuel consumption towards which we are aiming. In this connection it should particularly be borne in mind in any comparison with the present method of relatively local generation that the comprehensive system will bring the benefits of generation on a large scale to the entire area served by the system. An important industrial advantage of interconnection is the flexibility as to points where the energy may be distributed and the readiness with which load may be shifted from one part of the district to another. New consumers may be connected up at any point within the area at very short notice, whereas under present conditions they could only be supplied at great expense after long delay involved in the building of new power plants unless such prospective consumer is within the local restricted area of supply such as the International Settlement of Shanghai. This flexibility is of particular advantage in the case of large loads of a temporary character.

The frequency more generally used in China is 50 or 60 cycles. These frequencies are more generally applicable than 25 or 40 cycles to all the varied conditions met with in the distribution of power. More speeds are available with the higher frequencies than with 25 cycles, or intermediate frequencies. Motors for 25 or 40 cycles are more expensive to build than 50 or 60 cycle motors. They are more bulky and less efficient, and have no better operating characteristics and this same condition exists in the designs of transformers.

The higher inductance of 50 or 60 cycle apparatus has a tendency to dampen out disturbances originating in any transmission lines that may be feeding them, this being particularly true with very high voltage.

Synchronous converters which are now used almost universally for transforming from alternating current to direct current are now designed for operation on systems with the higher frequencies, and can be considered very reliable and efficient pieces of machinery for all conditions.

Another feature which should be considered is that the cost of apparatus is greatly affected by the multiplicity of parts. This is true not only in first cost but in maintenance cost. Take for instance alternating current motors, if manufacturers have to develop a complete line of motors for each different frequency in use, usually for several different voltages and two or more speeds together with the various methods of ventilation, this by no means produces a particularly economical manufacturing condition, and in consequence they cannot be expected to offer motors at the lowest possible price.

Unfortunately those nations who supply China with electrical machinery have not all adopted the same frequency and the manufacturers will when possible, recommend the frequency best suited to their own products. As development takes place in China this duplication will provide an inefficient individualistic state of the electric supply industry and render it a persistent obstacle to a comprehensive handling of the power supply problem and make it impossible to obtain just the advantages which are peculiar to the generation and distribution of electrical energy in regard to the economy of capital, economy of coal and other sources of power.

*Standardization of Voltages.*—The next consideration is the voltage of supply. In the interests of economy it is necessary to have several voltages and the number depends on the size of the system or installation. The first is that for detail distribution giving a supply for lighting and heating apparatus for domestic purposes,

At the present time the single-phase voltages for this purpose vary between 100 to 130 or 200 to 250 but in neither of these ranges is there any accepted standard. It is suggested that only one or at the most two values are sufficient. If voltage standardization could be agreed upon a very great benefit would accrue to the electrical industry. All apparatus which has to be closely selected for voltage such as lamps and heating utensils could immediately be manufactured and distributed with less cost and the saving would eventually react to the benefit of the ultimate consumer. Not only would the production and distribution be cheaper but it would be much more rapid. Contractors for electrical supplies could for the same investment in stocks carry more kinds and sizes of electrical apparatus where now they have to carry lines of apparatus of slightly different voltage.

As an illustration that standardization is required it is only necessary to mention the different voltages used in detail distribution in the international settlement of Shanghai and the French settlement. Those who use heating apparatus and have changed their residence from one settlement to the other will appreciate the draw-back of having two voltages for this particular kind of supply.

It is possible to maintain the supply voltage within six per cent. of the standard so that if a standard pressure of 200 volts were adopted, it would be unnecessary to have lamps manufactured for more than two voltages and this must have a marked effect on the cost of manufacture.

The next pressure is one that is necessary for a local supply to factories and workshops and is somewhat inter-dependent on the voltage for detail distribution as it generally determines the latter. The higher value of voltage known generally as the medium pressure supply varies between 350 volts and 550 volts. Instances may be quoted of three-phase motors being manufactured for the folowing supply voltages—350, 400, 415, 440, 500 and 550. It must be admitted that so many different voltages are unnecessary. The demand for electric motors is ever increasing and for each manufacturer to properly care for his share of the growing volume of business he has found it necessary to standardize his product as far as possible and to put production on a mass basis. Not only does this simplify factory methods and reduce overhead charges but what is of equal importance it means better service at lower cost to purchasers.

The facilities for handling special or modifications of standard apparatus of necessity extends through an entire organization as each case must be treated separately and on its merits : whilst in constructing and selling standard apparatus the most direct course is adopted from producer to user. Herein lies the saving by standardization as it presupposes mass production and the retailing of the article on the basis of wholesale cost.

The figure of 500 volts mentioned above is a case of a large industrial installation where it was found more economical to instal motors built for this pressure than 400 volts, this being the standard voltage for the district, as the saving on cables alone was considerable. This is an instance where motors built for a pressure of 2,200 or 3,000 volts should have been adopted and there are many other industrial establishments where motors built for this pressure would have proved more economical. A further advantage is that better voltage regulation would be obtained on the cable system. As a consequence a pressure of about 2,200 or 3,000 volts appears to be necessary as a standard.

Numerous voltages are adopted for purposes of generation up to 11,000 volts which is the maximum safe pressure. The economical generation pressure depends to some extent on the area of supply and the main distribution pressure. Under certain conditions it is very difficult to show that any pressure for the latter purpose below 50,000 volts is more economical than 11,000 volts owing to step-up transformers not being necessary, which extends the use of this pressure in an exceptional degree. When step-up transformers are necessary, a lower generation pressure from 5,000 to 6,600 volts would be more economical, but it is quite unnecessary to adopt various values in different parts of the country.

As development proceeds higher voltages will be found necessary but it is impossible to fix a definite standard except within certain limits.

Physical dimensions is another direction in which standardization might be applied within reasonable limits. At present it is not possible to purchase motors of the same rating from two different manufacturers whose physical dimensions are within sufficient limits so as to be easily interchangeable one for the other without more or less changes in the foundations.

It is recognized that all the physical dimensions of each motor rating cannot be fixed because of differences in shop practices and the widely varying ideas of designing engineers, but there could be approved limits within which new designs should fall and which would not interfere in the slightest degree with manufacturers' individuality of design.

A technically sound system of electric power supply is one with the problem of industrial development of the country and largely depends on increasing the net output per head of workers, consequently if it is developed on the most economical lines it will always be possible to offer a supply of electrical energy at the lowest possible rates.

In conclusion, when in 1841 Sir Joseph Whitworth was urging the necessity for standardization in Great Britain after he had introduced his standard screw thread, he illustrated his argument by mentioning that candles and candlesticks were in use in almost every house and nothing could be more convenient than for candles to fit accurately into the sockets of the candle sticks, which they seldom did. To-day this illustration applies with equal force to the electric power supply industry in China.

The difficulties of applying any form of standardization in China are admittedly great, but if through some centralized body representative of manufacturers who supply electrical plant and apparatus and those connected with the distribution of electricity alike can be persuaded to accept agreed standards, the interests of the industry as a whole would be realized and a high average efficiency secured. Satisfactory standardization is not arrived at by any section of the community imposing its opinions on others but rather the result of co-operative active on the part of all concerned.

The natural tendency of such procedure is to raise the standard as it reflects the concensus of opinion as to what constitutes the best practice. To ensure the best results it is imperative that any committee appointed to deal with the matter should be representative and all who have or could have any interest in any proposed standardization should give active assistance in drafting any recommendation. Such methods would register the views of the manufacturers as well as those intimately acquainted with the conditions of every day service and would ultimately bring about a feeling of mutual confidence such as could not be realized by isolated action on the part of either, however honorable and straight forward it may be.

The condition of the industry in London is an excellent illustration of lack of standardization. There are 109 supply authorities, 18 frequencies and 45 distribution voltages. If the industry in China is allowed to drift and each manufacturer and engineer is allowed to proceed on individualistic lines, then it is hardly possible to expect a supply of electrical energy at the lowest possible prices and industrial development must be limited.

# China and the Consortium

A leading article in a recent issue of THE FAR EASTERN REVIEW discussing the relation of the consortium and other financial undertakings connected with China, concludes as follows : As long as complete harmony, mutual trust, and confidence exist between the groups, the consortium will fulfil its mission, but just as soon as any independent British, French, American, or Japanese bank or commercial concern slips through a profitable contract by advancing funds to a needy government, be it to Peking, the provinces, or a municipality, the nationals of the other groups will charge unfair practices, and will go and do likewise. In the general scramble for profitable business, it will be difficult to avoid transactions of this nature, and it will require great patience and goodwill on the part of all to avoid hard feelings and jealousy.

# Shanghai as a Field for Electric Furnaces

*By Lansing W. Hoyt, American Trade Commissioner*

AT the present time there is but one electric steel furnace in China proper. This furnace is now being installed in the foundry of the Kiangnan Dock and Engineering Works at Shanghai. An electric furnace is operating in the British colony of Hongkong but strictly speaking there is not to-day a single steel foundry in China—either Bessemer, openhearth, malleable or electric.

The only city in China where an electric furnace (either Ferrous or non-ferrous) could be profitably operated at the present time is Shanghai. This city has greatly increased its municipal supply of electric power and the international settlement power house at Shanghai is as modern and efficient as any station in the world. The cost of electric power to large users of current is lower than it is in most parts of America. Power is delivered to cotton mills in Shanghai at less that 1$\frac{1}{4}$ gold cents per kilowatt hour. The price charged for electric power at Milwaukee (the centre of the electric steel casting business in U. S. A.) averages nearer 1$\frac{3}{4}$ gold cents.

In order to be more specific the writer will give below cost figures for actual operation in a cotton mill at Shanghai using municipal power.

Electricity is supplied on that is known as the " bulk " system of charging, whereby two separate and distinct charges are made. These charges are known respectively as the " Capital Charge " and the " Running Charge."

*The capital charge* is based upon the amount of capital which the Shanghai Electricity Department has to expend in order to meet a definite demand. This naturally varies to some extent with location of such demand in relation to the position of the municipal generating station.

*The running charge* is based almost entirely upon the actual cost of generating energy, and is naturally greatly influenced by the cost of fuel for the time being in force. To meet this variable factor a basic charge per kilowatt hour is made, based upon the assumption that fuel can be purchased at a cost of 1.6 gold cents per 100,000 British Thermal units. In the event of this assumed cost being either greater or less than the figure given, then a proportionate increase or decrease in the basic running charge is made effective. The equity of this arrangement will be apparent when it is borne in mind that the cost of fuel is outside the control of the municipal authorities.

*Concrete Example.*—A cotton mill, requiring 1,000 kilowatts, located near the main station in Shanghai is delivered power at 5,000 volts.

In this case the capital charge is G. $26,40 per kilowatt hour per annum and the basic *running charge* is .00616 gold cents per kilowatt hour.

To arrive at the " all in " cost per kilowatt hour, let us consider the operation of the mill over a month's time. Doing this we obtain the capital charge as follows :—

G. $26.40 . . 12 months × 1,000 k.w. = $2,200 gold.

The consumption in kilowatt hours during the month was—

27 days × 24 hours × 65% of 1000 = 421,200 kilowatt hours
(421,200 × G. $0.00616) . . = G. $2,594.40
Hence Capital Charge . . . . = G. $3,200.00
Running Charge . . . . . . = G. $2.594.40

G. $4,794.40
Hence " all-in " cost . . . . = G. $4,794.40

K.W. hours 421,200
= G. $0.01138 per kilowatt hour

Allowing for fluctuations in the price of coal at Shanghai which would effect the running charge, the writer (as stated above) considers his figure of about 1$\frac{1}{4}$ gold cents per kilowatt hour as ample to cover. The exact figures for this mill, of course, indicate about 1$\frac{1}{7}$ gold cents.

By means of these figures, Americans interested, will be able to compare the cost of electrical energy in Shanghai with that prevailing in manufacturing centres in America, and the writer is confident that they will find that the supply given by the municipality of Shanghai will compare very favorably.

So much for the cost of power, which in electric furnace practice in America usually constitutes one-third the cost of the steel in the ladle. Under conditions obtaining at Shanghai a very accurate estimate of electric hot metal costs can be made as nearly all materials entering into these costs have a known value in Shanghai, although none of these materials have ever been utilized in steel foundry practice here.

Let us assume that a 3-ton *acid* electric furnace is to operate in Shanghai and that a rate of 1$\frac{1}{7}$ gold cents per kilowatt hour has been contracted for from the city electricity department. (An acid furnace melts faster and consequently consumes less power. It is well suited to this market, because furnace practice in Shanghai need only be a straight scrap malting process. The furnace itself, of course, must be 3-phase for the city station could not allow a single-phase furnace to operate.) With this assumption, the figures given below have been deduced from what are known values for the scrap alloys, refractories and labor necessary to place an electric heat in the ladle. Electrode costs cannot be quite as accurately estimated because no electrodes have hitherto been imported into China.

6000-lbs. CHARGE (Figures in net tons).

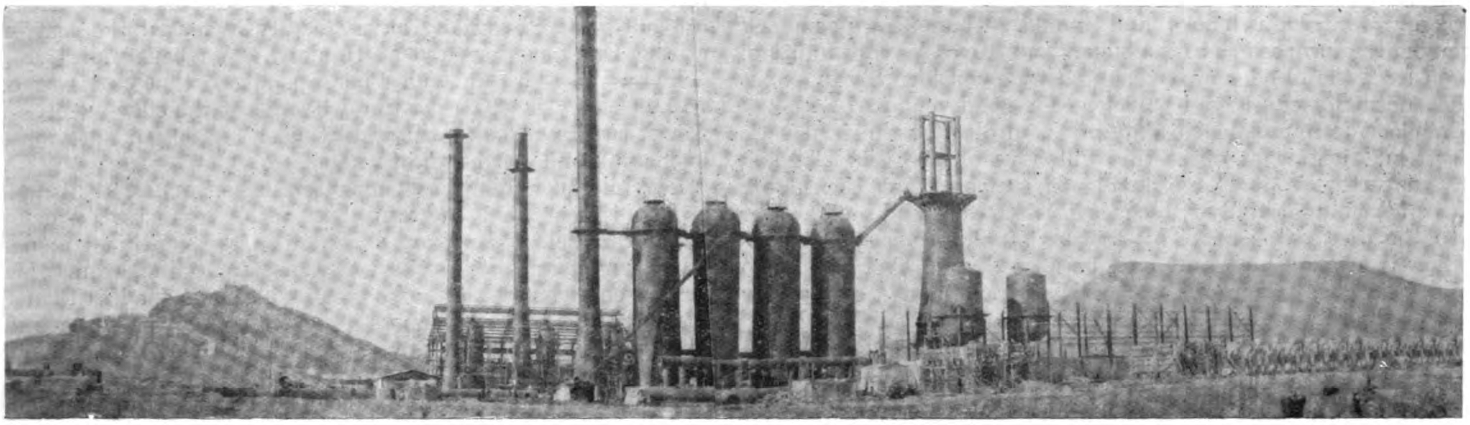
| Materials | Price per ton | Consumption | Cost per heat |
|---|---|---|---|
| | G. $ | G. $ | G. $ |
| 35%, Plate scrap | .. 22.00 | 1,500-lbs. | 16.50 |
| 10%, Punchings .. | .. 18.00 (local) | 600 ,, | 5.40 |
| 25%, Axle turnings | .. 18.00 ,, | 1,500 ,, | 13.60 |
| 40%, Operating Scrap | .. 19.70 | 2,400 ,, | 23.64 |
| 4%, Loss .. .. | .. 0.78 | 240 ,, | 1.63 |
| Ferromanganese .. | .. 75.50 | 50 ,, | 1.88 |
| Ferrosilicon .. | .. 70.00 | 25 ,, | .87 |
| Aluminium .. | ..388.00 | 5 ,, | .97 |
| Ganister .. .. | .. | 150 ,, | 1.00 |
| Silica Sand .. | .. | 50 ,, | 1.00 |
| Electrodes .. | ..200.00 | 65 ,, | 6.50 |
| Brick .. .. | .. | | 1.60 |
| Ladle drying .. | .. | | 5.00 |
| Electricity.. .. | 1$\frac{1}{7}$ per kwbr. | 1,800 kwbr. | 20.52 |
| Labor .. .. | .. | | 1.00 |
| Laboratory expense | .. | | 1.50 |
| Total for heat | .. .. .. | 6.585-lbs. | 102.71 |
| ,, ,, net ton | .. .. .. | | 34.24 |

From the above cost sheet, it will be observed that while the most desirable scrap for electric furnace work is more expensive in China than it is in America, still the cheaper electricity and the lower priced labor brings the cost of the hot metal in the ladle down to a figure which compares favorably with good electric steel practice in the United States.

The Chinese are excellent pattern makers and moulders and have been used to iron foundry work for generations. There is every reason to suppose that they would, with capable supervisions, readily and efficiently grasp the details of steel foundry operations. Electric steel can be melted in Shanghai as cheaply as in most cities of the world and owing to this steel's freedom from oxygen it would be the kind of metal best suited to Chinese practice.

A great advantage obtaining in the Chinese market over markets in America is the high price for finished steel castings. Prices for steel castings in Shanghai range from 25 gold cents to 30 gold cents per pound and where emergency work is required even higher prices could be demanded by a steel foundry located here.

The Chinese customs returns do not show steel castings as being a product of much value in imports. These customs statistics, however, do not go into detail and while thousands of tons of steel castings enter China each year, they are grouped for the most part under the general term machinery.



Blast Furnace of the Lungyen Mining Administration near Peking : during construction

# Blast Furnaces and Steel Mills in China, 2

## A Comprehensive Survey of China's Steel Industry

*By Lansing W. Hoyt*

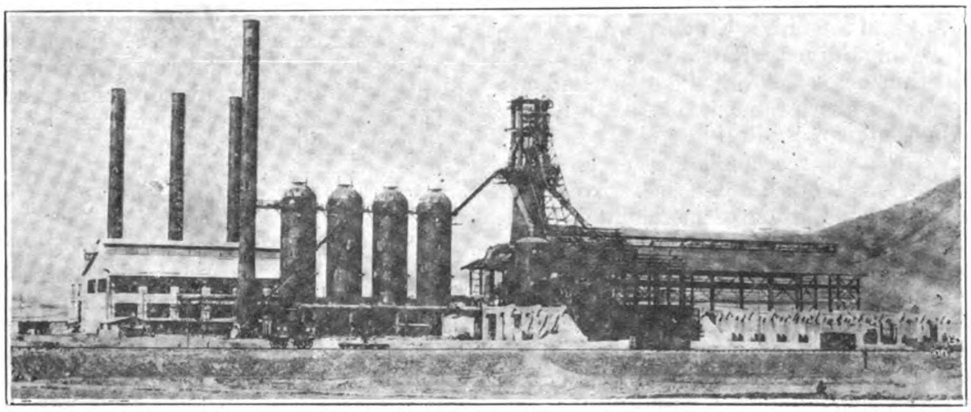
(The author of these reports is the American trade commissioner at Shanghai, who, before entering the government service, was for many years connected with the United States Steel Corporation and the Tata Iron & Steel Company, Ltd., of India. Mr. Hoyt is, therefore, an authority on his subject, and was instructed by the department of commerce last year to draw up the report on China's steel industry. These reports, since released by the bureau of foreign and domestic commerce, are undoubtedly the most careful and reliable ever presented to the technical press. The reports emphasize the slow progress of steel manufacture in China due to many natural and economic causes which together make it possible for foreign material to be delivered in China and undersell the home product.)

## The Lungyen Blast Furnace

THE most recent addition to the ranks of blast furnaces in China is the newly completed stack of the Lungyen Mining Administration located on the Mentakow branch of the Peking-Suiyuan Railway, about eleven miles from the city of Peking. This furnace is the only one in the so-called Chihli district of China and from the standpoint of design and auxiliary equipment is undoubtedly the best arranged plant in Asia, India alone excepted. It has a rated capacity of 250 tons of pig iron per day or about 90,000 tons per year. The plant was designed by Porin and Marshall, engineers, of New York, and ground was broken during the winter of 1921. In May of that year foundation work was started and in July the actual work on the "stack" itself commenced. The engineers are to be congratulated on the way the work was pushed to completion. There are few plants in the United States that have been completed in such a short time. Unfortunately, the political trouble culminating in the battle of Peking last March interfered with the financial side of the Lungyen Mining Administration's program, the leading stockholder finding it necessary to flee to the international settlement at Tientsin to escape his enemies.

The Company was originally supposed to have Mex. $5,000,000 in its command, but only $2,500,000 was paid in. This latter sum has been used up in completing the plant, and, at present, while everything at the site has been paid for, there is no money left for operation. This modern well-equipped "stack" could be "blown in" within a few weeks, if the operating capital were available. It stands to-day a good example of the energy and engineering skill of American builders, but no attempt is being made to make pig owing to the financial condition of the Lungyen Company.

The furnace measures 85-ft. from hearth to charging platform ; is 18-ft. through the bosh and 13-ft. at the hearth. The hearth jacket is of steel plate construction, lined with cast iron cooling plates. The stack is supported by eight fabricated steel columns. The tuyeres, eight in number, are of easy access, being offset from the columns in order to provide maximum working space. There are two iron notches, one above the other, the upper one to be used in case of emergency. The cinder notches are two in number, at the same level, and 90° apart. The tuyere and bosh jackets are constructed of heavy steel plate, protected by bronze cooling plates. Above the mantle just below the first ring of shell plates is a line of cast iron cooling boxes. The upper part of the lining is protected by cast iron wearing plates built in the brick. As a result of costly experience gained at the Yangtsze furnace, American brick was used for the furnace lining proper instead of domestic brick, although the stoves are lined with Chinese (Kailan Mining Co.) No. 1 fire brick. Chinese refractories do not as yet stand up under high temperature and wear, such as is encountered in blast furnace operation.



Another View of the Lungyen Blast Furnace

One of the distinctive features of this furnace is the Marshall top. The four bleeder pipes rising 43 feet above the level of the charging platform give a very sturdy appearance to the superstructure. These bleeders are high enough to efficiently carry excess furnace gases away from the working platform and in ad-

dition, should trouble develop at the furnace top, can be utilized as rigging for chain blocks and tackle. The "down-comers," conveying the furnace gas to the boilers and stoves for consumption, lead off from the bleeder pipes at an altitude considerably in excess of that normally considered sufficient for good practice.

While it is impossible to determine, until after the furnace is "blown in," just what effect this will have on the gases "going over," nevertheless it is reasonable to suppose that the higher "take off" will materially reduce the dust content and send clearer gas to the dust catchers. This feature of blast furnace practice in China is a very important one, because despite every effort to obtain clean gas, extraneous material is carried along, due to the nature of the raw materials it is necessary to use.

The four, two pass, stoves are fitted with inverted Spearman burners and are of the Marshall type. These stoves are built up with the best grade Kailan fire brick (Chinese), which has proved satisfactory for stove service.

The boiler house contains five, 500 horse-power vertical Wickes boilers, fitted with Foster superheaters, delivering steam at 165° superheat under 200-lb. pressure.

The power house contains two 20-in. by 30-in. Norberg engines, which drive two 350 kilowatt generator sets. "Wind" is delivered by two Ingersoll-Rand turbo-blowers of 3,000 H.R.M.

Possibly one of the best features of the entire furnace lay out is the very modern methods employed in handling stock. The stock-house is of sturdy construction super-imposed upon a 360-ft. concrete tunnel, the roof of this tunnel being perforated at intervals by hoppers to permit the ore and stone to drop through into the scale car below. The scale car carries the weighed charge to the skip pit where it is dumped into the skip-car and carried to the furnace top. An Otis elevator steam hoist operates the skip. While the limestone and ore are exposed to the weather above the tunnel, the coke stock is under cover and is stored in ample steel bine above the skip pit.

## Water Supply

One of the most difficult engineering problems which seems to have been overcome at Lungyen is the manner in which an ample supply of clean water is assured. The Hun river is the natural source of supply but owing to the heavy load of mud carried by this stream, it was necessary to provide a settling tank where gravity could reduce the mud content to a workable proportion. From the settling tank the cleansed water flows to a 60 million gallon reservoir located near the furnace. A half million gallon capacity pump delivers the reservoir water to a large sized concrete water tank near the power house. While it will be necessary for this water system to stand up under operation before it can be said to be adequate, nevertheless the experience gained through a study of the difficulties encountered by an adjoining municipal power station, certainly warrants the statement that Lungyen will be free from serious trouble in this direction.

## Raw Materials

The Lungyen Co. has been granted mining rights in areas in the province of Chihli from which it is assured a large supply of iron ore of good quality. The metallic content of the ore averages about 45 per cent., and in actual operation in the furnaces at Hankow, it proved itself to be on a par with the certain Yangtze River deposits. From a blast furnace standpoint, no difficulty should be experienced with the ore. The iron deposits of the Lungyen Co. are situated at Lunghwa (Chi.) and Süanhwa, which properties are connected by rail with the Peking-Suiyuan Railway.

Limestone deposite lie within seven miles of the plant and are connected by a standard gauge line with Sanchiatien, a town near the furnace site on the Peking-Suiyuan Railway.

The problem of good coke at a reasonable price, however, is one that will have to be worked out in practice. No doubt Lungyen will be able to make a good grade of merchantable pig, but there is some doubt as to whether this pig can be made at a cost which will enable Lungyen to compete in Japan and other Far Eastern markets against American, European and Indian pig. This doubt is based primarily on the cost of coke delivered at the furnace. From an engineering standpoint, Lungyen will in all probability be a success, but it remains to be seen whether or not coke can be brought to the furnace stock-house for under the figure now quoted at Hankow, namely $14.00 gold per ton. In fact, the recent political disturbances in Hunan and the labor and mining difficulties at Pinghsiang have steadily increased the cost of coke at the Hanyang furnaces at Hankow. A recent report from the collieries of the Han Yeh Ping Co. stated that coal was costing $10.08 gold (Tls. 4.00) per ton delivered at the coke ovens. If this report is correct, coke will cost at least $15.00 gold per ton at the ovens, 300 miles from the furnaces.

While such high costs may not be encountered at Lungyen, still it is reasonably certain that owing to disturbed conditions along the Peking-Hankow line and to the continual epidemic of labor unrest and banditry in that part of China, from which the coking coal comes, that coke cannot be made for less then $10.00 gold at the oven, and cannot be delivered at the furnace site for under $12.00 gold per ton, lower theoretical estimates notwithstanding.

From an analysis of the coal to be used by Lungyen, it is quite certain that the coke will contain nearly 20 per cent. ash and about 10 per cent. moisture when delivered at furnace stockhouse. In other words, it will take at least 3,000-lbs. of such coke to produce one ton of pig iron using a 50 per cent. ore. Generally speaking under Chinese blast furnace practice, the coke cost in pig iron is between 50 per cent. and 55 per cent. of the total cost. Figuring on 3,000-lbs. of coke, which is not considered bad practice in China, the cost of coke per ton of iron will be $16.00 gold. On a 50 per cent. basis, this means a total cost of $33,00 gold for one ton of pig ex cast-house. Should this figure be approximated when Lungyen furnace is "blown in," it will mean that costs at this furnace are below those of any other "stack" in China, Manchuria included.

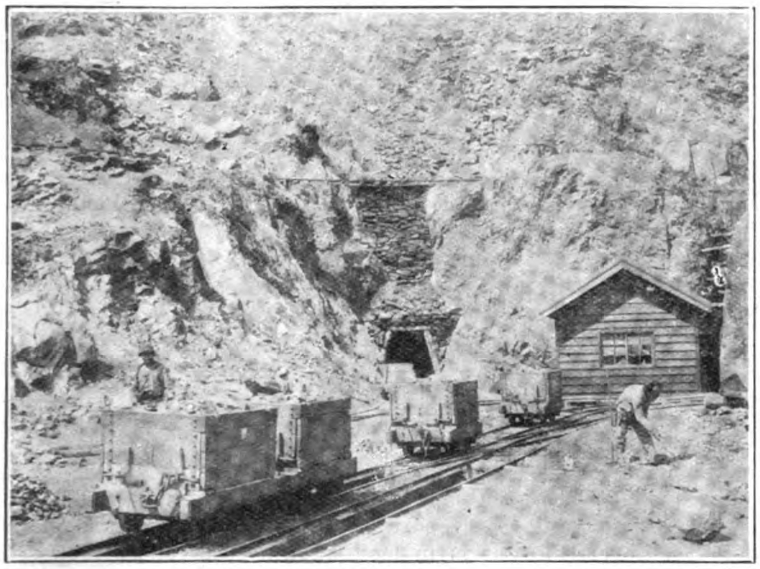
In order, however, to sell the entire output of Lungyen (90-000 tons) a price at Kobe of $38.00 gold must be quoted and this price must include a reasonable profit to the Company. Unless this price C.I.F. Kobe or Shanghai can be met profitably, it is doubtful whether the entire tonnage to be made at Lungyen can find a market. China has never taken much pig and at present is taking almost nothing. The imposition of *likin* or inter-provincial taxation, as well as export duties and charge, handicaps any furnace making pig iron in China. Adding these charges to railway and ocean freight, it is a question whether the difference in price at Kobe will be sufficient to ensure a Japanese demand. The Japanese are not going to favor Lungyen iron over Japanese or even Hankow pig. The Japanese have more than a market interest in the product of the Hankow furnaces and because of loans to the Han-Yeh-Ping Co. would naturally favor pig iron from this quarter.

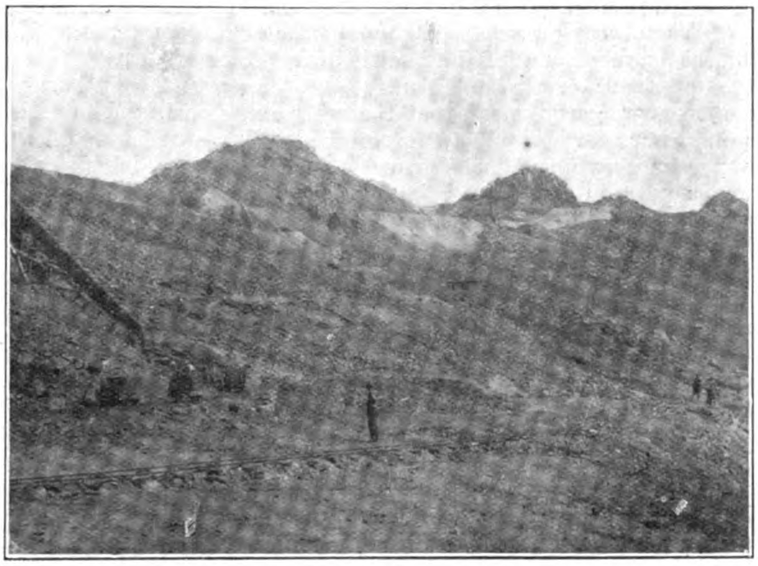
Unless capitalists taking over the Lungyen properties, are willing to put up enough money not only to operate the furnace itself but also to build a rail mill and a bar mill with the necessary steel mill units, it is not at all certain that Lungyen will be a financial success from an American standpoint. Putting up $2,500,-000 Mex. may operate the furnace, but China cannot at present consume even the pig iron output of existing domestic furnace, and unless rails and bars or other shapes are made by the Lungyen Mining Administration, Japan will be the sole arbiter of price as regards the Lungyen product.

A large capital will be necessary to install and operate the openhearths and mills which will make Lungyen an independant unit, but if this capital is raised, there is little doubt that North China would take the steel products made. If possible an arrangement should be made with the Chinese Government Railways to take the output of such a rail mill at a price based on C.I.F. Shanghai figures for imported rails. In normal times the bars would find a ready market. From experience gained at other blast furnace plants in China, the only hope of successful operation lies in making finished steel, and even then costly supervision will not permit of any remarkably low costs.

## The Anshan Iron and Steel Works—Manchuria

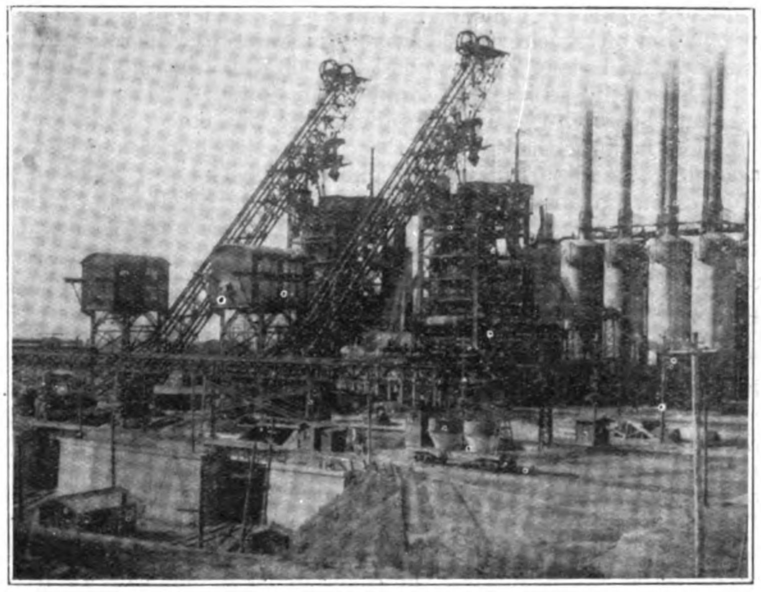
The Anshan Iron and Steel Works are a subsidiary of the South Manchuria Railway, and are located at a well selected site on this railway about 60 miles south of Mukden. The Company is purely Japanese in capital and management and was started in 1917 along very ambitious lines. Two blast furnaces were immediately contracted for, each with a rated capacity of 230 tons per day. These two furnaces were to have been but the forerunners of a scheme which if carried out meant the construction of a plant comprising a



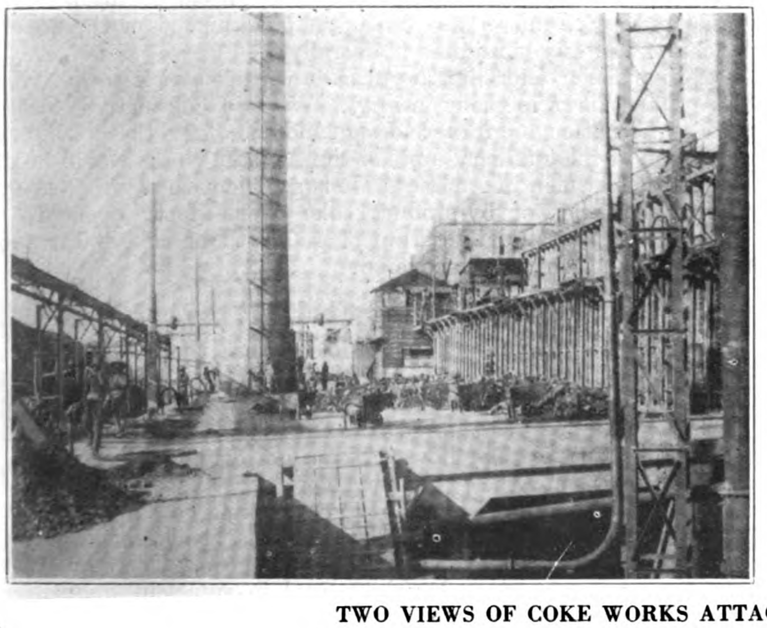


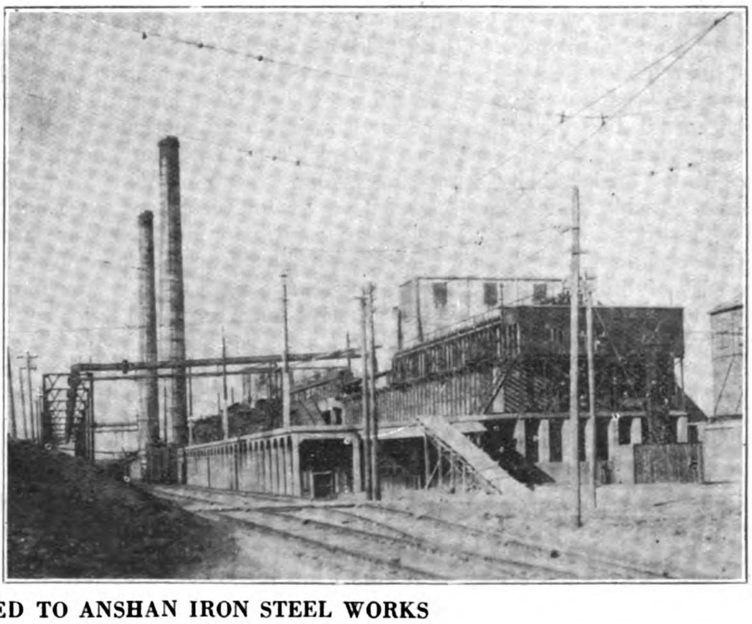
YINGTAOYUAN PIT, ANSHAN IRON MINES

Loading Platform at the Takushan Mine of the Anshan Group



Anshan Iron Steel Works





TWO VIEWS OF COKE WORKS ATTACHED TO ANSHAN IRON STEEL WORKS

battery of eight blast furnaces and a steel plant and mills capable of making 1,000,000 tons of steel per year.

When this plan was decided upon, millions of yen were provided for the establishment of the model town of Anshan near the site of the proposed works. Evidently the Japanese geologists and engineers were convinced that the ore, coking coal, and limestone so necessary for a plant of the proposed size was at hand and that it was more a question of finance and engineering ability than it was a question of raw materials. At any rate the first link in this ambitious chain for exploiting the iron resources of Manchuria was forged in May, 1917, when construction work started on No. 1 furnace. Simultaneously work was commenced on four batteries of coke ovens, a boiler house, power plant, stock house and the necessary auxiliary equipment for a plant of this kind. No. 2 blast furnaces construction was also started and every effort made to complete the first unit (two furnaces) of the scheme, as speedily as possible, so as to take full advantage of prevailing war and post armistice prices for pig iron. Just two years later on April 29, 1919, No. 1 blast furnace was " blown in." By this time a modern town with a population of 10,000 appeared in the model city of Anshan. Nothing was left undone to make this new Japanese town and plant a veritable Gary, Indiaua in embryo. The fact that but two of the eight furnaces were finished did not deter the management from anticipating the requirements which the town would have to meet later on when the other furnaces and steel works had been completed. Millions of yen were expended in making Anshan a city worthy of Japanese enterprise and one in every way capable of supporting a population of the size necessary for the successful operation of an iron and steel plant turning out 1,000,000 tons of steel annually.

Operation had scarcely commenced, however, when it became evident that high-grade ore in abundance was not present.

The facts of the case are that, while Manchuria does contain a considerable amount of iron ore and coal, most of this ore is under 35 per cent. metallic iron and the greatest body of coal (Fushun Colliery) refuses to coke. Of the 100,000,000 tons of iron ore controlled by the Anshan Iron and Steel Co. under its concession rights in the neighborhood of the town of Anshan, only a minute portion is suitable for direct smelting in a blast furnace. The ore, which up to now has fed the furnaces, is what is known as the " secondary enrichment " ore. It has been found in pockets here and there, but in such small and uncertain quantities that commercially it has proved very unsatisfactory. This " enriched " ore averages about 50 per cent. iron and has a hardness above 6. At the present time there is not enough of this 50 per cent. ore left, or in sight, to supply the two blast furnaces already erected. Consequently the directors of the Anshan Company were forced to abandon their original program and to curtail operation even on the furnaces now forming the first completed unit of the plant —namely Blast Furnaces 1 and 2.

It is stated that over $20,000,000 gold has been expended on the town of Anshan and the present plant. Most of this money went into the town and auxiliary equipment, because it was thought at first that it was only a question of a few years before a mamoth plant would be in operation and if this were to be the case such money would be considered well spent. The sudden awakening to the fact, however, that 50 per cent. ore was not to be had for long and that further profitable operation depended entirely on whether or not the lower grade (35 per cent. ore) homatite-quartz-schist formation could be enriched by a concentrating arrangement that would prove feasible, caused an immediate cessation of further extensions. The resultant effect of this sudden realization that the ore was of no commercial value, is that the Anshan Iron and Steel Works consist of but two blast furnaces with the necessary power plant and coke ovens, and of an unproductive town some 60 miles south of Mukden on the South Manchuria Railway. As the plant stands to-day it is a failure not only financially but matallurgically. The blast furnaces were not properly designed and No. 1 Furnace is now being rebuilt from hearth to charging platform in an endeavor to overcome certain operation troubles that precluded successful working when the furnace was in blast. Owing to the character of the ore and the coke, it is necessary to maintain a very high temperature on the other furnace now in blast in order to operate at all. The slag volume is tremendous. When the writer visited Anshan, No. 2 Furnace was making but 120 tons of pig per day and this iron averaged about 3 per cent. silicon. The natural conclusion was that the management was getting ready to " blow out " the furnace. When the writer, however, asked the blast furnace superintendent if that were the case, the latter replied very frankly that it was necessary to make " hot " iron in order to run at all. Such iron, of course, would be useless in an openhearth furnace on account of the high silicon content.

## Concentration of Ore

As stated above the great mass of iron ore around Anshan is a low grade primary ore without secondary enrichment. It contains about 35 per cent. iron and is very hard. This hematite-quartz-schist possesses scarcely any commercial value and, if it is to be used at all, must be concentrated and brought up to about 60 per cent. metallic iron. The specific gravity of this primary ore is 3.5 and its perosity is about 10 per cent. Generally speaking the hematite particles are slightly magnetic and where they have come in contact with granite are highly magnetic, being reduced to magnetite.

At present, investigations are proceeding at Anshan with a view to concentrating this ore by means of concentrating tables and by magnetic separation. A committee of eminent American geologists from Minesota has looked into this subject quite exhaustively and while the report of this committee is not public property, nevertheless it is understood that the report prepared was favorable as to concentration. The feasibility of this concentration may not be denied, but it is a question whether or not the additional cost may not be too severe a burden for commercial success.

The experiments now being made in the concentration of this primary ore necessitate the palverising to 65 much or less of the homatite-quartz-schist. This powdered ore is then concentrated by the Gründal method of magnetic-concentration, coupled with a concentrating arrangement that takes advantage of the difference in specific gravity between the homatite and the quartz in the ore. Analysiz show that this process is partially successful (at least from a sample standpoint) the primary ore being mechanically enriched from a 35 per cent. iron content to about a 60 per cent. content.

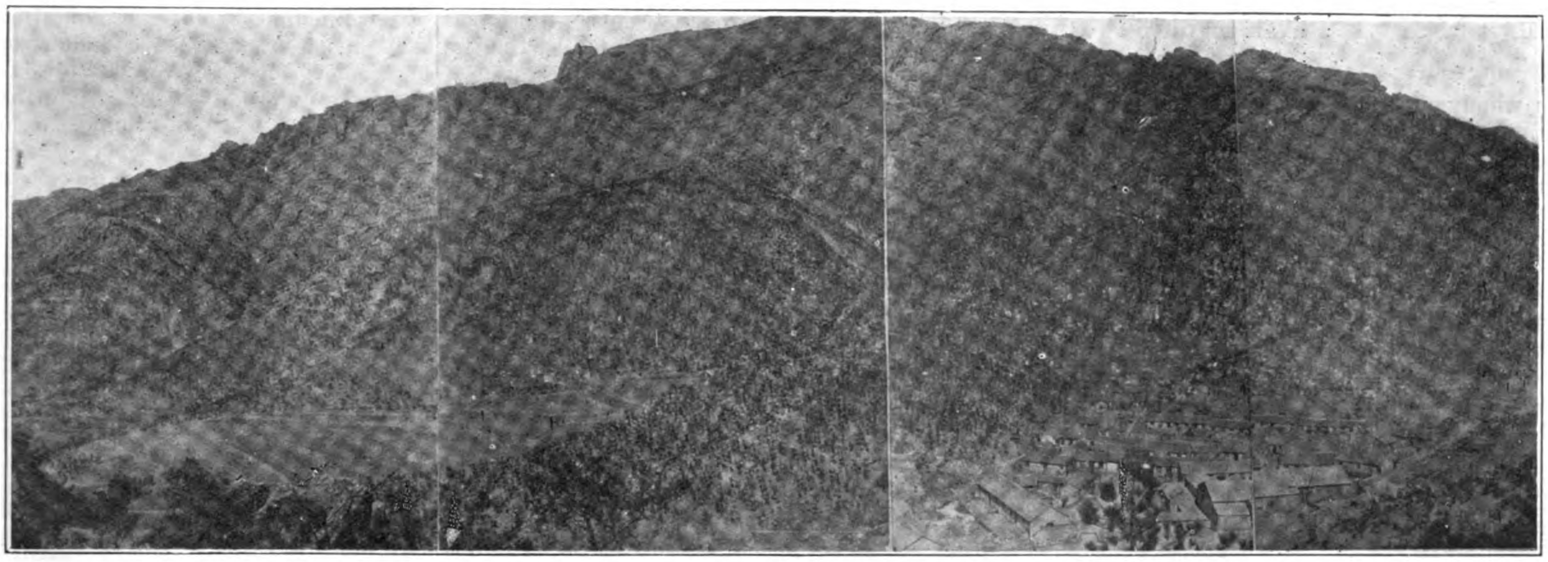
## Cost of Pig at Anshan

It is very difficult to obtain a figure on cost per ton of pig iron at Anshan, because there are so many extraneous items entring into costs there which are really not proper charges against operation, although, of course, they have to be met. If we consider only raw material, fuel and labor expense as making up the manufacturing costs of pig iron at Anshan, we can state that it is 70 yen or $35.00 gold per ton. If, however, other charges, such as interest, town expense, depreciation, relining, and ore concentration, are included, it is possible to put the cost per ton of product up to almost any figure, because one furnace is idle and the other is producing but 120 tons per day. With an investment of $20,000,000 gold and a production of but 45,000 tons of pig a year, it is seen that the plant is already a financial failure and that even with a successful outcome on the question of ore concentration, it can hardly become a great producer, unless the Japanese government or the South Manchuria Railway subsidizes it liberally.

No particular effort has been made in this article to deseribe the Anshan Works in their entirety. We laid considerable stress on the ore situation and furnace design and do not feel that a lenghty description of the auxiliary units of the Anshan Works would be of interest to steel men in America. It is sufficient to say that there are four batteries of by-product coke ovens—forty ovens to a battery—with a total daily output of 480 tons of coke. Tar and sulphate of ammonia are recovered.

## Coking Coal

It was originally thought possible to use the coal from the Fushun Colliery near Mukden for coking purposes. This Colliery belongs to the South Manchuria Railway. It operates one of the most extraordinary seams of coal in the world (1,000,000,000 tons in sight). Unfortunately, however, Anshan cannot utilize Fushun coal because it is of the non-coking variety. Anshan ovens have to resort to Penchihu coal, a fairly good coking coal mined about 120 miles from the plant and belonging to a rival Sino-Japanese concern known as the Penchihu Coal & Mining Co. There has been no difficulty in obtaining Penchihu coal in sufficient quantities, because the demand for coke at Anshan has been very limited on account of the restricted operations.



Panoramic View of the Mid Portion of Lushan Mountain. In the Foreground to the Right, is a Group of the Main Buildings of the Tsaoyuen Gold Mines Company, Tsaoyuen, Shantung Province. Looking West.

# Gold Ore Deposits of the Linglungshan Region, Tsaoyuen, Shantung

*By Y. Tsenshan Wang*

## Part I

### General Geology

THE information contained in this paper was obtained by the writer in the Spring of 1917, while engaged in a mining reconnaissance of the gold fields of East Shangtung. The writer is under obligations to the officers of the Tsaoyuen Gold Mines Company, particularly to Mr. Li Tse-kao, the superintendent, for valuable informations and for facilities extended during the execution of this work in and around their mines in the Linglungshan region.

### Scope and Purpose of the Work

In this paper are discussed very briefly the geologic conditions in and around the Linglungshan region as far as they are known, while the results on the economic side are described in comparative detail.

As no topographic map of any kind was accessible at the beginning of the work, one of first undertakings was the preparation of a suitable topographic map. It was also necessary to make a preliminary study of the geologic relation of the rocks of this gold producing region for the purpose of determining the nature and extent of the ore bodies, and ascertaining if geologic work of value to the gold miners could be done in advance of actual mining.

Field work for topographic and geologic mapping was carried on almost simultaneously as the geological structure is not very complex. (The lack of a suitable map at the beginning of the work made it necessary for the writer to run stadia traverse and level lines over much of the area beyond the productive hills, as indicated on the accompanying geologic map.)

### Geography

The area described in this paper occupies principally the Linglungshan and Lushan ranges, which run northeasterly, and almost east to west respectively, and are separated by the main traffic road between Whang Hsien to the north and Tsaoyuen Hsien to the southwest. It extends to a subordinate degree into the immediate ranges to the north east of Linglungshan, for a distance of not less than 15 *li*. Both Linglungshan and Lushan are situated northeast of the city of Tsaoyuen, in the northern part of the peninsula of Shantung. For convenience, the name of "Linglungshan region" will be used in this paper to designate the producing areas in the district of Tsaoyuen. The south end of Linglungshan and Lushan ranges merge into a valley developed by the river running from south to northwest. The land along this valley is thoroughly cultivated. Their northern ends of the ranges are, however, joined by higher or lower ranges and most of their slopes are equally utilized for agricultural purposes. The Linglungshan range and Lushan range, particularly the former, serve the principal portion of the area in which ore-deposits have been developed, though the mining camps may be at present found even outside of this area. As far as the Tsaoyuen Gold Mines Company is concerned, the mining has been carried on mainly in the hills of Linglungshan and subordinately in some of the lower hills in the Lushan range and in the hills of the Pudekong Kohsenken system. The main buildings of that Company are at the foot of the mid-portion of Lushan, from the top of which a comprehensive view of the mines may be obtained.

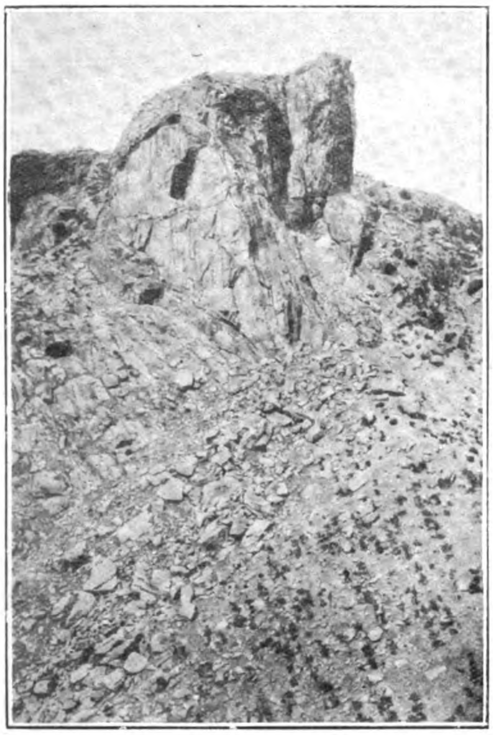
The area in which ore has been produced is 15-20 *li* north and northeast of Hechiachong, and at an elevation of 150-250 metres above the sea level. The wagon road or the main traffic road, leading to the Tsaoyuen Gold Mines Company's property from the southwest, and to Whang Hsien on the north, has a moderate grade for most of the distance, but is very steep near the camp. The haul from the camp southward is almost entirely down grade, but northward for not less than 1½ *li* is upward until after passing the divide of Fensailing the road is again down grade.

The top and the upper level of the ranges support no growth of cedar and other scrubby trees, but these are available, as fuel supply, on the lower part of the slopes.

There are several springs near the camp. The most notable one is on the southwest side of the main buildings of the mining company. The water, issuing from a small fissure in pegmatitic granite on the east slope of Lushan, is extremely good and is used for cooking and for all other purposes. It is usually allowed, by means of iron pipes, to run into an open reservoir situated at the foot of a lower hill near the camp.

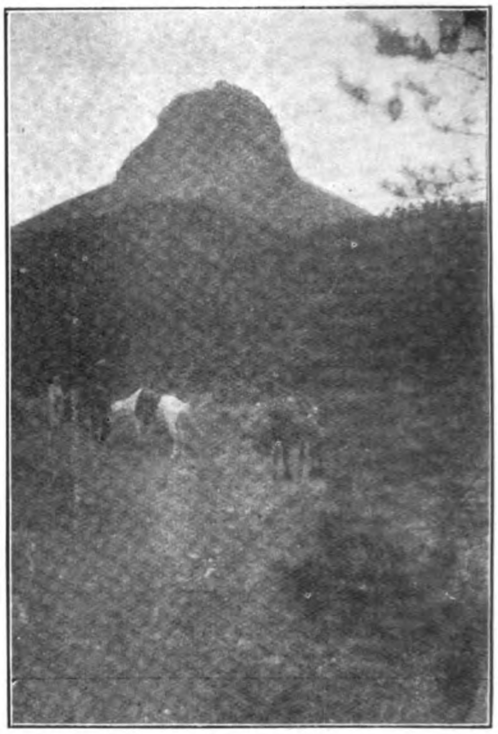
## Physiographic Features

The area in which the Tsaoyuen gold mines have been developed is wholly different from the regions to the south, southeast and southwest of the mining camp regarding topography. The valleys are peculiar in extent and arrangement. Lowlands penetrate far into the mountainous areas. The river beds are floored either with granitic sand or with irregular fragments of granites and gneisses. Mountains occur as isolated groups and seldom in well defined ranges, their altitudes varying with every individual group. The highest peak, Lushan, to the west of the present main camp, is 375 metres above the camp ground. Other consipcuous heights very from 100 to 300 metres and there are many lower hills isolated in different parts of the area under consideration. This area represents probably one of the mountainous districts in the northern part of Shantung. Plains: The only lowland of the region is about 8 *li* south southwest and 35 *li* northeast of the Tsaoyuen gold field. The regions to the east, north and west within a distance of 20-30 *li* are more or less hilly, if not highly rugged. So properly speaking, there is no plain in the immediate neighborhood in these directions.



**The southern limit of the Lushan Summit, showing both the rock talus and a portion of the wall, extends to the summit. In this picture is also indicated the difference in hardness of the gneiss as revealed by the effects of weathering and corrosion.**

**A Rock Ravine to the west of Hungtsinpeh. The gneissic granite at the back is badly jointed.**



**An oviline basalt neck intruded into a gneiss. The neck has a circumference of more than one li, and its height is not less than 450 feet between the point D. and its summit.**

*Drainage.*—All the streams and rivers were dry at the time of the writer's visit, and they are without exception floored with sand or full of angular rocks of all shapes and sizes, igneous and metamorphic. They are in some cases very wide, from 10 to 100 or more metres. They are known as Soho. But about 1-2 feet below the surface, the water is always present, and during the rainy seasons of the year, these rivers are generally covered with a sheet of water. Its depth and its continuance is commonly controlled by the amount of rain and the duration of the rainy season. If the rain comes in intermittent showers, the water in these sandy rivers may disappear soon after the rain stops.

The water which is required by the milling in connection with various processes of gold washing, is wholly drawn from a spring, on a hill side just at the back of the main buildings of the Company, and from the tunnel No. 1. The water from the former is purely a spring water and is also used for cooking, but that from the latter is used only for milling purposes. The last mentioned water is undoubtedly meteoric in origin, and seems to have thoroughly circulated in the upper part of the Linglungshan range in question. This is indicated by the fact that when a lower level is cut the wate gradually disappears in a higher level just above. it. Mr. Li, the manager and proprieter of the Tsaoyuen Gold Mines Company, has info med the writer that at the time when the tunnel No. 7, which is above the tunnel No. 8, was cut, there was plenty of water in the rocks on the first mentioned level, but within a short time the rocks gradually became dry and at present there is hardly any water. The walls in the upper tunnel are more or less wet indicating that the water is running off in its downward journey through the cleavages and fractures in the wall rocks.

As to the supply of water for the people in general, it is all drawn from their wells which can be found almost within every individual compound. This is also true all over the entire north eastern part of the province of Shantung, which the writer had the opportunity to visit in the spring of 1917.

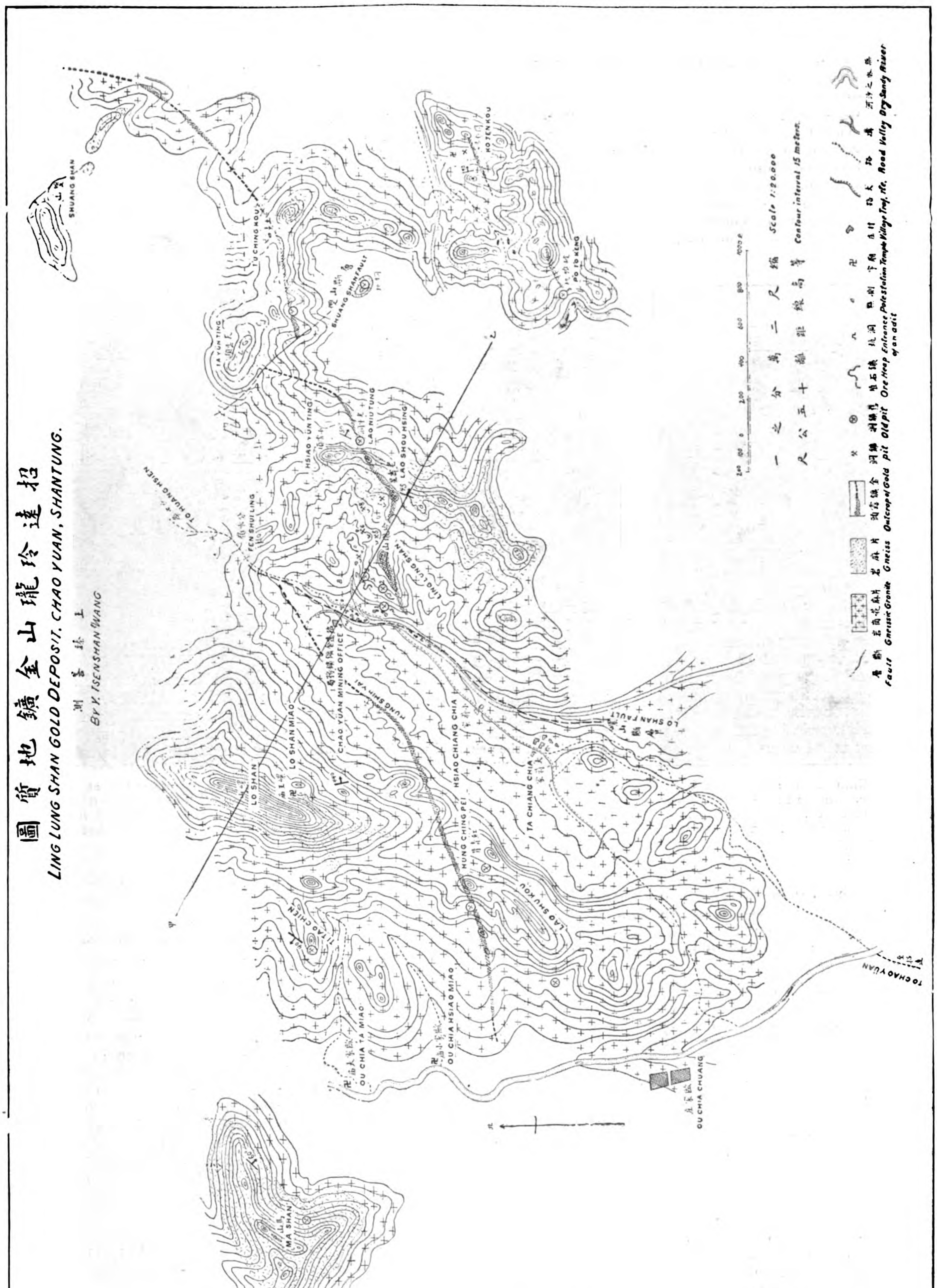
## Geology

*Igneous and Metamorphic Rocks.*—The rock formations of the Tsaoyuen gold field may be divided into two very distinct groups. One comprises a variety of ancient and metamorphosed rocks, which form a large part of Lushan and Mashan mountains and some of the hills to the northeast of the present main camp, and of the hills to the east of Linglingshan. These rocks originally occupied the entire area under consideration.

In Pre-Cambric or rather in Algonkian time, as a part of the second great volcanic activity manifested in this general region and elsewhere in the province, a number of volcanos probably from various centres, broke through these fundamental rocks which are undoubtedly Archaean in age. The products of these volcanos, which are more or less similar everywhere in this region, together with a minor occurrence of a darkish green rock of aphanitic texture, constitute respectively the second and third groups of the ancient igneous rocks.

### I. Ancient Netamorphosed Rocks

*Gneiss.*—The rocks of this division may be divided into two varieties, schists and gneiss, each distinctly recognizable in the field, but the former occurs only sparingly. In general, they


招遠玲瓏山金礦地質圖
LING LUNG SHAN GOLD DEPOSIT, CHAO YUAN, SHANTUNG.
BY Y. TSENSHAN WANG
Scale 1:20,000
Contour interval 15 meters.
Fault
Gneissic Granite
Gneiss
Outcrop of Gold
pit
Old pit
Ore Heap
Entrance
Pole station
Temple
Village
Tomb, etc.
Road
Valley
Dry Sandy River
LO SHAN
LO SHAN MIAO
CHAO YUAN MINING OFFICE
LING LUNG SHAN
LO SHAN FAULT
TO CHAO YUAN
TO HUANG HSIEN
OU CHIA CHUANG
MA SHAN
SHUANG SHAN

strike S. 30 W. with a dip of 45-65 to northeast. Their general character has been described by Baily Willis and Blackwelder under the general term of Taishan complex*. But owing to its small and indefinite extent, the schists are not differentiated from the gneiss on the accompanying map and no separate discussion is made in this paper.

The differentiation between the gneiss and the gneissic granite as indicated on the map, is in some case wholly arbitrary, for the exact contact between these two rocks is usually obliterated by weathering and sometimes covered by lose rocks.

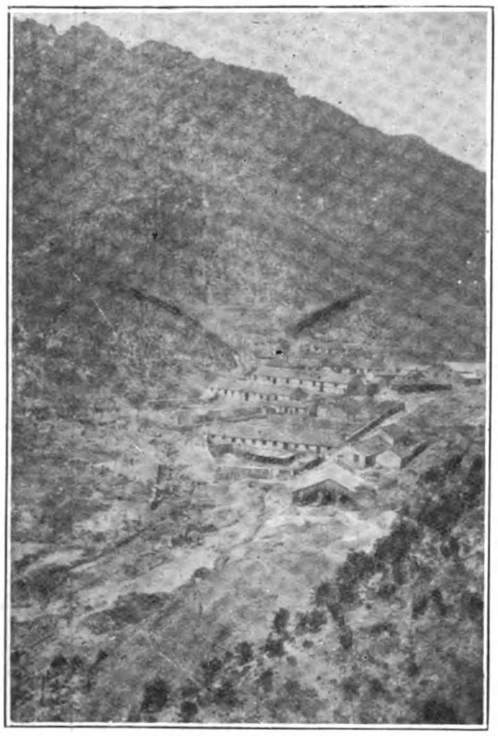
The gneisses which form the mountains of Lushan, Mashan and the peaks of Dayinting, Siaoyingting, Saiting and Hsanshan, are most easily recognized, as they show more or less foliation and sometimes distinct banding, and they expose to the surface and on slopes. They belong to two varieties, one is whitish-gray and the other is brownish. Their texture may also be divided into two classes, as one is finer than the other. The finer grained gneiss is usually harder and not so easily broken into pieces as are the coarser phases, which are often characterized by the presence of numerous eye-spots of feldspar and large crystals of quartz as a grano-gneiss. As a rule, most of the gneisses in this region are coarse. In the coarse grained gneiss, muscovite or white mica forms a dominent part, while in the finer ones biotite is more common. No attempt was made in differentiating them and the two gneisses, irrespecting their color and texture, have been given the same sign on the map.

The rock is not always characterized by a gneissic structure, but when such a structure is present, it varies from schistosity to a foliation, usually so massive that a hand specimen shows almost no banding and only large exposures reveal the true foliated nature. Weathering has not only changed the color to a whitish-gray or brownish as already mentioned, but also leaves the biotite or the secondary mineral chlorite conspicuous and thereby exaggerates the schistosity.

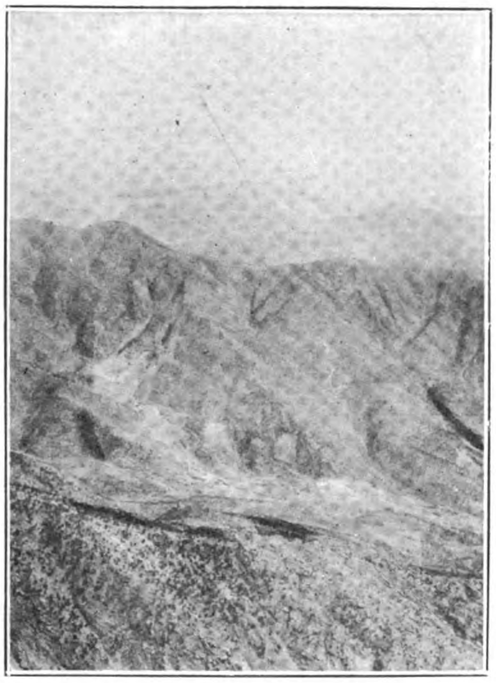
These rocks have been considered as the oldest in the Archaeau complex. Their origin is difficult to explain, but judging from the fact that there is no sedimentary rock found in the neighborhood of this region and that their mineralogical character is in every respect similar to that of a metamorphosed granite, it is here inferred that they have been derived from igneous rocks of very acidic character.

*Moshan and Lushan Gneiss.*—The type of the gneiss which has the greatest development, forms the ridge and a large part of the upper portion of these two mountains. Along the central part of the Lushan range this rock forms on the east side almost a vertical wall which is very close to the form of " hog back " when viewed from a distance. Farther down for a distance from 100-150 metres, the precipitousness of this wall-like slope gradually becomes less and less.

Masses of similar character occur on the hills around the camp site and in some cases are seen clearly down to the bottom of deeply cut ravines. The best contact is seen along a deep ravine at Liusaiken where the gneiss directly overlies the Liusaikeh granite, the latter has been utilized by the villagers for making domestic grinders. The thickness of this gneiss varies greatly with different places, depending largely on the height of the hills or mountains. In Lushan range, the thickness is about 220 metres, while in Mashan, it is less than 180 metres.



**The Main Building of the Tsaoyuen Gold Mines Company. In the background shows the northern half of the Lushan summit. Looking southwest**



**A portion of the principal workings. Looking east from the summit of Lushan**

**A vertical water pit at Koshenkeh. The water is allowed to settle at the bottom of the pit and is removed by a windlass and bucket**

## II. Ancient Igneous Rocks

*Gneissic Granite.*—Below the gneiss lies the reddish gneissic granite, which varies from a coarse to a medium grained variety. They are composed chiefly of othoclase, quartz and biotite without accessory minerals. Closely connected with the gneissic granite, are pegmatitic and quartz dikes and veinlets in the gneiss system, suggesting the antecedent tectonic course of the region. It is believed that most of the pegmatitic and quartz veinlets or dikes were a late phase of the eruption which produced the masses of granite of gneissic structure in Algonkian time, for in several places, notably around the mountains of Mashan and Lushan, typical dikes of pegmatitic character and of quartz in the gneiss, seem to grade directly into the gneissic granite in question. In some cases the fissures and fault-planes in the granite itself are filled by pegmatite and particularly by quartz dikes. Later than these last mentioned intrusions, the gneissic granite was intruded by innumerable dikes of a darkish green rock of densely fine texture, which range in width from a few inches to several tens of feet, and which, according to their mineralogical composition, are olivine-basalt or dolerite.

*Research in China, Vol. I, pp. 19-21.

*Dolerite.*—This group of rocks is represented by numerous dikes. They commonly occur in gneissic granites and run parallel to or cut across the quartz dikes*. In fresh conditions, this rock is extremely hard, but when it has been subjected to the actions of percolated waters from above, it is thoroughly disintigrated and decomposed and in some cases appears as a soft and darkish thick mud. It appears to be of much economic importance in this district. as will be pointed out in the section devoted to the ore-deposits. Nearly all these These dikes are found in practically all the workings at all elevations, but they have not been found to appear at the surface. They can be studied to particular advantage on every level in the mines, their green or darkish green color and aphanitic texture contrasting strongly with the quartz and granitic rocks. In some case the remarkable irregularity of the dikes is clearly shown. They branch and coalesce; they swell and pinch out; they change abruptly in course and dip.

Magascopically it may be taken for aphanite. As seen in thin sections, the rock is essentially composed of plagioclase, pyroxene and olivine. It occurs in ophitic or trachytic structure. As accessory or occasional constituents, occur biotite and magnetite. The feldspar crystals, chiefly labrodarite, show strong tendency to automorphic with marked tabular habit, and exhibit twin-lamellation. They occur at times as phenocrysts. Augite occurs as phenocrysts, generally characterized by good crystallographic form, and also as more or less irregular grains in the ground mass, suggesting their crystallisation in two generations. The latter type previously occupies the interstices of plagioclase feldspars. The thin sections made from the specimens taken from various levels, show that this mineral has been completely sericitized. Biotite occurs sparingly in some specimens, but in others it is rather abundant. It is almost in all cases in lath shape and commonly occurs interstitially or included in some of the plagioclase feldspara. Olivine occurs as large and small phenocrysts, more or less idiomorphic and sometimes as small grains in the ground mase. They all seem sensibly colorless in ordinary light. When fresh it shows the usual irregular cracks along which alteration begins and in some instances shows an imperfect cleavage also. Generally it is in an advanced stage of alteration, the more noticeable product is serpentine. Zonary changes of this mineral in form of iron oxides, are also shown in several cases.

It is believed that these dikes are later than those quartz dikes mentioned above, as the former cut across the latter as seen in some of the workings. It is probably safe to say that these dolerite dikes are of late Algonkian age.

## Structure

*Folding.*—That the rocks of the Linglungshan region have been thrown into numerous and complex folds and that the metamortphism of the gneiss or the Taishan complex is extreme, cannot be doubted. The strike in the main is prevailingly N.E. and S.W. with a dip varying from 46 to 65, mainly to northeast. In most parts of the region a dominent trend, which represents the axes of the principal folds, is recognizable and the minor strikes in various directions transverse to this trend are probably due to local flexuse or mark the ends of pitching folds. Practically speaking, no great folds are traceable for an appreciable distance, this is no doubt due largely to the probability of complex overthrusting originally involved as in case of the structures of the Laurentian in North America.

*Faulting.*—In the Linglungshan region the evidence of faulting may be considered as proved by the difference in altitudes or in certain topographic features. The relatively rapid erosion which took in the crushed rocks of the zone of fracture, which probably represents a fault line, has tended to develop the present stream valley which is partly occupied by the mining community. Furthermore the abrupt discontinuity and reappearance of ore outcrops and abrupt changes in dips in a short distance as observed in the workings at Hungzahyia are indicative to the presence of faults, though they are not clearly shown on the surface.

*Joints.*—The rocks of the Tsaoyuen gold field have been much divided into large and small blocks as the result of both anamorphism and katamorphism which they have experienced as described by Baily Willis in his work on the structural geology of Shantung†. Many examples of this kind occur just N.E. of the mining camp, where the striking peaks, like Siaoyinting and Hsanshanting, rise 120 or more metres above the valley, the masses of these pecks are composed of widely jointed blocks whereas the rocks in the valley are jointed much more intensely.

# Part II

## Economic Geology

### General Mineralogy of the District

*Minerals.*—The number of minerals which are particularly common in the rocks in this mining area are:

Gold, silver, pyrite, chalcopyrite, oxidation products of copper, quartz, coless, sphalorite, orthoclase, laboradorite, albite, pyroxene, olivine, hornblende, biotite, hemetite, magnetite spricite, epidote, aptite, serpentine.

Notes on occurrence of some of the before-mentioned minerals especially those of economic importance:

*Gold.*—Within the oxidized zone, native gold of minute grains may be seen with unsided eye by grinding a pice of quartz rich is sulphides. The small particles of native gold in the sulphides of iron and copper are, however, invisible to the naked eye before the ore is crushed and washed with water. In a few cases spongy masses intermixed with the oxidized products of chalcopyrite or with the disseminated native copper, which was reduced from chalcopyrite by oxidation, say be distinguished with more or less difficulty. Examination of the ores of all classes, rich or poor, supposed free from oxidation, seems to indicate that the gold in all cases is free.

The so-called placer gold along some of the sandy rivers is either wholly won from the slopes of some of the productive hills or wholly carried down by the waters from the washings of the native milling camp, or composed of broken pieces from the quartz veins having decomposed and disintegrated by deep-seated weathering.

*Silver.*—Silver is commonly present with gold in the sulphides, especially the ores which are free from oxidation. No native silver has ever been found in this district, and from the fact that it is very rich in the ores in which copper sulphide predominates, it is inferred that the silver is probably chemically combined in a compound such as tetrahedrite though the presence of the latter has not been identified. The largest amount of silver found in the ore is 2.472 ounces per ton according to the analyses made by the industrial experiment station of this ministry.

*Pyrite.*—This mineral is the most common metallic sulphide in the district. It occurs widely in the quartz veins. It is commonly in massive form, or in veinlets, or occassionally in large, irregular masses. It is sometimes crystallized, showing cube or ostehedrons or a combination of both. Some of the pyrite veinlets are poor in gold or almost valuless as far as the gold content goes. Some of it is strongly cupriferous, as most pyrite veinlets show stains of copper carbonates as seen in different ports of the workings.

*Chalcopyrite.*—Next to pyrite, chalcopyrite is the most common metallic mineral accompanying the gold content. It is particularly abundant in some of the important veins such as those seen on the upper levels. The mineral is usually of dull yellow color and occurs as small masses with pyrite in the quartz veins. It is not know to form distinct crystals. In rich suriferous veins this mineral is usually covered with a coating of dull lead-gray opaque color, indicating oxidation. This coating is so thin that its exact nature is not determinable, but it is believed that the portion of iron sulphide chemically admixed with this mineral, is liberated under the influence of oxidation, leaving the copper in the form of chalcocite or cuprite.

The presence of this mineral in the ores especially when it shows the dull color mentioned above, is of great economic value indicating generally the rich content of gold. According to the analysis made by the industrial experiment station of this ministry, it shows that the amount of gold carried in the ores of cuprifercus sulphides varies from 4.838 to 17.203 ounces per ton.

*Oxidation Products of Copper.*—Of the oxidized products of copper, the sulphates, chalcocite and bornite are most common. The latter two occur chiefly in the veins in which the copper sul-

*These quartz dikes later became the centre of ore deposits and they are called quartz veins in discussions of the gold ore.

†Research in China, Vol, I, pp. 5973.

phides are particularly rich, whereas the former occurs usually in cracks, or as a coating on some of the rocks in the workings, and it is never found in the veins which are free from oxidation.

*Quartz.*—This is an important mineral in most of the rocks in the district. In constitutes a mass which occupies the major portion of the veins. The specimens taken from different parts of a vein and different veins all seem to indicate that some of the quartz crystals are of secondary origin and much of the larger crystals of this mineral have been distorted and fractured, and wherever this dynamic disturbance took place, secondary or granulitic quartz is present as a filling between the larger crystals of the same mineral. Most of them show strong pleochroism under microscope and they commonly show enclosures of minute crystals of quartz probably partly formed by recrystallization and partly deposited from the ore depositing-solutions as shown elsewhere in this paper.

*Galena.*—In some of the quartz veins galena occurs in very small quantities. It is commonly .associated with iron sulphides in the veins in which gold is either poor or absent. It is therefore assumed by the miners that the veins in which this mineral is present, are not auriferous. Other occurrences of this mineral are in the quartz veins which do not carry pyrite. It is not known whether this mineral occurs at all depths, and it is not altered even within the oxidized zone.

*Sphalerite.*—This mineral has so far not been commonly found in the veins. The writer has been informed that it has been found in quartz, but he himself has never seen it in any part of the workings.

*Orthoclase.*—This occurs as an important constituent in all the rocks, such as gneiss, grano-gneiss, or gneissic-granite and pegmatitic granite in the district, except of course the dolerite dikes and basalt eruptions. It is seen, moreover, as a mineral of the veinlet-forming period in some of the fissures in gneiss.

*Plagioclase.*—They are chiefly represented by laboradorite and occur as principal constituents in dolerite dikes and in basalt rocks. Laboradorite is much less common than is orthoclase and albite, the latter usually occuring with the orthoclase.

*Pyroxene.*—This is represented by augite, and occurs in dolerite dikes and in the basalt eruption which forms the famous neck of Tsanshan 60 *li* east of the present mining camp.

*Olivine.*—This mineral is fairly abundant in those dolerite dikes which are commonly found in the mines.

## Geologic Sequence

A period of fracturing and shattering: Long previous to the intrusion of granite which is now more or less in the form of gneissic-granite, the area was subject to very extensive diastrophism the compression being largely horizontal and probably extended in all directions. It was due to this great movement that numerous fractures or sheared zones were formed in the gneiss which overlies the genissic-granite every where, and it is not improbable that the gneiss was developed during the same period.

Following this period of extensive and great fracturing and shattering there seems to have occured a period of successive intrusions which do not appear to be very far apart from each other. These intrusions were first largely granitic and were followed toward the end of magnatic eruption, by the intrusions of pegmatitic granite and quartz veinlets and dikes. They filed every fracture in the gneiss as well as in the earlier part of granitic rocks. The grains of some of the pegmatitic veinlets are usually coarse.

Following these successive acidic intrusions, including those quartz dikes which are now regarded as quartz veins, and the period of their mineralization and replacement, there seems to have occured a separate and last period of volcanic activity, giving rise to the intrusion of dolerite dikes which are one of the common rocks in the mines.

These periods of intrusions were later followed by movement largely upward, which seem to have tilted northwestern Shantung toward northeast and which raised that part of the province probably not less than 2,000 feet.

## History and Technology of the Gold Deposits

*History of Mining Development.*—The story of the discovery of gold in the district of Tsaoyuen has hitherto not been summarized, though scanty information from various sources exists. The following sketch is a summary of a series of conversation between the writer and the superintendent of the Tasoyuen Gold Mines Company in the spring of 1917.

It appears that when the gold mines near Judien, in the district of Pingtu, Shantung, became unworkable below the underground water level, the late Li Tsoon-dai, father of the present general manager of that Company, started another search for gold with the assistance of the natives, in the hills of Lushan and Linglungshan on the strength of the historical facts which are mentioned elsewhere in this paper, * and on information furnished to him by the natives of that locality. In the course of desultory diggings, he found a vein on the southeastern slope below the Hunzahyia peak in the 16th year of Kwang Hsü of the Tsing dynasty. In the following year his attention was directed to the hills of the Linglungshan system on the east side of the narrow valley, and the first adit was driven at the foot of the south wing of Linglungshan. The entire work was then operated under the direction of an American mining engineer. In the fall of the same year they installed a milling plant of purely native character.

As soon as the true character of the ore body was ascertained the tunnelling work was rapidly pushed forward. In the next two years (the 16th and 17th years of Kwang Hsü) the tunnels Nos. 2-8 inclusive were cut one after another all of these being situated on the northwest slopes of the Linglungshan proper.

No complete record is obtainable as to the yearly production of gold under the management of the late Mr. Li Tsoon-dai, who died in the 20th year of Kwang Hsü. He was succeeded by his second son, Li Tao-yuen, the present general manager of the Tsaoyuen Gold Mines Company. Under the management of this gentleman the Company was very prosperous in the 23rd and 24th years of Kwang Hsü, during which period the maximum production of 50-60 ounces gold per day was sometimes attained, while the production of 5-40 ounces gold per day was common. Thereafter, the production declined slowly and since that time till the present, the mine has not been operated to any further extent. The decrease in the production of gold dropped to an amount insufficient to cover their expenses.

This condition was to some extent due to the impoverishment of the veins, but the main causes must be attributed to the lack of capital and of proper knowledge of the deposits.

OUTPUT OF GOLD-ORE FROM 1912-1917 (INCLUSIVE)

| | Ore in Catties. | Gold in Ounces. |
|---|---|---|
| 1917 .. .. | 275,900 (Jan.-April incl.) | 221.14 |
| 1916 .. .. | 1,292,490 | 686.81 |
| 1915 .. .. | 1 027,280 | 390.75 |
| 1914 .. .. | 775,820 | 443.98 |
| 1913 .. .. | 997,800 | 278.68 |
| 1912 .. .. | 514,580 (July-Dec. incl.) | 108.26 |

The total dividends cannot be ascertained on account of the imcompleteness of the book-keeping and of the records on the profits received from the sub-mining parties operating in the region under contract as mentioned elsewhere in this paper. But for the year 1916, the dividends of the Tsaoyuen Gold Mines Company are said to have amounted to $50,000.00 as a net profit. This amount, in the company's opinion, is considered a very handsome profit.

It is interesting to know that Linglungshan produced about one-fifth of the total tonnage of gold for any year since the beginning of the republic. The investigation made is the spring of 1917, shows that 80 per cent. of the ore came from the hills of the Linglungshan system, 10 per cent. from Lushan system and 10 per cent. from Koshenkeh-Pudehkong system.

*Investments by Foreigners.*—As the company has had constant trouble in money affairs, the present manager and proprieter of the company made contracts with several parties of foreign nationality on different occasions, among which may be mentioned. The Macco & Co., of Chefoo since the latter actually sent men there to direct the work.

As far as the writer could learn from the present manager the contract was made between his company and The Macco & Co., in July in the first year of the republic of China. According to the contract, the foreign company was to finance his company for the continuation of its mining operations while the latter agreed, in return, to deliver a certain number of tons of ore of certain grade at

a fixed price for an indefinite period of time. The contract was, however, soon cancelled on account of the quality of the ore received by The Macco & Co., which was below the profitable limit.

It has also been learned from another source that prior to the last mentioned transaction, the Tsaoyuen Gold Mines Company entered into a similar agreement with the Collbran Bostwick Development Company of New York. The latter is said to have spent a sum not less than $20,000.00 in these mines for underground surveying at different times. But the said contract was not sanctioned by the government until the early part of the 3rd year of the republic. This contract was, however, later cancelled by mutual agreement between the Tsaoyuen Gold Mines Company and the Collbran Bostwick Development Company of New York as the latter was unable to comply with the financial requirements of the contract.

In the fall of 1917, the Oriental Mines Company of New York became also interested in these mines. Mr. Wammer, a mining engineer of that company, visited the property in the early part of last fall, and he is understood to have made a very favorable recommendation. But the negotiation was dropped owing to the sudden departure of Mr. Finch, the resident manager of the Oriental Mines Company, for New York City.

Lately Mr. Li Tao-yuen of the Tsaoyuen Gold Mines Company has entered into two separate agreements, one with..........and the other with............... To the former he has contracted to sell 10,000 tons of his ore and a sum of $15,000 has already been paid him in advance ; while from the latter he has received $80,000 in advance but the nature of that contract is not known to outsiders.

*Mining.*—The methods of mining employed by the Tsaoyuen Gold Mines Company are not materially different from those used in former times when the gold was first exploited. Over hand stoping is only occasionally used. Stulls of any kind are seldom used whether the veins are wide or narrow. No consideration is taken as to whether the wall rock is compact or hard enough for the stopes to stand unsupported. It may be noted that the disintegrated dolerite dikes at many places in the workings cause dangerous scaling off on the walls and is a consequence of this condition of affairs the roofs of some of the upper most levels have fallen at several points.

In general the ore is driven off by drifting which is conducted by making a number of chazel holes with long steel chazels in a desired portion of the rock by a number of men who usually work under contracts. When a sufficient number of chazel holes is made, the holes are filled with ordinary gun powder, and by its explosion the rocks are then broken, sometimes this requires a series of explosions. As soon as the smoke disappears the men return to pick out the ore, which is placed in the ordinary half ton-cars, and then, when filled are hoisted or rather pushed out on narrow tracks by the men under the same contract. The work of this group of men ends with the delivery of the ore or rock at the main entrance of a particular tunnel which connects with their respective levels. No electric or steam power has ever been used in this district so far the writer knows.

*Sub-mining.*—Besides the mining operation carried on by the company, there is another way in which the ore is exploited. The inferior ores or the gold bearing material rejected by the company after the rich portion has been sorted out, are sold to the nearly villagers or farmers. These ores are sold at seven or eight coppers per 100 catties. The treatment of these ores is carried on by the purchasers in their own "plants" and the methods of treatment is much the same as that used by the company as described elsewhere in this paper.

There is still another way of working this class of poor ores. The farmers are not required to buy the ore from the company, but extract whatever amount of gold they can get from it. This is divided in equal proportions between the company and the farmers concerned, on the basis that the company furnishes the necessary tools for the various processes, while the farmers furnish the labor.

(*To be continued*).

## THE MANILA RAILWAY

(*Continued from page 405*)

No construction work is being done on any of these projects at the present time on account of lack of funds. Their completion means the life of the road. The construction of the line from Aloneros to Pamplona will connect up the Legaspi division with the main line south and will give through railroad lines from Tabaco and Legaspi in the south to San Fernando, La Union, in the north. This will make it possible for the Legaspi division, which is now a charge on the earnings of the Company of from P.450,000 to P.500,000 a year in unearned operating expenses and interest payments, to earn at least its fixed charges. A bill has been introduced in the legislature authorizing and directing the governor-general to subscribe for 70,000 shares of the capital stock of the Manila Railroad Company at par and to be paid for in yearly sums of not less than P.2,000,000; the sums so received to be used for the sole purpose of constructing the lines of road above specified. Its passage is assured and approval by the governor-general is hoped for.

### Legislation

There have been submitted to the legislature for consideration during the present session the following measures :—

A bill authorizing and directing the governor-general to subscribe for 70,000 shares of the capital stock of the Manila Railroad Company, the funds so derived to be expended in the construction of certain specified lines.

A bill exempting the Railroad Company from taxation so long as it is owned and operated by the government.

A bill regulating the operation of motor-driven vehicles and providing taxation therefor.

A bill granting to the Railroad Company foreshore rights along Manila Bay, north of the Pasig River.

The passage of these bills seems to be essential for the economic prosperity of the Railroad Company. They all have the approval of the board of directors and their passage and approval by the governor-general is expected.

In the recommendations for new work it is believed that a considerable saving might be effected by the inauguration of single unit, gasoline railway cars for light passenger and package traffic on branch lines. If successful, a service of this kind might also tend to solve the problem of motor truck competition in the territory affected. The specific appropriation of a moderate sum to be used for investigating and experimenting along these lines is recommended.

*General Improvements and Betterments.*—During the past five years the funds available for expenditure have largely been put into the construction of new lines, and improvements and betterments and facilities for the economical and efficient operation of existing lines have suffered accordingly. Estimates made as to cost of various improvements, such as replacement of 45-lb. with 65-lb. rail, the substitution of permanent steel for temporary wooden bridge structures, acquisition of modern rolling stock, building of shops, locomotive sheds, stores, warehouses, and stations, amount to upwards of P.11,000,000. Better results might be secured in the carrying out of these projects by the sanctioning by the board of a definite plan or program, to be followed say for a period of five years.

## THE MANILA GAS WORKS

(*Continued from page 406*).

other industries have also found gas to be a necessity in their line of business.

During the first years, before the general public knew exactly what gas was and realized its great advantages over other fuels, many hesitated to have it installed in their homes. The first consumers were mostly those who had live elsewhere and were acquainted with the advantags of gas service. However, the native population were quick to realize that gas was far superior to their primitive methods of cooking, and to-day 75 per cent. of the gas consumers are native born.

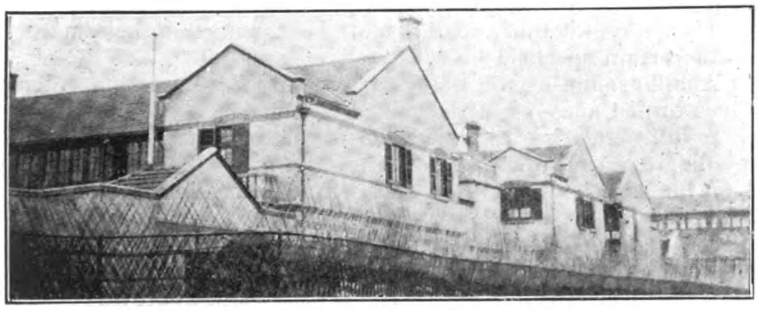
In recent years the public has come to realize the advantage of hot baths, and as gas water heaters supply an abundance of hot water instantly, these heaters are now greatly in demand. Already there are almost 1,000 homes equipped with gas water heaters and new installations are made daily. The gas water heaters range from the small instantaneous shower bath heaters to the large automatics capable of producing sufficient hot water for four or five hot baths at one time.

The growth of the Manila Gas Corporation has been practically spontaneous, mainly because of the superior advantages of gas as a cheap and efficient fuel for all purposes. It is understood that the company is planning an extensive educational publicity campaign dealing with the influence of gas in relation to health and sanitation, which will undoubtedly further popularize the use of gas.

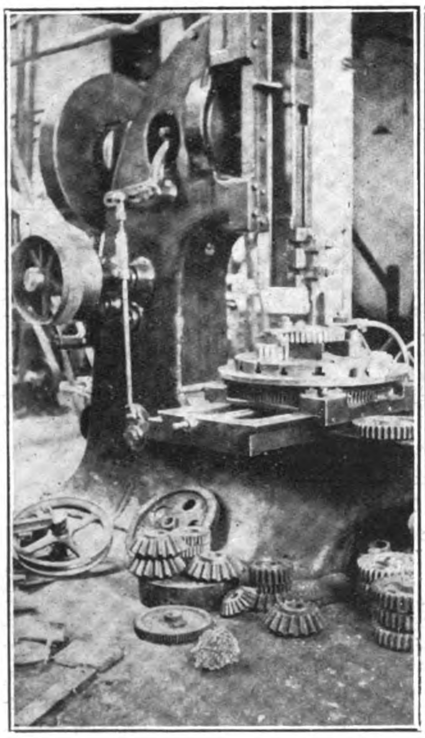
# Chinese Engineering Works in Shanghai

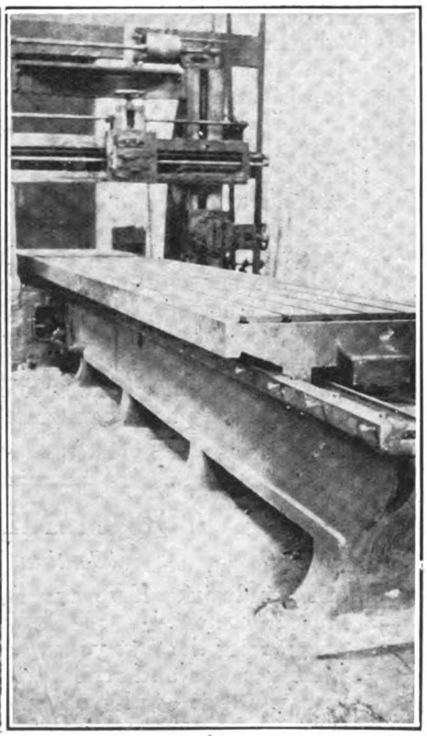
*By M. H. Chou*

TO the great surprise of foreign visitors, most of the successful engineering works in Shanghai are managed not by the engineering graduates from the local technical schools in China nor by the graduates from American or European universities, but by those who are blacksmiths by profession, having very rude knowledge of Chinese and arithmetic. They learn their trade from experience and can talk a little English through having been employed by foreigners. They always start with one small crowded shop where all their family and apprentices live together and gradually expand into respectable engineering establishments covering a few acres of land. Because of extremely low overhead expense, they can easily compete with the modern engineering works run by foreigners or returned students, although the workmanship of their product may not be high-grade. A fair example of these shops is the Yah Tai Engineering Works situated on JH 12 Kwenming Road, Shanghai, started by Mr. Tsai Fong Yuen, a native of Ningpo, about thirty years ago.



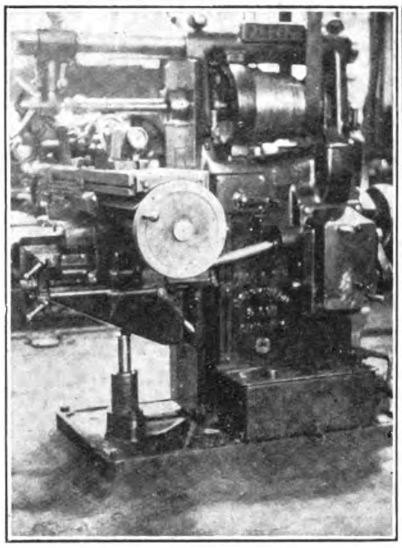
**Yah Tai Engineering Works: A Typical Chinese Machine Shop of the Better Class**

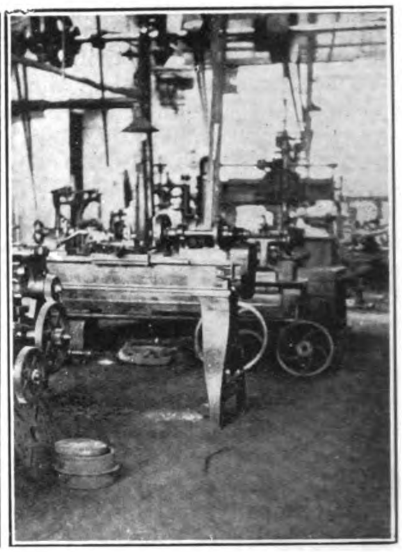




**Yah Tai Engineering Works:**

**Punching Machine** **20-ft. Planing Machine**





**Yah Tai Engineering Works:**

**Milling Machine** **Foundry Machine**

Their works consists of four departments : *Foundry, Machine, Repair and Contracting.* The foundry department manufactures boilers, steel structures, water pipes, cylinders, valves, bed-plates, layers, brackets. The machine department makes various types and kinds of machines such as humidators, crude oil engines, motors, pulleys, reeling machines, cranes, shovels, cars, elevators, road rollers, fire engine, pumps, water towers, etc. The repair department sends out skilled labor to repair the machines of different cotton mills, power stations, etc. The last department contract labors for erecting turbines, boilers, flour machinery, oil machine, etc.

In this they have done very satisfactory work with the following works:—Ewo Cotton Mill, Yangtszepoo Cotton Mill, Kung Yih Cotton Mill, Anglo-Chinese Cotton Manufacturing Co., Caoching Cotton Mill, Tientsin, Soochow Electric Co., Wah Foong Cotton Mill, Dah Seng Cotton Mill, Nantung Chow.

The proprietor of this engineering works is assisted by his eldest son, Tsai Chin-ze, who is taking an English and engineering course from the International Correspondence School.

From him, we learn the following interesting information about the Chinese labor system. If any boy of ten or less years of age wants to take up blacksmithing as his profession, he has to perform the ceremony of adopting his master by holding an incense before him and kneeling down before him and ponding his head three times. By this ceremony he is initiated into their labor fraternity. He is given free board and lodging and 50 cents Mex. a month for miscellaneous expenses such as hair cutting, buying shoes, socks, etc. He has to work for his master for 3-5 years without pay. The training is very severe. Any boy of delicate health can hardly survive. After the period of his apprenticeship is over, he may work for his master or some other men for ten to fifteen dollars a month. All those working under the same master consider themselves as brothers. Their fraternal tie is exceedingly strong. They help one another in employment and in other ways.

They have no social club for recreation, but spend their time in tea-shops which are considered as social centres where they communicate to one another news about the work, and all gossips of the time. They also settle their claims or differences there. If two parties do not agree, they fight.

They have one central guild which is very loosely organized. Its chief function is to have some Buddhist monks sing their incantations to drive out the evil spirit once a year and to furnish coffins at very little cost to deceased members.

# The Coal Resources of Asiatic Russia

*By P. P. Goodkoff*

*From "The Geographical Review"*

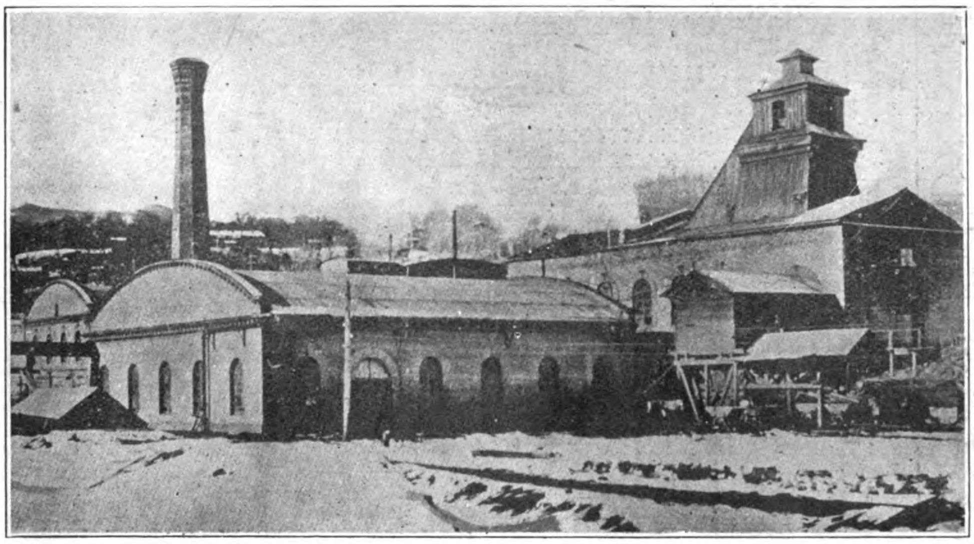
IN view of the immensely important part which the coal deposits will play in the economic regeneration of Russia which is bound to come and which we may assume will follow, in a general way at least, the channels already marked out at the outbreak of the revolution, it seems worth while to discuss briefly each of the individual coal basins and to indicate something of their economic and geographic relationships. We may divide these basins into two main groups. In the first are those which are best known and situated most advantageously in respect to present centres of population and lines of communication. In the second category are the deposits which have been less thoroughly explored are less favorably situated geographically, and whose probable future importance we may only estimate in a very general way. To the first group belong the basins of Kuznetsk, Irkutsk, Minusinsk, the Kirgiz Steppes, Sakhalin Island, and the maritime province, as well as the less rich deposits of Turkestan and the brown coals of the Yenisei government. In the second group fall the coal fields of the Amur and Transbaikalian provinces and of the Tungusk basin and the deposits of the Yakutsk and Kamchatka provinces.

On the accompanying map, the larger basins and fields are shown in black*; separate deposits of lesser area and known crops are indicated by crosses.

## Coal Basins and Fields of Primary Importance at the Present Time

### 1. The Kuznetsk Basin and Gorlovo Field

The coal reserves of this basin, which covers over 8,600 square miles, are said to represent more than 50 per cent. of the total reserves of Russia. Only within the last decade has their full significance been appreciated. The coals are of all kinds and of high quality. Mining was first developed in the northern part of the area in 1898, when the western section of the Trans-Siberian railway was opened. The demand for fuel by the railway led to a rapidly mounting output from the mines, which in the years between 1910 and 1917 increased over tenfold, or from 88,710 to 1,237,800 metric tons annually. It is estimated that in the near future the annual output, in so far as it depends on the reserves of coal prepared for mining, may well reach ten million tons. This would not only satisfy the demand for fuel in western Siberia expected to prevail in 1930 as a result of the increase of population, the construction of many miles of railways now contemplated, the transition on the river steamboats of the Tom, Ob, and Irtysh from wood to coal burning, and the development of the local metallurgical industries, but it would also make possible the realization of a project for the construction of three large iron works in the Ural to be operated with Kuznetsk coke. In this connection, the total quantity of fuel which will have to be transported to western Siberia and the Ural region will probably amount to as much as 13 million tons, about 75 per cent. of which must be furnished by the Kuznetsk basin.



Shaft of the Suchan Coal Mine, No. 1, near Vladivostok, Siberia

Between 1913 and 1917 geological explorations and prospecting were conducted throughout the basin by the Kuznetsk Coal Mining Company. The construction of a railway, which is to run through the basin from north to south, was completed in 1919 to a point about 52 miles northwest of the town of Kuznetsk.

West of the Kuznetsk basin lies the so-called Gorlovo anthracite field, occupying an area some 43 miles long by 6 miles wide. The reserves of the northern part alone are calculated at 3.8 million tons, but, owing to unfavorable geological conditions, this field is as yet undeveloped.

### 2. The Irkutsk Basin

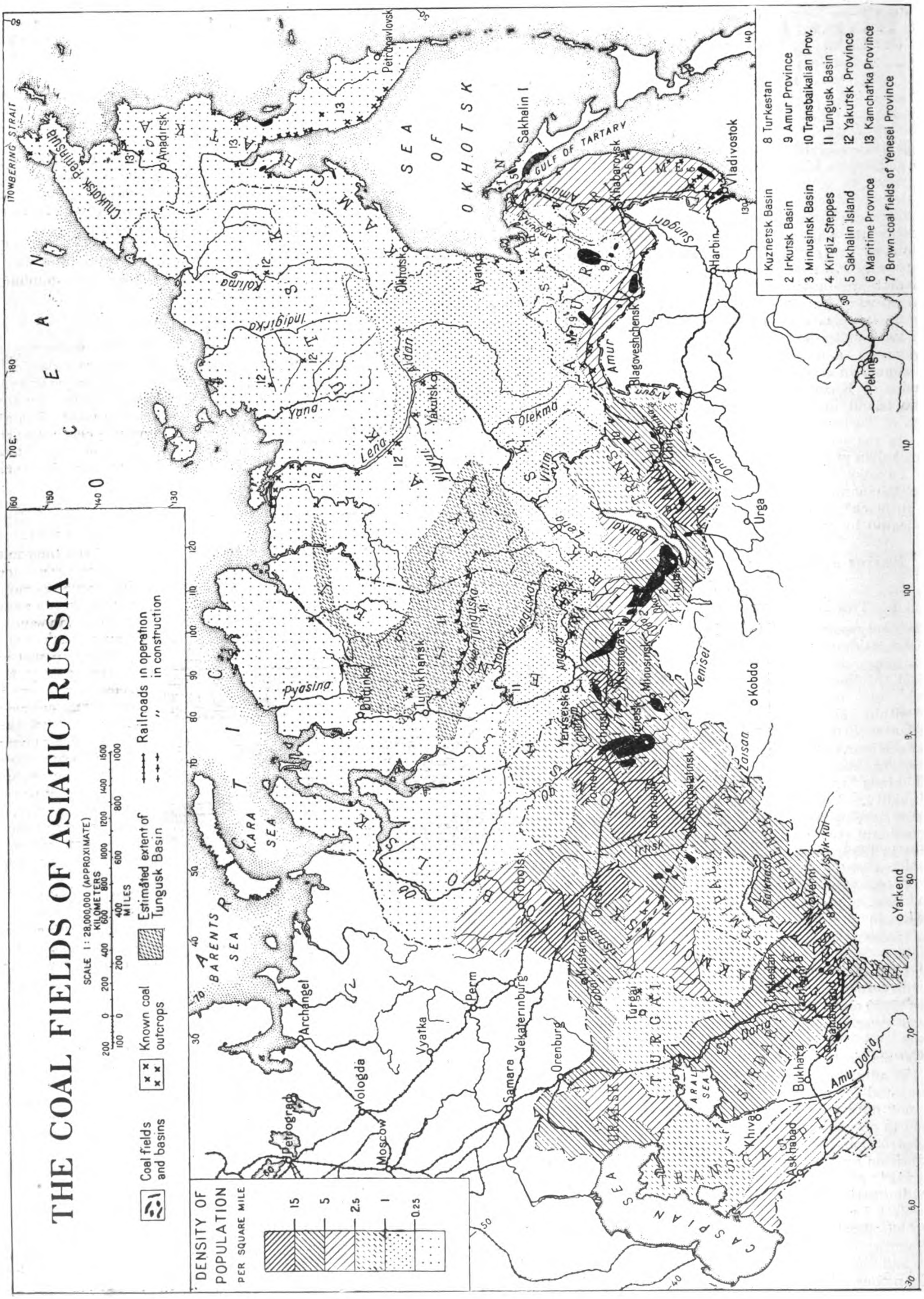
This basin occupies an area of 17,200 square miles, or nearly twice that of the Kuznetsk fields. Over 32 million tons have already been prepared for mining by means of excavators. For the most part the deposits consist of bituminous coking coals; but at some places a transition into brown coal is known to occur, and resinous coals are found in other localities.

Here it was that coal mining on a large scale was first conducted in Siberia. The Irkutsk basin has supplied fuel for the Transbaikalian and Amur railways, and coal has been shipped from it westward as far as Taiga (southeast of Tomsk) and occasionally even to the Ural mountains. The output has ranged as high as fifty per cent. of that of all the Siberian coal mines (1,237,800 tons in 1917). Future development is guaranteed by geological conditions exceptionally favorable to mining, by an advantageous position along the railway for a distance of over 300 miles, and by the absence of sufficiently developed mines in the Transbaikalian and Amur provinces. If the production of coke is found possible, the future of the region will be even brighter. Furthermore, in connection with the projected enlargement of the Ural metallurgical industry referred to above, it has been estimated that by 1930 no less than 2.42 million tons of Irkutsk coal may be transported annually in a westward direction.

### 3. The Minusinsk Basin

The coal-bearing formations near Minusinsk cover an area of 215 square miles and include both bituminous coking coals and subbituminous coal, of a quality on the whole somewhat inferior to that of the Kuznetsk coals though superior to that of the Irkutsk fields. The total output before the revolution was very limited in comparison with the output of the Kuznetsk basin, being 21,000 tons in 1914 and 40,000 in 1917. Future development depends upon the improvement of means of communication. The Achinsk-Minusinsk railway, which will connect the coal fields with the Trans-Siberian line, is as yet

*The coal deposits as shown on this map are based upon: (1) a map annexed to "The Natural Resources of Russia," Vol. 4, No. 10, "Gold" (see above, footnote 2); (2) a map in "The Mining Industry and Mineral Resources of the Russian Far East" (see above, footnote 4); (3) S. V. Obruchev: The Tungusk Basin, *Ore Bulletin (Rudni Vestnik)*, Moscow, 1918, No. 4. The density of population is adapted from "Atlas of Asiatic Russia" (Atlas Aziatskoi Rossii), edited by the Department of Immigration, Ministry of Territorial Organization and Agriculture, St. Petersburg, 1914, map No. 26


THE COAL FIELDS OF ASIATIC RUSSIA
SCALE 1 : 28,000,000 (APPROXIMATE)
KILOMETERS
MILES
Coal fields and basins
Known coal outcrops
Estimated extent of Tungusk Basin
Railroads in operation
" in construction
DENSITY OF POPULATION PER SQUARE MILE
15
5
2.5
1
0.25
1 Kuznetsk Basin
2 Irkutsk Basin
3 Minusinsk Basin
4 Kirgiz Steppes
5 Sakhalin Island
6 Maritime Province
7 Brown-coal fields of Yenesei Province
8 Turkestan
9 Amur Province
10 Transbaikalian Prov.
11 Tungusk Basin
12 Yakutsk Province
13 Kamchatka Province

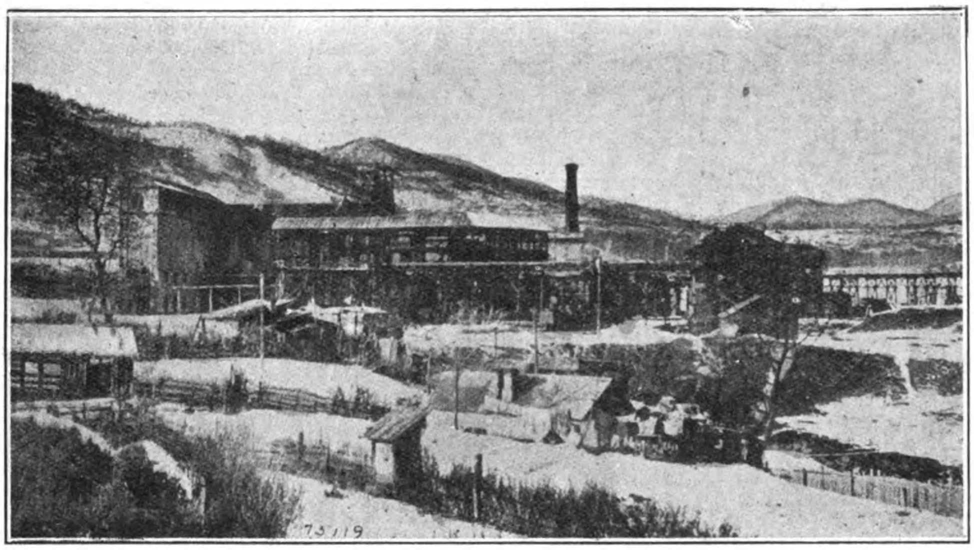
unfinished, for, although the roadbed, stations, and many of the bridges have been constructed, rails have been laid only to a point some 30 miles south of Achinsk. The line Minusinsk-Kuznetsk-Barnaul, which will also link up the basin with the Trans-Siberian and South Siberian roads, is yet as merely a project. Much may be expected from the completion of these routes, as well as from the increase of steam navigation on the Yenisei and from the exploitation of the rich iron and copper ore deposits of the southern part of the Minusinsk district. Broadly speaking, it is expected that 350,000 tons of Minusinsk coal will be sent annually to western Siberia for use as fuel.

### 4. The Kirgiz Steppes

The deposits of the Kirgiz Steppes consist of anthracites, coking coals, dry coals, and brown coals—all of relatively inferior quality. The total output mounted from 27,666 tons in 1914 to 98,050 in 1917. Slow advance in the industry has been largely the result of inadequate means of communication. The portion of the South Siberian railway west of Semipalatinsk was not begun until 1917. Though the deposits are neither large nor of high quality, they are of great local value on account of the absence of any other fuel in the region. Lack of adequate communications has also been a serious handicap to the exploitation of the numerous copper, silver-lead, and zinc deposits of the Steppes, as well as to the progress of steam navigation on the Irtysh.

### 5. Sakhalin Island

The Sakhalin fields are the best of all deposits immediately adjacent to the Pacific. They include an abundance of high-quality bituminous and coking coals and more or less lignite. Development has been seriously retarded by the absence of good harbors for the protection of loading vessels from the stormy waters of the Gulf of Tartary.



Suchan Coal Mine, No. 2, near Vladivostok, Siberia

### 6. The Maritime Province

Coal-bearing Jurassic rocks and lignite-bearing Tertiary deposits are widely distributed in the southern part of this province north and south of Vladivostok and for a long distance along the coast. The Jurassic coals are mainly anthracites and semi-anthracites, but coking coals and some other kinds also exist. Most of the coal is of rather low quality, though the lignites furnish a good fuel and in some deposits are very rich in volatile matter. The total production (including lignite) in 1917 was 584,800 tons. Inasmuch as a very considerable part of the coal-producing area is still unexplored, the real reserves may be greater than the estimated figures. A large increase in mining in this region is to be expected coincidently with the growth of sea and river fleet, the construction of railways, and the probable future development of the metallurgical industries on a more extensive scale.

The brown coals of the maritime province are rich in volatile matter: it is thought likely that they will be utilized for obtaining distillation products such as paraffin, benzine, creosote, etc.

### 7. The Brown Coal Fields of Yenisei Government

Several basins of rather large size constitute these fields. Some of the seams are rich in volatile matter which renders possible their use in the production of paraffin and other similar substances. Good domestic fuel can also be obtained from them. In the years 1917-1918 oniy a few small mines were in operation in this district.

### 8. Turkestan

The fields of Turkestan contain anthracite, coking, and non-coking coals, but of these only the coking and non-coking coals are of practical importance. On account of their low calorific power and the unfavorable conditions of stratification in which they occur-the latter have come into use only after the almost complete exhaustion of wood for fuel.

## Coal Basins and Fields of Secondary Importance at the Present Time

### 9. The Amur Province

Four fields of bituminous coal and one rather large basin of brown coal (about 215 square miles) are known in the Amur province. Shortage of fuel needed for the Amur railway and the impending change from the use of wood to that of coal on the large fleet of steamers on the Amur River will in all probability stimulate their development. A contributary incentive may well be provided by the exploitation of the very promising iron-ore deposits in the vicinity of the Little Khingan range. Means of communication, however, must first be improved.

### 10. Transbaikalian Province

The coals of the Transbaikalian province are found in separate and very small basins which contain beds of brown coal. Mining has been carried on only in two fields and there on a small scale. The most promising fields are those which lie near the town of Chita, where mining by excavators is possible, and the Bukachachi field, which, alone in the entire region, produces coal of high calorific power. On the whole it is to be expected that the coal industry of Transbaikalia will remain of limited and exclusively local importance.

### 11. The Tungusk Basin

According to S. V. Obruchev, the numerous coal deposits that have long been known in the region between the Yenisei and the Lena must be considered as belonging to one immense continuous basin occupying an area of as much as 387,000 square miles. The boundaries of this basin, as shown on the accompanying map, are drawn from Obruchev's data. The coals are both anthracite and bituminous, the latter in some localities grading into lignite. Near numerous trap intrusions the coals have been transformed into graphites which form at some places deposits of very considerable extent and of high quality. Information at hand regarding this great basin is very scanty; in fact it is impossible at the present time even to estimate the reserves of the greater part.

### 12. Yakutsk Province

Coal beds are known to exist at numerous points along the Lena north of Bestia station (60 miles below Yakutsk) and at various places in the valleys of the Vilyui, Olekma, Aldan, Indigirka, and Kolima River systems. The beds of the Vilyui valley are perhaps a continuation of those of the Tungusk basin. The deposits of first potential value are probably those on the right bank of the Lena sixty miles above the mouth of the Vilyui near Jigansk.

### 13. Kamchatka Province

Although coal is found at many places in the extreme northeast of Siberia and formations in which it occurs are widely distributed throughout vast tracts, the deposits of this remote quarter still remain almost totally unexplored. It is quite impossible to estimate their reserves even approximately, though it seems likely that bituminous coal and lignite are present in no inconsiderable quantities. The economic importance of these fields will depend on the use that may be made of them as a supply of fuel for the

merchant marine and on the exploitation of gold placers known to exist along the coast of the Okhotsk Sea and in the Chukotsk peninsula.

## Total Resources of the Siberian Fields

Table I is a summary of the total coal resources of the various fields just discussed and of the total reserves of Siberia. "Actual reserves" are calculated on the basis of positive knowledge regarding the actual thickness and extent of the beds; in the case of "probable reserves" only an approximate estimate can be arrived at; and "possible reserves" are those where no estimate in figures can be given. No account of the category "possible reserves" was taken in adding up the grand total. The figure, consequently, is conservative.

According to "The Coal Resources of the World" referred to above, the total coal reserves of the globe were estimated as follows, in million tons:

| | | | |
|---|---|---|---|
| Oceania.. | .. 170,410 | North America .. | 5,073,431 |
| Asia .. | ..1,279,586 | South America .. | 32,097 |
| Africa .. | .. 57,839 | Europe .. .. | 784,190 |

Of these total reserves of 7,397,553 million tons those of Siberia were given as 173,879 million tons, which is considerably less than half the figure which can now be given. The resources of Asiatic Russia (over 400,000 million tons) consequently represent a quarter of the total reserves of Asia and are one and a half times greater than those of Oceania, South America, and Africa put together. Nor is it at all unlikely that future explorations in the Tungusk basin, maritime province and the far northeast may bring to light resources whose amount is unsuspected at the present day.

## Future Development

The revolution called a halt to the industrial operations which created a demand for these coals. Siberia and Russia during the last five years have together gone through a period of economic setback. Recovery will come through the return to political and social tranquillity and through the re-establishment and increase of exports. In northern Asia Russia will find her most abundant treasure of raw materials for export. As compared with European Russia these resources are almost virgin. But they are also to a very large extent ready for exploitation, and many are very favorably situated in relation to lines of communication by rail, river, or ocean. Hitherto Russia has neglected her Siberian resources perforce, by reason of the scarcity of population in Siberia and the lack of labor which this scarcity entails. Refugees from the war and famine zones, however, have tended materially to make good this lack; and there is no reason why, when conditions are ripe for the resumption of industrial activity, there should not be available an ample personnel to carry forward this activity on an even broader scale than was the promise of 1917.

The most extensive industrial growth may be looked for in the southern and western portions of Asiatic Russia. As one advances eastward there is a progressive diminution in the magnitude of probable developments until, in the far east, one reaches a region where all projects for a long time to come will be confined to the Pacific coast and to the neighborhood of the larger rivers. The distribution of population in the case of Asiatic Russia is a fair index of economic potentialities, and the accompanying map shows how markedly the density of settlement (1911) falls off to the north and east.

The geographical distribution of the coal resources likewise coincides with the regions of porbable maximum industrial progress and increase of population. The construction of the Trans-Siberian railway resulted in the acquisition of knowledge of the coal deposits along its route and in their exploitation at a relatively early period. But the presence of the railway accounts only in part for the fact that the known coal deposits shown on our map appear to be predominant in southern Siberia close to the line. Though coals are found widely throughout Asiatic Russia, it is also likely that future exploration will serve to confirm us in our present belief that the southern and central belts are the areas where most coal will be obtained. But even were this not so, the largest basins known at the present time, those of Kuznetsk and Irkutsk, are so favorably situated that even without any assistance from other fields the former can satisfy for a long period every possible demand for coal from southwestern Siberia and the latter can do the same in respect to southeastern Siberia. The Sakhalin basin, almost unique among the coal fields of the Pacific coasts by reason of the high quality of its output, seems especially designed by nature for the export trade, and it is probable that the southern Ussuri region (maritime province) may participate in this export. The successful maintenance of commercial connections with northern Siberia through the Kara Sea seems assured by the discovery of good coal near the source of the Pyasina River and by the probability of equally valuable coal deposits throughout the immense areas of the Tungusk basin which are as yet virtually unexplored. Finally, adding to these circumstances the fact that numerous deposits are known to exist within the province of Yakutsk, we may conclude that industrial development in so far as it depends on coal supplies is possible in any part of Siberia and that, however rapidly the demand for coal in Siberia and even in European Russia may grow, Asiatic Russia will long be in a position to meet this demand.

TABLE 1—COAL RESOURCES OF ASIATIC RUSSIA—(*In metric tons*)

| | ACTUAL | PROBABLE | TOTAL |
|---|---|---|---|
| 1. Kuznetsk basin and Gorlovo field ... ... | 1,125,000,000*b(a)* | 248,875,000,000*b(a)* | 250,000,000,000*b(a)* |
| | | 3,800,000*a* | 3,800,000*a* |
| | | | 250,003,800,000*b(a)* |
| 2. Irkutsk basin... | 1,040,000,000*b* | 148,960,000,000*b(l)* | 150,000,000,000*b(l)* |
| 3. Minusinsk basin | 72,500,000*b* | 800,000,000*b* | 872,500,000*b* |
| 4. Kirgiz Steppes | | 1,100,000,000*b* | 1,100,000,000*b* |
| 5. Sakhalin Island | 255,000,000*b* | 1,745,000,000*b* | 2,000,000,000*b* |
| | | 2,000,000*l* | 2,000,000*l* |
| | | | 2,002,000,000*b(l)* |
| 6. Maritime province ... | 4,800,000*a* | | |
| | 18,230,000*b* | 46,970,000*a-b* | 70,000,000*a-b* |
| | 32,000,000*l* | 168,000,000*l* | 200,000,000*l* |
| | | | 270,000,000*a-b-l* |
| 7. Brown coal fields of Yenisei government ... | | 2,050,000*l* | 2,050,000*l* |
| 8. Turkestan ... | | 170,000,000*b* | 170,000,000*b* |
| Total reserves in the basins of primary importance ... | 3,280,730,000*b(al)* | 400,926,970,000*b(al)* | 404,207,700,000*b(al)* |
| | 4,800,000*a* | 3,800,000*a* | 8,600,000*a* |
| | 32,000,000*l* | 172,050,000*l* | 204,050,000*l* |
| | 3,317,530,000 | 401,102,820,000 | 404,420,350,000*b(al)* |
| 9. Amur province | 1,380,000*b* | 5,000,000*b* | 6,380,000*b* |
| | | 625,000,000*l* | 625,000,000*l* |
| | | | 631,380,000*l(b)* |
| 10. Transbaikalian province... | 30,000,000*l* | 170,000,000*l* | 200,000,000*l-b* |
| 11. Tungusk basin | 32,030,000*b(a)* | 40 500,000*b(a)* | 72,530,000*b(a)* |
| | | 32,000,000*a* | 32,000,000*a* |
| | | | 104,530,000*b-a* |
| 12. Yakutskprovince ... ) | | 650,000*b* | 650,000*b* |
| 13. Kamchataka province...) | Very considerable possible reserves of bituminous coals and considerable reserves of lignites | | |
| Total reserves in the basins of secondary importance ... | 33,410,000*b(a)* | 46,150,000*b(a)* | 79,056,000*b(a)* |
| | 30,000,000*l* | 32,000,000*a* | 32,000,000*a* |
| | | 795,000,000*l* | 825,000,000*l* |
| | 63,410,000 | 873,150,000 | 936,560,000-*b-a* |
| Grand total in all the basins of Asiatic Russia | | | Over 405,000,000,000 |

*a*, anthracite. *b*, bituminous. *l*, lignite. *b(a)*, bituminous including a minor part of anthracite. *b(l)*, bituminous including a minor part of lignite. *b-a*, bituminous and anthracite in unknown quantitative relations.

# Progress in the Formosa Sugar Industry

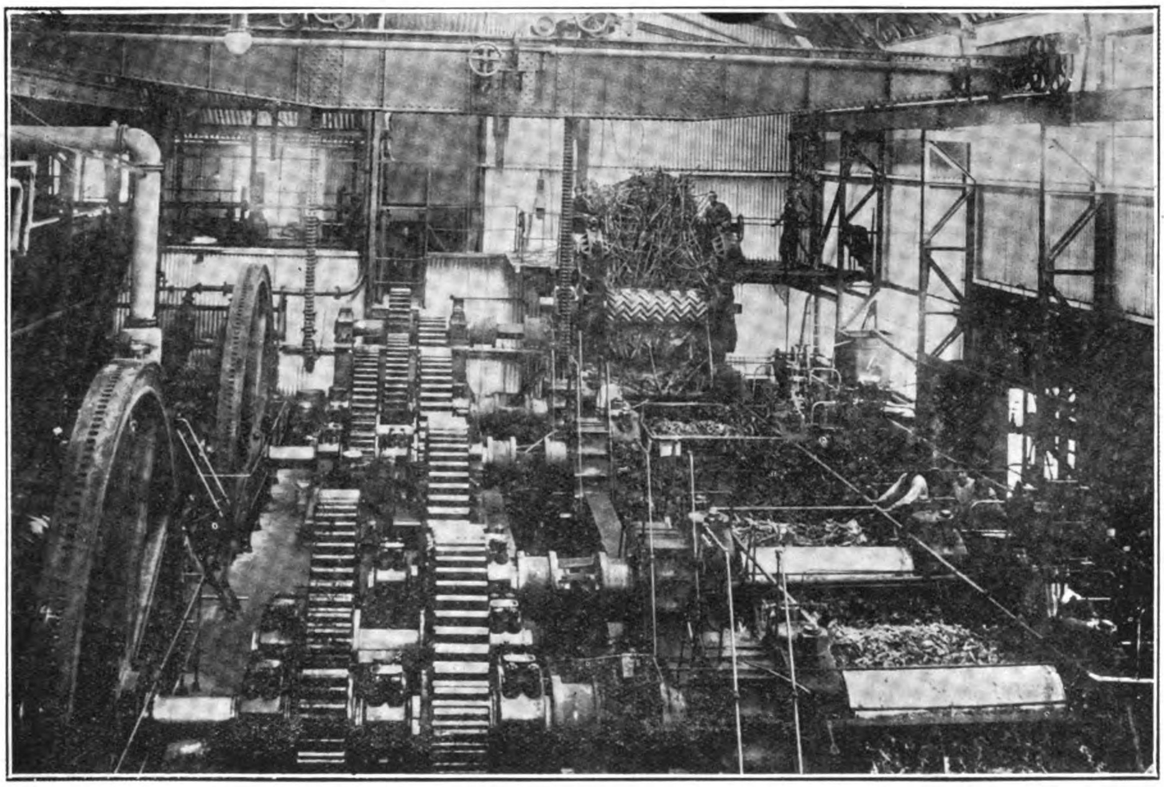
## *Plans to Double Production in Ten Years*

THE original sugar program of the Taiwan government aimed at a production of 15,000,000 piculs of raw sugar in the districts south of the Dakesei-kei river and although the 1910 crop in this section reached 4,500,000 piculs, the typhoons of 1911 and 1912 caused such serious damage that grave fears were entertained for the future of the industry. Experiments, however, carefully carried out, showed that by substituting the rose bamboo cane with its high percentage of sugar but susceptibility to damage from wind, with a different type with great wind-resisting qualities, that the losses caused by typhoons would be obviated. Accordingly, seedlings were imported from Java, which stood the test, and to-day about 87.7 per cent. of the Taiwan fields are planted with this cane. The following table compares the percentage of the area planted to Java cane with the total area :—

| Years | Total area of cultivation | Area of Java cane | Percentage |
|---|---|---|---|
| 1918 .. | .. .. 101,539 *ko* | 35,220 *ko* | 35.1 per cent. |
| 1919 .. | .. .. 93,374 | 47,839 | 51.2 |
| 1920 .. | .. .. 108,345 | 74,223 | 68.2 |
| 1921 .. | .. .. 129,205 | 105,196 | 81.3 |
| 1922 .. | .. .. 110,630 | 96,888 | 87.7 |

(*Ko* equals 2.397 acres.)

Believing that a still more perfect cane could be grown, the Taiwan government is experimenting with a native seedling developed from the Java species, under the direction of Dr. Ishida, chief of the sugar division of the central research laboratory. This cane, called the "F-19," is said to have a very high wind-resisting power, and experimental cultivation has shown that it yields more sugar per acre than the Java cane. Greater developments are confidently expected as the experiments are carried out over a longer period of time.



**The maximum of extraction is obtained at the No. 1 Mill of the Japan Sugar Company, Ltd. in Formosa, by means of a "Krajewski" crusher and twelve roller mill supplied by the Honolulu Iron Works**

After the severe losses incidental to the storms of 1911-12, the Taiwan sugar companies co-operated with the government for the formulation of a permanent policy to regulate the industry, but before it could be put into effect, the war came bringing with it a rapid rise in prices. The producers naturally bent all their efforts towards increased output with no regard for the increased costs of production. Extremely expensive methods of cultivation became the rule, and the question of a permanent program was lost sight of in the desire for high profits while the demand lasted. The decline in the price of sugar commencing in 1920, brought great distress to all the mill owners, especially to the cane growers, causing them to once more to turn to the government for relief. As a result of this new co-operation between the authorities and the sugar companies a program of intensive cultivation has been adopted which has already shown improved yields and bids fair to lay the foundation of a real sugar industry in the island. In the year 1920, the production per *ko* was 41,538 *kin*. This was increased to 43,517 *kin* in 1921 and to 48,531 *kin* in 1923. The total production and averages for the 1923 crop will not be known until the end of May, but it is expected to show a substantial increase over 48,000 *kin*. This improvement has been brought about by abandoning old fields where the yield has been low and concentrating on the newer lands with intensive methods of cultivation.

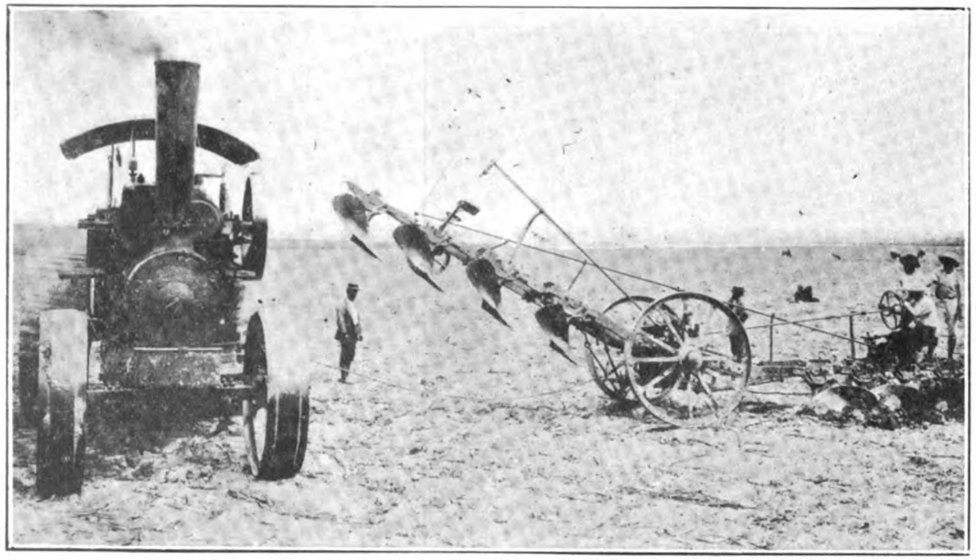
The imperfections of the tenant farmer system are held to be largely responsible for the extensive cultivation of lands, where the tenancy of the farmer has been limited to one year. The improvement of the fields by fertilizing and deep plowing at the expense of the tenant, resulted in the owner invariably exacting a higher land rent for the following season. For thirty or forty years in the new districts and for hundreds of years in the older sections this style of tenancy contract has been in vogue, resulting in a steadily diminishing return from the land. The government has now reformed these old regulations so the tenant will have possession for a minimum of six years, with all agreements in writing and registered, instead of by oral agreement as in the past. Unless notice of termination of contract is given within six months of the date of its expiration, it is to be regarded as renewed on the same terms.

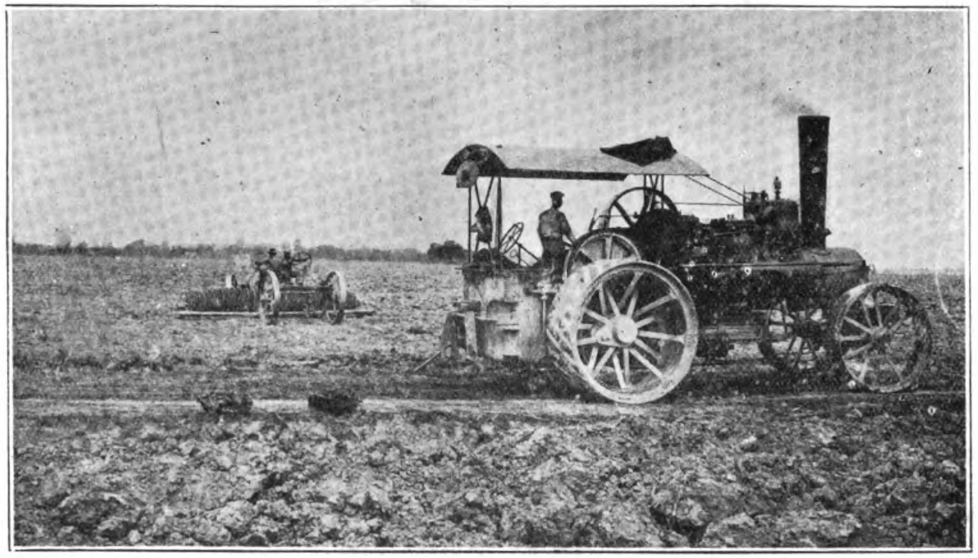
As an instance of how this method is working out, the case of the Hokko Mill of the Toyo Sugar Company may be cited. This mill has a large tract of land badly drained, and in consequence, nearly wild. The land has been rented to a selected number of farmers for an unlimited period, the shortest contract being for six years. As a result of this longer tenure and prospect of reaping adequate rewards from their labor, the farmers have exerted themselves to increase production, and have boosted the yield of cane per *ko* from 26,879 *kin* in 1913 to 69,877 *kin* in 1921, an increase of almost 250 per cent. Further increases are expected for the present year when it is expected the lands will yield more than 75,000 *kin* per *ko*.

The results obtained by the Toyo Company have convinced the other operators that the simplest way to increase production is to reform their tenancy agreements, believing that if this showing can be extended to all the other sugar districts, it will be possible to increase production to a point where Taiwan can compete with other sugar-producing countries in the world markets. The

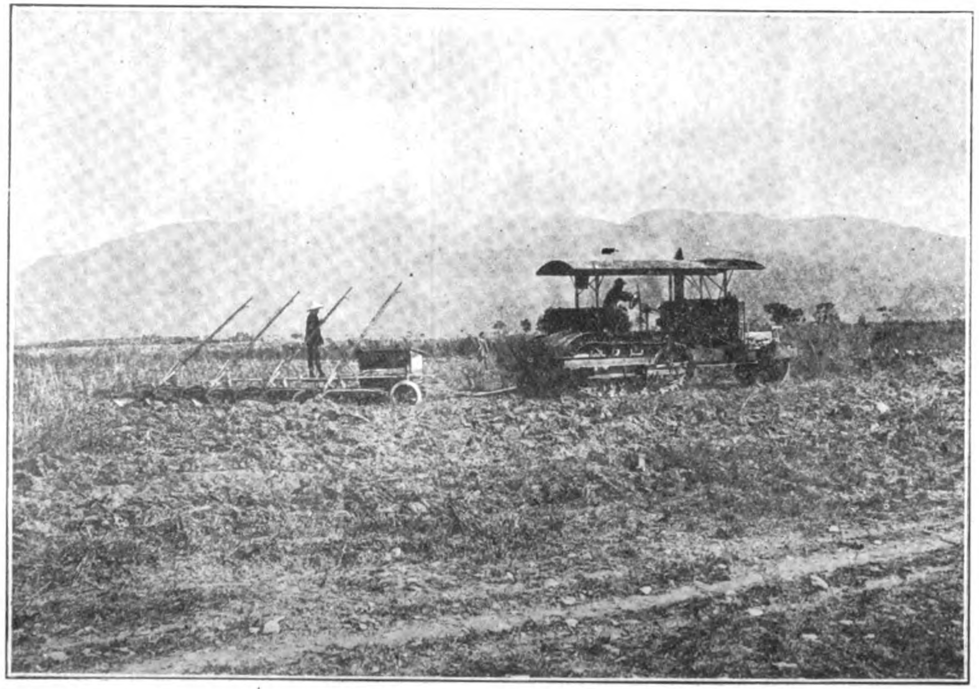
# DOUBLING THE FORMOSAN CANE CROP BY INTENSIVE CULTIVATION

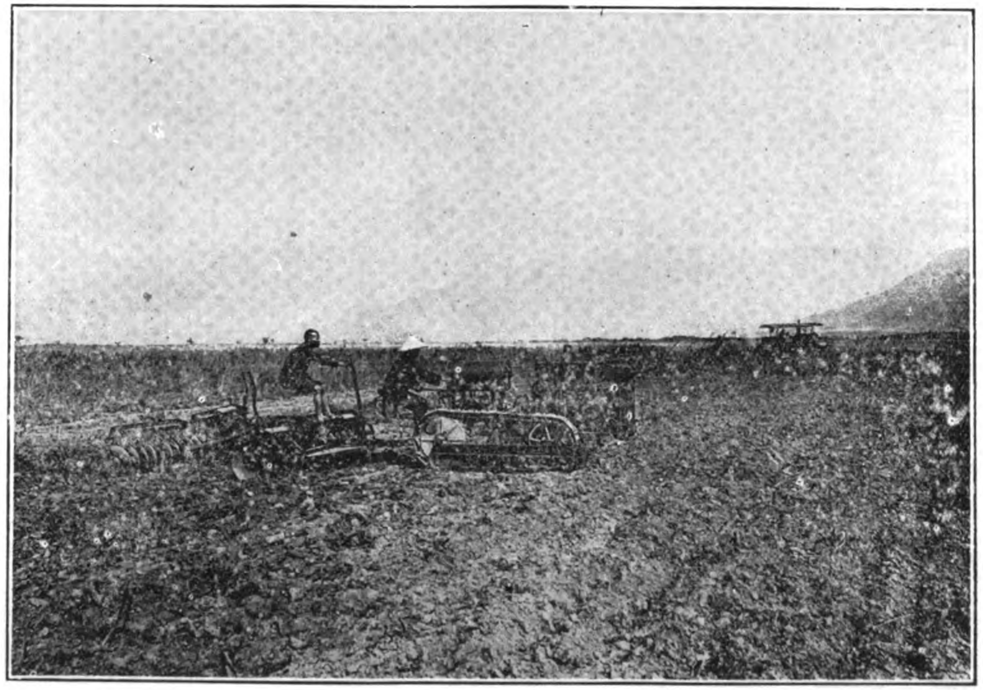
## View of Modern Agricultural Machinery on the Lands of the Taiwan Sugar Company, Ltd.





"Fowler" Steam Plows and Harrows Prepare the Land for Planting



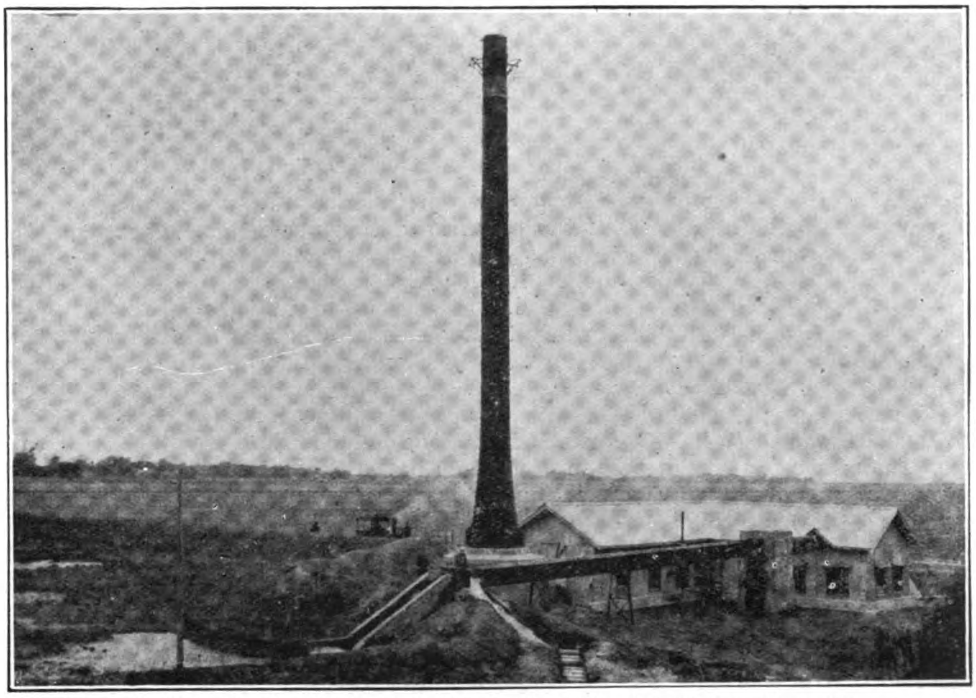


Caterpillar Tractors Hauling Gang and Disc Plows

Rinhongen Sugar Company has already made great progress since it instituted changes in its tenancy system, and its Hokko mill is accepted as a model for others to follow. All the other leading companies, such as the Taiwan, Ensuiko, Dai Nippon, Meiji and Niigata have commenced to apply the new regulations, encouraging early planting, with the result that an excellent cane is being grown that stands the ill-effect of wind and rain storms better than any species yet planted in the island.

The sugar expert of the Taiwan government looks forward to doubling the present production during the next ten years. By judicious selection of seed cane the crop yield can be increased 20 per cent.: scientific fertilizing will increase the yiled at least 50 per cent. irrigation and draining another 20 per cent. and 10 per cent. by exterminating insect pests. Already the improvement from better seedling has been noted, but as fertilization of many fields has been neglected for so many years, it will take some time before any appreciable betterment will be noted from this item.

According to the central research laboratory, the economic limit of fertilizing is ammonium sulphate, 20 *kwan* (*Kwan* is 8.28 pounds), bean cake, 10 *kwan*, and superposphates, 30 *kan*, per *ko*.



One of the Pumping Stations for irrigating in the fields of the Taiwan Sugar Company

To provide water for irrigation, the government plans to construct a great reservoir at Kandenkei, in the Tainan district, receiving its supply from the Sobun-kei river, while another plan contemplates the irrigation of 150,000 *ko* from the Dakusei-kei river. The total cost of these two projects is estimated at Y.42,000,000, the work to be completed and water for irrigation ready in April 1926. The districts covered by these plans will include the lands and mills of the Taiwan, Meiji, Ensuiko, Toyo, and Japan Sugar Companies. When completed, it will be possible to convert the present uplands into irrigated fields, and increase production by about 20 per cent.

From almost every point of view the future of the industry in Taiwan is very bright. If the companies restrain their tendency to declare extraordinary dividends, the industry should be firmly established on a new and sounder basis within a few years.

## UNZEN

(*Continued from page 421.*)

is taken from Nagasaki to Mogi, via Tagami, and from Mogi to Obama one crosses by the steamer.

Obama is situated on the west coast of the Shimabara peninsula at a distance of 15 miles across the Chijiwa Sea from Mogi. There are several saline hot springs of intermittent nature. The Ikkakuro Hotel opens throughout the year; visitors to Unzon find it advantageously situated for passing a night or obtaining meals *en route to* or from the Hill resort. There are no less than fifty inns for the accommodation of Japanese. The beach is reserved for recreative purposes. Obama has a good water supply, waterworks having been constructed there in 1907.

The climate in winter is warm and attracts many visitors. Within a short distance of the town is a white sandy beach, with pine groves extending several hundred yards. This beach is excellent for sea bathing.

About one mile and a half from Obama on the road to Unzen is Bingushi, and another mile and a half higher up is Kagotateba, which in olden days was a station at which the bearers of *kago* (palanquins) of nobles stopped to rest, hence the name.

This point is about half-way to Unzen and commands a splendid view of Ariake Bay, over the Aino isthmus, the lovely hamlets of Obama, Chijiwa, Aino, Moriyama and Uki, and the Chijiwa Sea at the foot of the mountain.

Ascending again about two miles from Kagotateba, Fudanohara is reached.

Here are found several tea-houses, and the neighborhood is extensively cultivated. About three hundred years ago it was the site of the famous Mammyoji monastery, when hundreds of temple buildings occupied the place. They were all destroyed by fire in the Shimabara rebellion, during which they were attacked by the Christians who had fortified themselves in the Hara Castle at Arima. The fragments of a large *torii* (Shinto gateway) are the only ruins now to be seen. The road divides here, the left branch leading to *shinyu* (new spring), Unzen, and the right to Kojigoku, which is half-a-mile distant. These roads are quite level. The bath-house at Kojigoku is supplied from a spring of boiling water which is worth seeing. Near Kojigoku, in the steam which has its source in the springs of Shinyu and Kojigoku, there is an attractive waterfall, called Issaikyo-no-taki.

Unzen park occupies a tract of land with stretches of hills lying between the peaks Kinugasa-yama and Yatake and covers an area of 649,000 square yards. On the east side of the park are many fumaroles which send up vapor and gasses to some height. Benches have been placed near them for the convenience of visitors. Azaleas grow in every part of the park and present a very beautiful sight in May when they are in bloom.

The construction of a large meeting-hall was completed in 1913, by the prefectural authorities, the building called The Public Social Hall; it covers 552 square yards and in bad weather is used for indoor exercise. The extension of 143 square yards of the building to provide for a reading room, and a card-playing room was completed in 1915. Its verandah, being large, is convenient for enjoying a fine view. A billiard-room adjoins the hall.

There are two lawn tennis courts, both open to the public on payment of regular fees, and attached to them is a pleasant pavilion.

There are two sections in Unzen, Shinyu (new) and Furuyu (old).

The Shinyu public bath-house is located in the park and is connected with the springs at the foot of Yadake. It is four bath tubs, which are kept clean and always overflowing.

There are six hotels, the Shinyu, Kyushu, Takaki, Yümei, Fukiya, and Midoriya which have adequate foreign accommodation.

A post office is opened every year on March 1st and closed on October 31st. It transacts telegraphic, telephonic, money order service, etc., and distributes mails thrice daily.

Furuyu is situated 600 yards from Shinyu, and the springs are similar to those at the latter place. There are about a dozen inns.

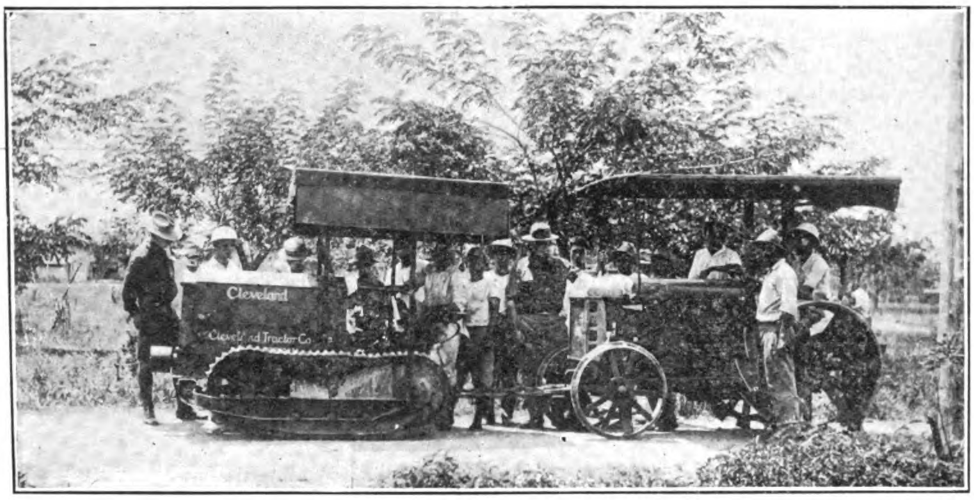
There are two paths to reach the golf course, one running from the park via Yadake above the fumalores, have been completed in 1915 for convenience of the players, and the other going through a thick wood turning off to the right from the Chijiwa-road to Furuyu. The course, which runs round a pine-clad hillock, covers 203,000 square yards and has nine holes. The links are open to public on payment of regular fees. A pavilion, equipped with toilet and dressing-room, dining-room, and bar, was built in 1913. It is one of the best in the Far East, as no pains were spared by the authorities in its construction. The site is naturally suited for the pastime and is very attractive, especially in May when the azaleas are in bloom.

# Progress in the Rice Industry

By Kilmer O. Moe

THE region of greatest progress in the rice industry is the north half of the province of Nueva Ecijs in central Luzon, otherwise known as the homestead country. This province has had a wonderful record due principally to the influx of settlers to take up virgin lands. From investigation made from reports of rice buyers the palay (paddy) actually sold in 1909 was found to be 1,600,000 cavans; in 1916 it had reached the total of 5,000,000 cavans; and, at the present writing, it is approximately 7,000,000 cavans. (*Note.*—A cavan is 44 kilos of unhulled rice).

The reason for this increase in production lies in the fact that the wild lands of the northern half of the province, in which the Muñoz agricultural school is situated, are fast being converted into productive rice fields yielding every year an increased production. The jungle and cogon lands of 1909 have nearly all disappeared and in their stead are new barrios and cultivated fields. It is a significant fact that this progress has been coincident with the construction of roads which open up the country and provide an outlet for the products raised.




**Learning to Operate Agricultural Machinery. Tractors are used for a Variety of Purposes in the Rice Industry.**

Roads accomplish for the farmer more than he often realizes. They not only give him better transportation facilities but open up for him opportunities which he never dreamed of before. Intercourse with his fellow men affords an interchange of products, but what is of greater importance, it affords an interchange of ideas. Isolated towns which for a long time have dozed away in sleepy indifference, take a new lease on life as soon as the road is extended. The sound of the auto is heard through the streets, markets flourish, and business becomes brisk and vigorous.

The old residents shake their heads over the changed conditions but new blood soon makes itself felt and new ideas gain control. Those who are unable to adjust themselves to the changed conditions are left behind.

Any one who has seen the long strings of bull carts on the road to market stacked high with paddy will appreciate at once the economic value of good roads. These carts, because of the surfaced road, carry 20 to 25 cavans of grain, when formerly on account of inferior roads half of this was considered a good load. Every thoughtful citizen must look upon road building as one of the great factors in the industrial, commercial and educational development of the country. Let us see what progress it has brought to the humble producer in the rice industry.

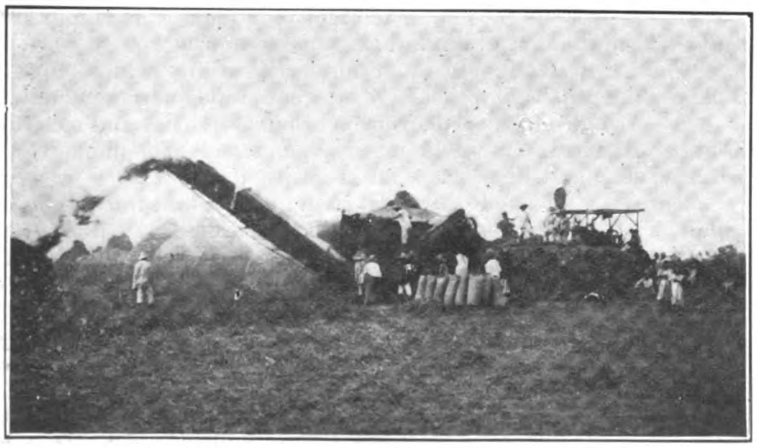
### The Small Rice Mill

Until very recently anyone would know the proximity of a barrio or village in the rice provinces by the thump of the pestles which the women use in pounding rice. Even now, in all the outlying districts, any other process of removing the husk from the rice kernel is unheard of. Wooden mortars with a capacity of a ganta (*Note:* A ganta is equivalent is three liters) or two are still a part of the household equipment in rural sections of the Philippines and it is even now the daily task of the women to pound out the rice for the next day's meal.

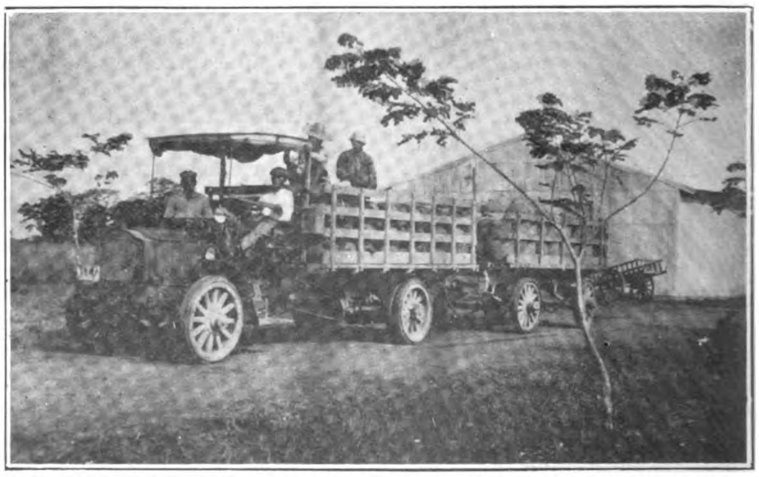
But a gradual change is coming over the situation. As progress finds its way along the newly built roads that penetrate through to the sleepy towns and villages, the drowsy country side is roused out of its age-long sleep and begin to sit up and take notice. Even the women refuse to be bound any longer by the traditions of the past. They are fast going on a strike so far as pounding rice is concerned and are seeking other means of preparing the daily ration.

This is the opportunity of the small rice mill. These little plants are multiplying in number very rapidly. It may be said that they have already invaded the towns and most of the barrio in central Luzon and the end is not yet.

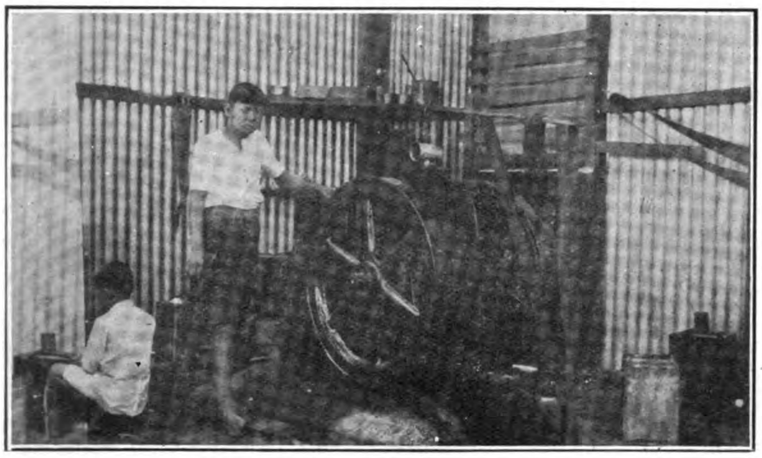
The first of these little rice mills was brought to the central Luzon agricultural school at Muñoz about ten years ago. It was a plantation huller of the type which has since found great favor in



**Steam Rice Thresher at Work on the Central Luzon Plain.**



**The Heavy Service Truck with Trailer is Supplanting the Bull Cart for Rice Transportation in the Philippines.**



Type of Power Plant in Common Use in the Rice Growing Provinces for Hulling Rice

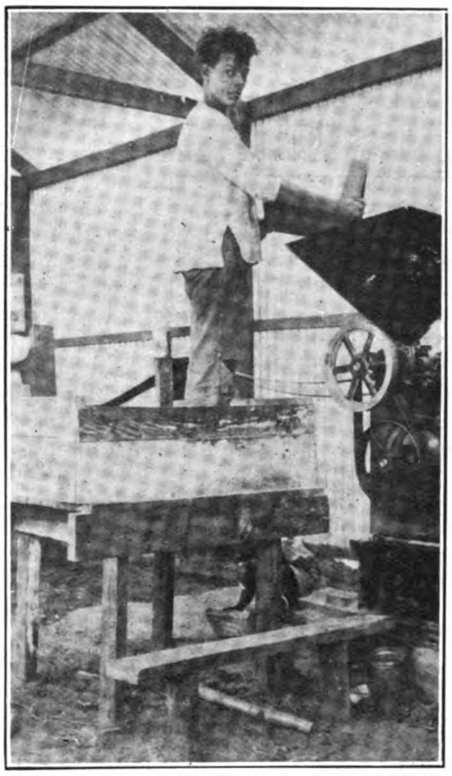
Small Rice Mill in the Rice Provinces

the rice provinces. For a number of years the people in the towns and barrios looked askance at this innovation and continued to pound out the rice by utilizing the unpaid labor of women and children.

But little by little the small rice mill plant came into its own. When once started the movement spread very rapidly. The last three or four years have been the greatest progress. This is undoubtedly due to increased prosperity in the rice-growing region, but also, in no small part, to the desire for better things that come with progress and enlightenment. It is found that the forty centavos collected for hulling a sack of paddy rice does not pay for the labor expended in pounding it out. The barrio people are learning that it is easier to earn the money by other means and to have the rice hulled by machinery.

Importers in Manila tell us that it is almost impossible to supply the demand for small rice mills of the kind that are being installed in the barrios. An avalanche of orders came and for a time it was difficult to get the mills in fast enough.

It doesn't do to go too fast in this game, however. The writer found that the mill installed was not able to keep up with the demands upon it so a stone mill was added with elevators, a separator and a polisher. The small farmer brought in his couple of sacks of paddy to be hulled and dumped it into the hopper. When he saw that it disappeared up the elevator he was unable to follow its progress any longer. He stood around with considerable anxiety until his sacks were accounted for in hulled rice and by products at the other end of the building. But he wasn't at all convinced that he was getting it all back in a process that he could not understand. His companions also held off and refused to patronize the mill unless the old installation was used. To satisfy this class the more economical mill had to be discarded and a battery of steel burr mills was substituted. The *taos* were satisfied because they could pour their own grain into the hopper and see the hulled rice and the by-product come out below.



Small Rice Mill of the Burr Type

The small rice mill is just the thing for hulling the grain locally. Of course, it cannot compete with the large mills at the large centres but it will do sixty to eighty sacks a day which yields the operator a neat income after the pays his expenses. The installation is usually a crude oil engine of 10 h.p. or thereabouts turning a rotary burr in close proximity to fixed steel knives or sharp edges. The paddy is ground between these surfaces until the husks are removed and the size of the kernel is so decreased that it will pass through the screens. A fan separates the chaff together with the lighter by-products from the grain and the clean rice is then caught in sacks. One of these little mills can be installed, everything complete, for Tls. 2,500 Philippine currency.

## The Service Truck in the Rice Industry

From time immemorial the rice grower has depended upon the carabao and bull-cart for transporting his crop to market. It is not uncommon even now to see strings of bull-carts several kilometres long in the rice-hauling season lumbering along at a slow moving gait toward market. These strings have lessened considerably in the last couple of years in spite of the fact that the harvests have been larger than in former years. This is due entirely to the fact that the heavy service truck is taking the place of the bull-cart in transportation.

Anyong passing along the Manila north road will see piles of sacks filled with palay (paddy) stacked up along the highway waiting for some truck to stop and convey it to market. This innovation takes very well with the rice producer who lives in the proximity of the main road, as he can leave his sacks on the side of the road and have them transported to market quickly and with one-third of the labor and trouble of former years. This releases his caraboas for more important work on the farm or gives them a rest and puts them in fine shape for the approaching planting season.

There is no doubt but that the heavy service truck will, in the future, be a most important factor in the rice industry. It is true that these heavy conveyances grind up the roads but that opens up another problem which must be solved, the sooner the better. Roads that were built to carry the traffic of former years no longer serve the needs. We have trebled the traffic and this should call for an increased expenditure in the care and maintenance of our highways. Above all the roads should be built so as to meet the increasing need for service. If progress demands the use of the heavy service truck, then the roads must be so constructed that they will stand up under it. The authorities should realize tha the roads are built for the convenience of the producer rather than for that of the pleasure seeker. These will be a great demand on the part of the farmer for better roads just as soon as he realizes their value in the transportation of agricultural products.

The heavy service truck has come to stay. It will eventually supplant the carabao and cart wherever the roads are such that the truck can be used economically. Its use is tied up with the problem of extending them and in keeping them in a good state of repair.

Along with the freight truck is the passenger truck that solves the problem of easy communication between towns and binds extensive areas into one large community. Every time a new road is opened an auto line is started with the net result that it arouses new interests and awakens new desires. It is the gratification of these desires that make for progress in the community.

The farmer needs his work animals on the farm to help build up the farm home. These forces will be released for productive purposes when the service truck carries the load of transporting the produce to market.

### The Farm Tractor

There was a time when prices of farm products soared. Labor and work animals became scarce and the farm tractor came along, a much heralded solution to the problem of increasing production. A campaign of advertising set in and ship loads of tractors were imported. A thousand or more tiactors found their way into the hands of Filipino farmers in the period of a single year.

But a situation soon developed that was anything but satisfactory. The dealers for the most part concentrated on sales rather than on service. In this way they did the very thing that tended to kill the business in the shortest time possible. No farmer is going to buy tractors unless they prove satisfactory in his community. If it is necessary for him to pull a tractor out of the field and again resorts to the slow moving carabao, it will mean an object lesson for the entire community which will not be lost on prospective buyers. Every *bonâ-fide* tractor dealer must be ready to expend money for a large supply of spare parts and for service. A follow up system must be installed looking to the economical use of every tractor put in the field.

There was a tendency on the part of tractor dealers to scatter individual machines over wide areas. In a campaign for selling this system was adopted in the hopes that these machines would establish a market for other machines. Such a procedure would have been satisfactory provided a mechanic had been placed with each machine to keep the outfit running so that it would prove a satisfactory investment for the purchaser. This was not done except in a few cases and the scheme proved the worst kind of salesmanship.

Service is the weakest link in the tractor game. The dealer that disregards it is a menace to the industry. To make matters worse, numerous tractor companies sprang up all over America to take advantage of boom prices. Many of the machines turned out fell below the requirements. Some are no longer made. These machines represent a great deal of money and, unless something is done to prevent it, they will be dumped on countries like China and the Philippines.

Every tractor dealer should be forced to take over a live agency. He should be forced to keep an adequate number of spare parts in proportion to the number of sales made. This feature will have the tendency of increasing the price of machines, but it is far better to pay the price and get the service than to buy something that becomes useless in a short time.

But in spite of shortcomings on the part of dealers and other drawbacks too numerous to mention, the farm tractor is gaining in favor. In the rice industry it has a place in the breaking up of new land and in preparing the soil for upland rice. In the Philippines there are millions of hectares of uncultivated land. To bring these areas under the plow would help to drive away the menace of food shortage which threatens the islands from time to time. Lands that are flooded and diked are difficult to manage with machinery but new fields may be tilled without any serious trouble.

Besides being used for plowing the tractor finds a great many other uses in the rice industry. It is a good power plant for stationary work. It will pull a threshing machine, pump water for irrigation, run a little rice mill, and haul heavy loads. A farmer who knows how to manage may keep his tractor running every day in the year.

The plowing season is usually only about one hundred days. After that there is the threshing and the bulling of the grain. The demand for tractors in large numbers will develop as progress in the rice industry develops. But it is constructive work in which dealers must co-operate with farmers to get the best results.

### Threshing the Grain

One of the first attempts to modernize the rice industry was the introduction of the steam thresher. In the province of Nueva Ecija more than fifty of these units are operating at the present writing. A dozen or more have been operating successfully for at least ten years.

This improvement supplants the time-honored system of threshing the grain by treading it out with animals. This is yet the common practice even after a decade of demonstration with threshers. The operation of rice threshers are seriously handicapped in the orient due to inefficient labor. Because the concaves are improperly adjusted, they break the grain, partly hull the kernels and otherwise lower the quality of the product. Farmers who observe these defects are apt to enlarge upon them and go on using the old, old practices of their fathers.

But the thing that prevents the use of threshers on a larger scale is the fact that the industry is organized on the old basis and it is difficult for the farmer to realign his forces to meet the changed conditions. He has on his hands a herd of animals. They will eat their heads off unless he finds steady employment for them. After the harvest, therefore, he gathers them in and drives them round and round on the threshing floor. If he engages a machine to do his threshing he will have to pay eight to ten per cent. of his harvest. Being naturally frugal in disposition the farmer does not see why he should not save this amount by using his own animals.

In one sense, he is right. Success in farming is based, to a large extent, on ability to use the means available to the best advantage. So long as he does not use his animals to a better purpose he might as well thresh his grain with them. But the way out is to use them for other productive purposes. The rice farmer is very apt to be satisfied with poor living conditions. He should build up his home by having a vegetable garden, an orchard and other crops besides rice. Root crops and legumes are good food crops and may just as well be grown as not. Permanent agriculture will demand a change from the one crop system and this will call for machinery to do its share of the work so that men and animals may be released for other purposes. That is the great service that machines can render for mankind.

Of late years the farms tractor has become more popular in its use with the threshing machine. This is a big improvement as the heavy steam outfit is too cumbersome to handle in a country where all cultivated areas are criss-crossed with irrigation ditches. One of the most difficult phases of using the steam thresher is the crossing of ditches and small streams in moving from place to place. The lighter machine with a gas motor as the power plant is much more convenient.

The ideal threshing plant is a small threshing machine that can be operated with a farm tractor. It does not thresh out the volume but neither does it involve a large amount of money. After the threshing season the farm tractor can be used for plowing or for operating stationery machinery.

Progress in the rice industry will involve many changes. Customs and practices that severed our fathers do not do in this day and generation. As the human forces are released from the burdens that weigh them down they should seek to followthe path of progress. Otherwise the extra leisure will do more harm than good.

# Motor Cultivation in Indo-China

## Disadvantages of the Existing Native Methods of Culture

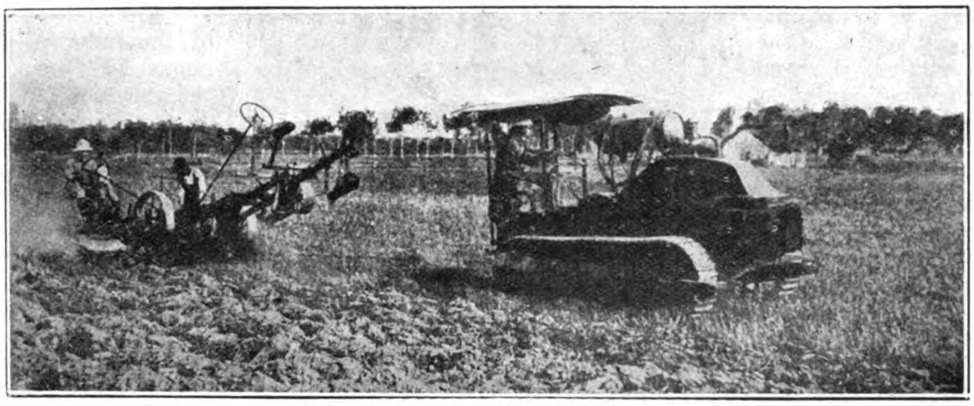
THE introduction of modern methods of culture has always been difficult owing not only to the absence of labor in certain districts but also to the inefficiency of the work done by this labor when obtainable, as well as by the slowness of work in which oxen are engaged so that wide-awake colonists have followed with great interest the moevment in France and America towards the introduction of motor-culture.

It is chiefly in Cochin-China with its extensive rice-fields and its flat and relatively sparsely populated country where this need has been most felt. Furthermore, the vast trade of Saigon has brought much capital to the port, which naturally seeks for investment in the rich surrounding country.

## First Attempts at Motor Culture in the Rice Fields of Cochin-China

Hitherto all work in the rice-fields has been done with the aid of buffaloes and it was quite natural that the colonists should try and find some substitute for this expensive animal which is by no means hardy and easily falls victim to epidemics, killing in a few days a third, or event half, of the herds.

Towards 1900 an enterprising man with the aid of an engineer undertook trials of motor-culture on an extensive estate in the west of Cochin-China. Unfortunalety difficulties were continually cropping up, the floods of the Me-kong, stagnant ponds of rain-water and the difficulty of constructing appropriate tools—all contributed to bring the trials to an end after two years of courageous toil. Anyway the experience was not lost, as it showed that motor-culture is possible only where seconded by a preliminary series of public works. The water system of the country must first be controlled so as to prevent the land being flooded by the Me-kong and all superfluous rain water must be drained into the sea. To a certain extent the colonist can protect his land from flooding by surrounding it with dykes, but the drainage of a district necessitates large canals and these can be planned and cut only by a central authority, such as a public works department or a syndicate of estate owners. The only tools to be found at the time were a windlass driven by a petrol motor of small horse-power for winding a cable. Steam was out of the question as the water was full of sulphates and chlorides which would have soon destroyed the boilers, and, furthermore, the transport of wood across immense marshes full of tall acquatic plants and with a sub-soil of clay was practically impossible.



Ploughing in Indo-China by Tractor

### Steam Culture in Rubber Plantations

Some years later important rubber plantations were started in the east of Cochin-China on very rich land of volcanic origin, known as the " red lands." Here other difficulties cropped up : absence of labor in a country covered with forest of huge trees with in places thickets of thorny bamboos in interwined clumps of 10 or even 13-ft. in diameter and a soil full of roots, which combined were enough to dishearten the most sanguine of colonists. Men and animals were not equal to the task and so the aid of steam was invoked. Powerful steam tackle, of well-known type, consisting of two locomobiles together with steam windlasses for working a cable and clearing out the tree stumps, and steam traction engines such as are used on roads in Europe, was employed. By means of powerful scarifiers and extra-strong ploughs this virgin forest was cleared, and magnificant plantations of hevea—amounting to some several thousands of acres—took its place.

Here the use of steam was fully justified for numerous streams of pure water supplied excellent feed-water, while the forest itself supplied more than sufficient fuel.

### Use of Explosion Motors

Over ten years passed before a fresh attempt was made about 1917. The war had called attention to the use of tractors run by oil, and the papers gave glowing accounts of their prowess, so that the department of agriculture in Cochin-China sent to America for a " Caterpillar Holt " tractor and a four-shared American plough.

During 1918 and 1919 trials of ploughing flooded rice-fields were made, thus simply following native methods substituting mechanical power for that of men and oxen. Thanks to the regularity and depth of the ploughing the yield was increased by 30 per cent., but the difficulties were enormous, for, although the tractor worked well, the heavy plough sank into the mud and when it came to turning it at the end of each haul, the Annamites were not physically strong enough, except with immense difficulty, to handle the plough which had been built for sturdy American laborers.

Profiting by the above experience new trials were made in 1920, but the American plough previously employed was replaced by a European balance-plough specially adapted for work in the rice-fields, according to data supplied by the author of this article. Further, as in European and American rice-fields the land is ploughed before it was inundated, the department of agriculture of Cochin-China decided to make a complete series of trials of both dry and wet ploughing, at depths varying from 5 to 10 inches on a large scale in the west of this colony, and they supplemented their existing plant by the acquisition of a light tractor. These trials were possible owing to the collaboration of the president of the syndicate of rice-growers and were carried on over about 200 acres, so that they were eminently practical and of real interest.

At the same time trials were made to determine what advantages there might be in ploughing up by mechanical power instead of by the time-honored yoke of oxen, marshes having a good soil hut covered with large weeds. As a matter of fact rice-fields are formed by the conversion of such marches into cultivated land and experiences has shown that in the past, from six to ten years are necessary for the usual chemical reaction to take place and bring the soil to complete fertility.

The trials showed that when these marshes are ploughed mechanically in the dry season they bring in a return from the second year after ploughing, the crops being largely sufficient to cover the cost of the petrol and the small hydraulic work, such as banks and ditches 4-ft. wide required, as already explained, to control the irrigation.

In old and fully-productive rice-fields working by oil power comes out more expensive than by oxen, but it should be noted that the quality of the machine work, in regard to depth and regularity, is above all comparison with the old, and the yield was increased by from 25 to 40 per cent. The rich Annamite growers followed the trials with the greatest of interest, ready, as soon as sure that they can obtain suitable tackle, to scrap their oxen and use tractors.

Further, rubber planters in seeking to plant other produce between their rubber trees, naturally turn to tractors, and in many plantations especially on the siliceous grey lands, tractors have ploughed deeper than was ever possible with oxen, these latter being employed only for light surface work. All of this goes to show that motor-culture in Cochin-China is a real live thing.

In Tonkin this question is much more complicated for the extreme smallness of the rice-fields, the lay of the ground in the coffee plantations and the abundance of labor all militate against the use of mechanical power. All the same, some interesting trials of motor-" bineuses " for working the land while the crops growing have taken place.

In Cambodia the experimental stage still exists, but it is probable that motor-culture will develop rapidly as the conditions are the same as obtain in Cochin-China—vast lands mostly level and but sparsely populated.

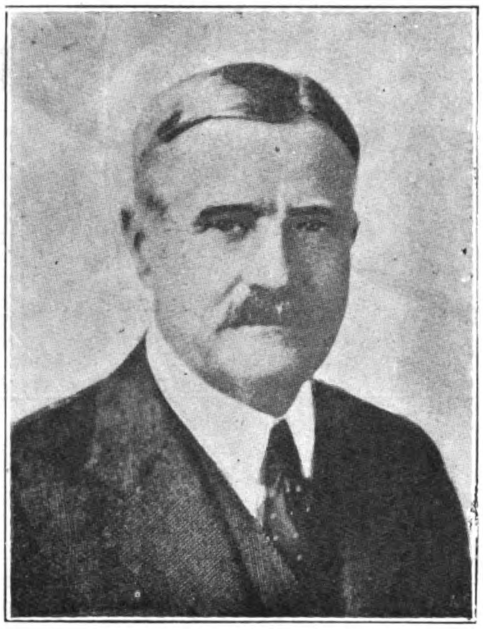
As may be seen, Indo-China has followed France very closely in adopting these new methods in agriculture. The government, also, by means of substantial subsidies, varying in their methods of application in each of the countries of the union, does all it can to encourage this movement. Without being too optimistic it may be predicted that within a few years the agricultural tractor will invade the colony as successfully as its elder brother the motor-car has done, especially in view of a recent improvement in carburetters enabling oil to be used in place of petrol without fear of fouling the motor. As combustion is complete the economy in the quantity of combustible used is over 20 per cent. and taking the prices of oil and petrol at Saigon at the beginning of this year, the economy in money would be nearly 65 per cent.

# The Manila Railway

## The Result of One Year's Operation Under Efficient Administration. An Argument Against State or Political Control

THE 1922 report of the Manila Railway Company stands as the highest testimonial to the wisdom of General Wood's business administration of the islands and the efficiency of the new management under Colonel H. B. McCoy who has been directly responsible for the working of the properties during the entire year with the exception of the first thirty days. The beneficial results of purely business methods as distinguished from political control is seen in the reduction of operating expenses effected during the year making possible a net profit of P.2,281,318 as compared with P.297,156 for 1921, an increase of P. 1,984,162, or nearly a million gold dollars.

The operating revenues for 1922 amounted to P.12,210,797 a decrease of P.63,000 under the previous year, yet despite this falling off in revenues the saving was made by cutting down the expenses which in 1921 were P.9,506,807 and in 1922, P.7,300,646, a decrease of P.2,206,160. The net operating income, after deducting taxes and bad debts was P.4,887,748 as against P.2,767,228 in 1921, an increase of P.2,120,519. This commendable showing is further emphasized by the following recapitulation of the comparative income statement for 1921-22 :—



**Colonel HENRY B. McCOY,**
**General Manager of the Manila Railway Co.**

| | | |
|---|---|---|
| Total operating revenues for 1922 were | P.12,210,797.77 | |
| A decrease under revenues for 1921 of | 63,500.92 or | .52 of 1% |
| Total operating expenses for 1922 were | 7,300,646.83 | |
| As against .. .. .. .. | 9,506,807.12 | |
| For 1921, a reduction of .. .. | 2,206,160.29 or | 23% |
| Total operating income for 1922 was | 4,887,748.32 | |
| As against .. .. .. .. | 2,767,228.72 | |
| For 1921, an increase of .. .. | 2,120,519.60 or | 76.6% |
| Total non-operating income for 1922 was .. .. .. | 233,965.11 | |
| As against .. .. .. .. | 213,973.96 | |
| For 1921, an increase of .. .. | 19,721.15 or | 9.2% |
| Total fixed charges and extra deductions were .. .. | 2,783,405.16 | |
| As against .. .. .. .. | 2,718,309.13 | |
| For 1921, an increase of .. .. | 65,096.03 or | 2.39% |
| Total net income for 1922 was .. | 2,338,038.27 | |
| As against .. .. .. .. | 262,893.55 | |
| For 1921, an increase of .. .. | 2,075,144.72 or | 789% |

The above is a very striking illustration of the manner in which reduced expenses increase net income. It will be noted that the variation in total operating revenues was almost negligible (i.e., 0.52 of 1 per cent.) whereas a 23 per cent. reduction in expenses resulted in increasing net income almost eightfold (789 per cent.), even though fixed charges and extra deductions increased 2.39 per cent. Expressed differently, income is limited to the amount of traffic offered and the capacity to handle it, while outgo (expenses) is measureably subject to control. The proper exercise of such control is one of the main functions of management. Operating ratio (proportion of operating expenses to gross operating revenues) was 59.8 per cent. for 1922 as against 77.45 per cent. for 1921. Operating ratio of all Class I railroads in the United States combined for 1922 was 74.89 per cent.

Reduction in operating expenses during the year was the result of (*a*) reduction in salaries and wages paid and reduction in actual quantity of operating supplies used; and (*b*) reduction in the cost of operating supplies.

The comparison in the consumption of coal and lubricants demonstrates the efficiency of the new administration and from this distance it would appear that considerable graft or gross extravagance and supervision characterized the political administration of the company, when a saving of P.1,333,725 could be effected in the item of operating supplies alone. The total saving in the cost of coal was P.1,266,502 of which P.446,999 was the result of greater economy in quantity consumed and P.819,612 due to saving in perie.

In the matter of personnel, there were 1,929 regular employees receiving monthly salaries, a reduction of 100 from the year 1921, and 4,235 daily paid employees, or a total of 6,164 on the company's pay roll. Large reductions in the number of daily paid employees were made by closer co-ordination of duties and elimination of unnecessary labor and sinecures. As usual in state-owned or politically-directed enterprises, the sentiment had been allowed to develop among the employees of the company that the railroad existed primarily for their benefit, a Filipino application of the soviet principle, or their idea of what a republic or self-government should do for them. The reversal of this attitude has fortunately been effected with benefit to all concerned and the efficiency of the service

## MANILA RAILROAD COMPANY

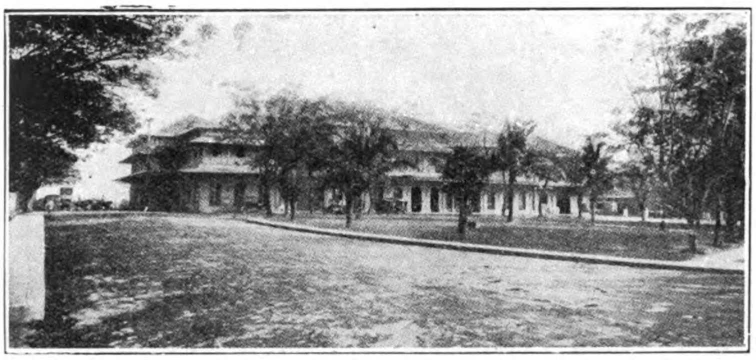
STATEMENT OF CONSUMPTION OF COAL AND LUBRICANTS SHOWING AMOUNT OF INCREASE AND DECREASE AND PERCENTAGE OF CHANGE FROM PREVIOUS YEAR AND AMOUNT AND PERCENTAGE OF SAVING WITH RESPECT TO QUANTITY AND CHANGE IN PRICE.

| | 1921 | | 1922 | | Increase (+) or Decrease (—) | | | | Distribution of Savings | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Saving in consumption | | Saving in price | |
| Articles | Quantity | Amount Pesos | Quantity | Amount Pesos | Quantity | Per cent. of change from previous year | Amount Pesos | Per cent. of change from previous year | Amount Pesos | Per cent. | Amount Pesos | Per cent. |
| Coal (tons) ... ... | 83,618 | 2,929,118.67 | 70,454 | 1,662,516.40 | —13,164 | —15.74 | —1,266,602.27 | —43.24 | 446,990.06 | 35.29 | 819,612.21 | 64.71 |
| Oil engine ... ... | 46,625 | 52,972.39 | 30,932 | 25,289.07 | —15,693 | —33.66 | — 27,682.42 | —52.26 | 17,116.83 | 61.83 | 10,565.59 | 38.17 |
| Oil axle ... ... ... | 63,511 | 47,696.76 | 51,254 | 35,690.08 | —12,257 | —19.30 | — 12,006.68 | —25.17 | 9,205.03 | 76.67 | 2,801.65 | 23.33 |
| Oil cylinder, superheater | 8,130 | 15,788.95 | 8,594 | 20,997.41 | + 464 | + 5.71 | + 5,208.46 | +32.99 | *1,134.20 | 21.78 | *4,074.26 | 78.22 |
| Oil cylinder, ordinary ... | 13,835 | 14,284.83 | 6,652 | 8,753.38 | — 7,183 | —51.92 | — 5,531.45 | —38.72 | 5,531.45 | 100.00 | ... | ... |
| Oil signal ... ... | 11,149 | 12,999.60 | 8,363 | 8,078.54 | — 2,786 | —24.99 | — 4,921.06 | —37.86 | 3,255.01 | 66.14 | 1,666.05 | 33.86 |
| Oil kerosene ... ... | 35,699 | 32,997.17 | 30,856 | 17,083.95 | — 4,843 | —13.57 | — 15,913.22 | —48.23 | 4,838.88 | 30.41 | 11,074.34 | 69.59 |
| Gasoline ... ... ... | 17,064 | 17,882.14 | 13,344 | 11,603.96 | — 3,720 | —21.80 | — 6,278.18 | —35.11 | 3,966.16 | 63.17 | 2,312.02 | 36.83 |
| Total Decrease ... | ... | ... | ... | ... | ... | ... | 1,333,726.82 | | | | | |

*Increase.

*Note.*—Quantity of all items is given in gallons, except coal which is given in tons.

Luzon Island
and Lines of the
Manila
Railroad
Company
Scale
KILOMETERS
LEGEND
Lines in Operation
Lines under Construction
Proposed Lines
Steamship Lines
LUZON
ISLAND
MANILA
MANILA BAY
LINGAYEN GULF
TAYABAS BAY
RAGAY GULF
LAGONOY GULF
ALBAY GULF
SAN BERNARDINO STRAIT
MINDORO



Manila Terminal Station

Paco Station

increased materially due to better supervision and improved morale. Increased ability and efficiency of employees means an increase in salaries and wages paid, and during the government control of the railroad the average wages paid in 1916 as compared with 1922 shows that station agents which formerly received P.477 are now receiving P.834 : conductors, P.444 now 744 and locomotive drivers, P.540 and now P.1,116. No decrease in the wages paid was made during 1922 but rectifications will be made in this year that will bring about an adjustment.

The total saving of P.2,206,160 under the new administration is made up of the P.133,726 in operating supplies : P.387,965 in decrease in salaries and wages : P.50,807 in stationary and office supplies : P.127,714 in cost of ties and P.305,945 in miscellaneous supplies and other economies. The following statement shows comparison by sources of operating revenues for the years 1922 and 1921 :—

| | 1922 | 1921 | Increase or Decrease |
|---|---|---|---|
| Passenger .. .. | P. 5,430,631.25 | 5,955,975.45 | P.525,344.20 |
| Freight .. .. | 5,602,576.39 | 5,032,275.39 | 570,301.00 |
| Express .. .. | 690,578.80 | 797,225.92 | 106,647.12 |
| Water Lines .. | 174,588.86 | 192,484.52 | 17,895.66 |
| Miscellaneous .. | 312,422.47 | 296,337.41 | 16,085.06 |
| Total .. .. | 12,210,797.77 | 12,274,298.69 | 63,500.92 |

The number of passengers carried in 1922 was 6,501,363 as compared with 6,956,149 in 1921, a decrease of 454,786 or 6.5 per cent. The number of passengers carried in 1921 represented a decrease of 25 per cent. from the total carried in 1920, evidence that passenger traffic has been severely affected during the past two years attributable to continued and increasing competition on the part of motor buses and the commercial depression prevailing since the latter part of 1920. Fortunately the decrease in passenger traffic was more than offset by the increase of P.570,301 in freight income.

The ever growing competition of the motor trucks in the matter of transportation of passengers and express freight is seen in the consequent reduction of the railroad revenues derived from these two sources. This loss is offset somewhat by the traffic which these trucks assist in developing when they act as feeders to the railway. In complaining about these conditions and offering suggestions to avoid unfair competition the railway authorities insist on a policy on the part of the government not to construct roads parallel to the railroad. Such a policy they contend, will undoubtedly limit the motor competition to sections where existing highways now parallel the railway and will at the same time enable the government to construct urgently needed highways in many parts of the islands where no means of communications now exist. The railway company declares that it has spent tens of millions of pesos originally and pays out annually hundreds of thousands in maintaining its track and right of way. Twelve per cent. of its income is the average amount devoted to this purpose. It is true they point out, that the railway track is for the exclusive use of the railway company, but a large proportion of the moneys expended for maintenance is in the form of wages to workers, which is spent in the communities in which they live. It is believed by the railway administration that the license fees and taxes paid by the truck owners permitting them to use the public highways, are insignificant in proportion to the benefits they derive from such use and the constant damage to the roads that they cause. For this reason, it holds that legislation be enacted that will exact from the owners of motor vehicles something like a fair and just proportion of the upkeep of the public highways they utilize.

With regard to the disposition of the profits made by the company the president recommends that they be expended on important improvements and betterments of existing lines essential to the economical and efficient operation of the road. With this end in view a comprehensive improvement program is being worked out.

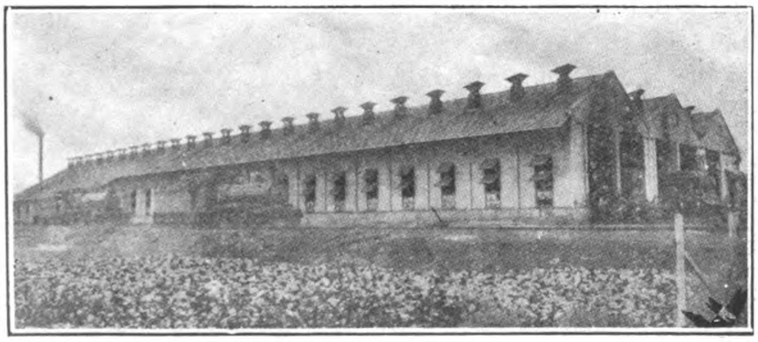
In regard to the finances, when the road was first taken over by the government in 1917 a deficit of P.1,480,390 was taken over and also a heavy deferred maintenance obligation assumed. The profits of the company from 1917 to 1921 have been applied almost entirely to the payment of this deficit and a considerable amount of moneys available for expenditure had to be utilized not only for the extension of existing lines but also for important repairs, improvements and betterments of road as well as for the replacement of unserviceable rolling stock.

## New Financing

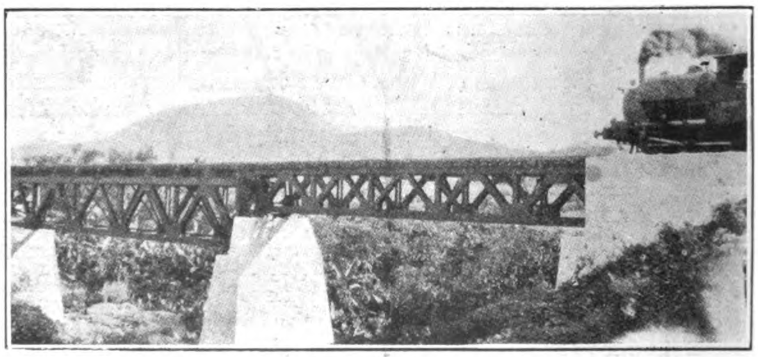
Early in the year 1922 it became urgently necessary to devise and carry out a plant to raise funds, both to liquidate past indebtedness and to continue construction work then in progress. During the year 1921 short-term loans had been contracted to the extent of P.2,700,000 as follows :

P.2,000,000 Chase National Bank, New York .... due April 7, 1922
700,000 Philippine National Bank Manila....due Jan. 26, 1922

In addition, the sum of P.1,689,741.40 had to be paid during the months of Feb., Mar., and Apr., 1922, to cover drafts for coal, bond interest and settlement of accounts for supplies in the United States

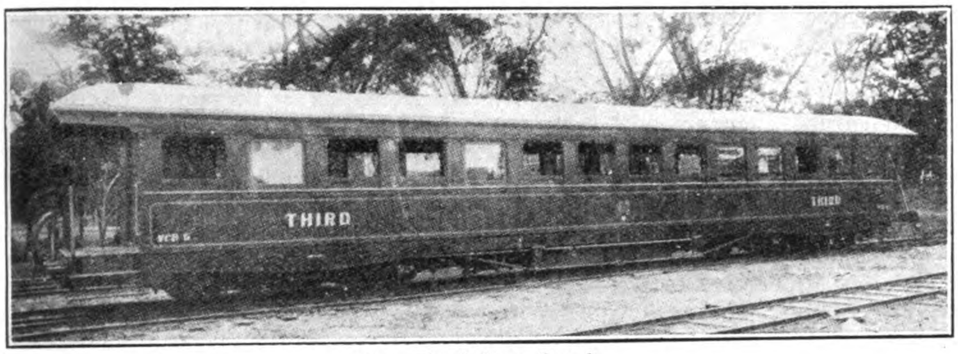


Manila Engine Shed

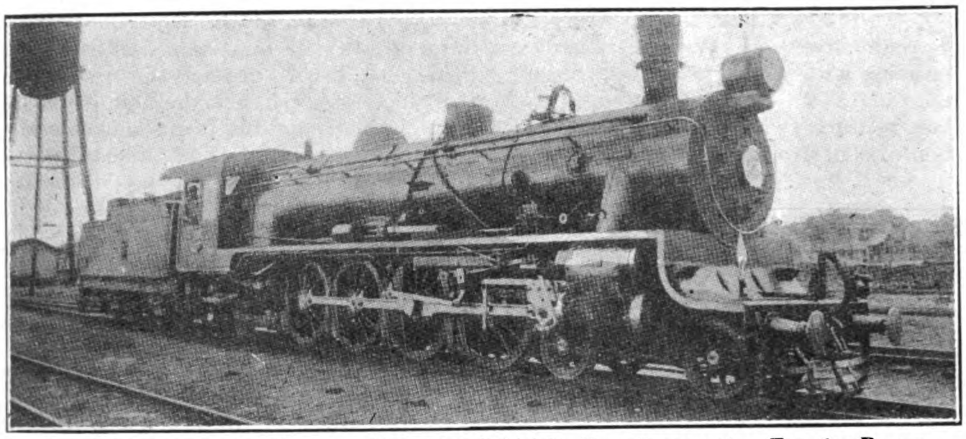


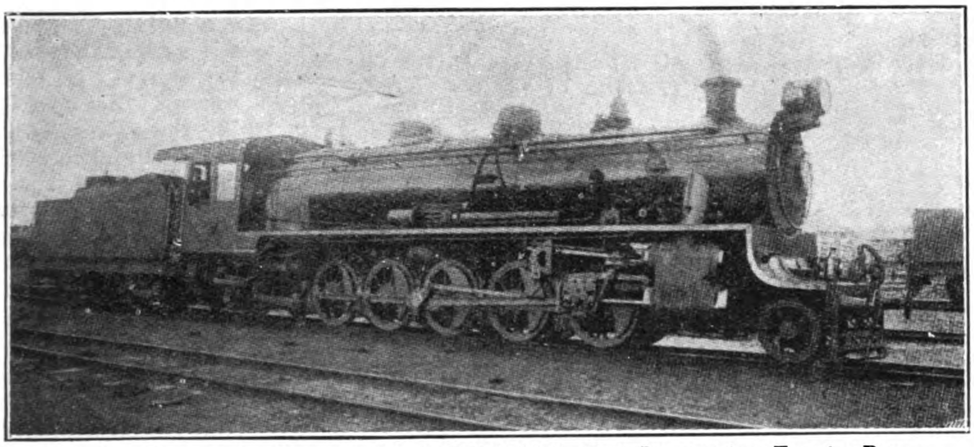
Steel Bridge on Concrete Pier, Los Banos-San Pablo Cut-off

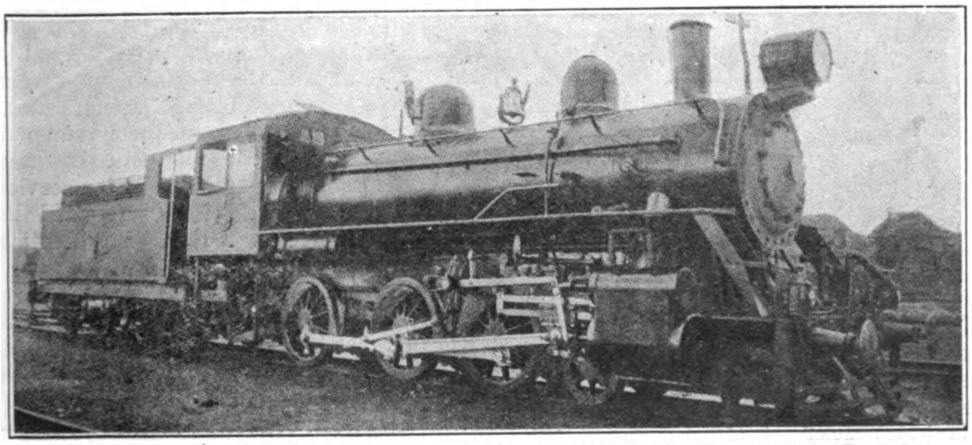
A plan had been proposed to issue P.8,000,000 par value 7 per cent. 18-year sinking fund bonds, supplemented by a subscription on the part of the insular government to additional stock to the amount of P.2,000,000. The financial condition of the government was such as to render this subscription impracticable, however, and the issuance of sinking fund bonds to the amount of P.8,000,000 would have meant an addition of approximately P.1,000,000 per annum to the fixed charges of the Company. The assuming of this increased fixed annual obligation would have been extremely inadvisable. The amount of bonds outstanding is disproportionate to the amount of stock and an additional issue to the extent of P.8,000,000 could simply further weaken the existing financial structure.



New Third Class Coach


American Locomotive Company "Mountain" (4-8-2), Type Locomotive, Tractive Power, 25,200 Pounds; Weight (exclusive of Tender), 83.18 Metric Tons


American Locomotive Company "Santa Fe" (2-10-2), Type Locomotive; Tractive Power, 31,500 Pounds; Weight (exclusive of Tender), 85.45 Metric Tons


H. K. Porter Co. (American) Locomotive, Type 4-6-0; Tractive Power, 15,840 Pound ; Weight (exclusive of Tender), 41.74 Metric Tons

The present management therefore proposed the following plan, which was adopted: The issuance of P.3,000,000 7 per cent. refunding bonds, payable in 15 years, the sinking fund and interest to be guaranteed by 4 per cent. southern lines gold bonds to the amount of P.5,622,000 which were being held by the Chase National Bank as surety for the payment of the P.2,000,000 due on April 7, 1922; the money received from the sale of these bonds to be used for the payment of the loan due the Chase National Bank, for the continuation of the construction work on the Los Baños-San Pablo cut-off and the reduction of the loan of P.700,000 from the Philippine National Bank. It was also contemplated that a subscription of P.1,000,000 by the insular government for additional stock might be arranged.

The negotiation of this bond sale was successfully conducted, the entire issue being subscribed for jointly by Messrs. Hallgarten & Company and the Chase Securities Corporation, both of New York City, at a price of 107.047 plus accrued interest. The proceeds of the sale amounted to $1,650,038.40 or P.3,300,076.80, a premium of P.300,076 80 over the face value of the bonds.

Pending the consummation of this sale the loan of P.700,000 from the Philippine National Bank had been extended, and it was promptly liquidated when the proceeds became available. The completion of this financing, together with current receipts from operation, enabled the Company to pay off the bank loans of P.2,700,000, continue the construction work on the Los Baños—San Pablo cut-off, and take care of all indebtedness in the form of interest on bonds, bills payable for supplies and drafts for coal. This was accomplished with an additional interest charge of P.210,000 per annum and the creation of a sinking fund running for 15 years. This sinking fund will retire the issue at maturity.

## Equipment: Rolling Stock

The following statement shows the number of locomotives and cars of all types on hand at the end of 1922:—

| | |
|---|---|
| Passenger coaches .. .. | 197 |
| Baggage and passenger brake vans | 55 |
| Freight cars .. .. .. | 1,882 |
| Service cars .. .. .. | 51 |
| Total cars .. .. .. | 2,185 |
| Locomotives .. .. .. | 155 |

## Construction

There are still 144 kilometres of railroad to construct to complete the lines already planned, as follows:

| | Kilometres |
|---|---|
| Main Line North, Bauang Sur to San Fernando, La Union .. | 16 |
| Tayug Branch, San Quintin to Tayug | 8 |
| Main Line South, Aloneros to Pamplona .. .. .. | 120 |
| Total .. .. .. .. | 144 |

(*Continued on page 389*)

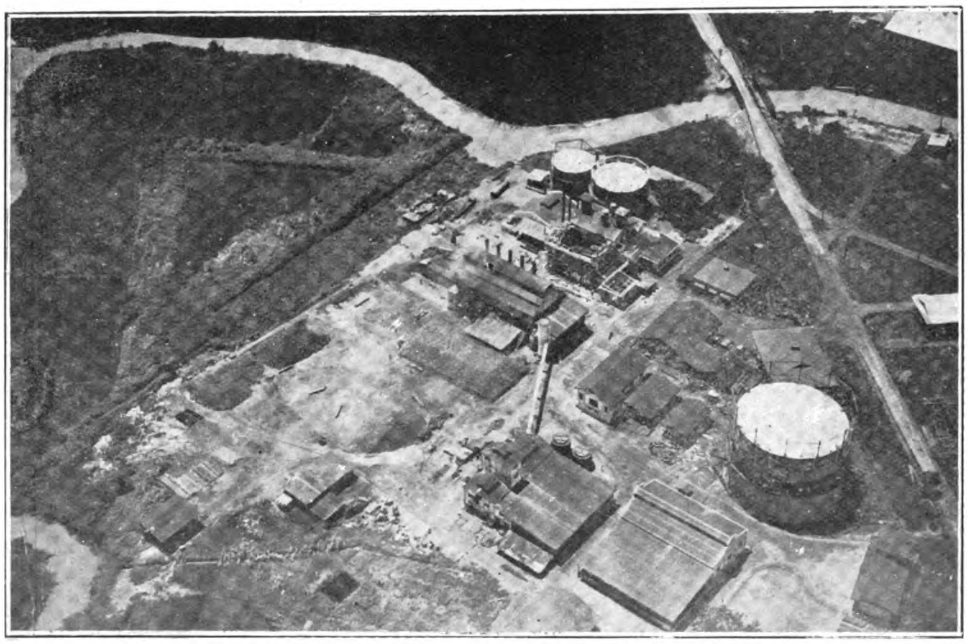
# The Manila Gas Works

INCORPORATED in 1912 under a fifty-year franchise, the Manila Gas Corporation has developed from 1,183,000 cubic metres output in 1913 to 7,608,000 in 1922, supplying at the present time over 7,600 consumers. Although the sum of Pesos 814,725 was expended on new construction in 1922 another Pesos 300,000 will be required for the current year to improve and extend the plant, when it will be one of the most up-to-date in the Orient.

The capital of the corporation is Pesos 1,500,000 with first mortgage 5 per cent., thirty-year debentures outstanding redeemable in 1942 at 105. The operating revenues for 1922 were P.1,250,076 and expenses P.772,601 and with net profit on showroom of P.7,091 left P.484,556 for distribution. After setting aside interest on debentures and current accounts, depreciation, and special depreciation, and amortization appropriations, there was a net profit for the year of P.78,289.

The original plant consisted of a retort house, containing five benches of nine retorts each, an apparatus house, a meter house with one station meter, three purifying boxes, and a gas holder of 7,000 cubic metres capacity. Only coal gas was produced up to June, 1917, when the production was increased by the addition of a new water gas plant. From November 15, 1913, to December 31, 1914, the entire production was only 1,800,000 cubic metres.

The number of customers had increased to 3,400 in 1916, and the gas consumption for that year to about 3½ million cubic metres. With the steady increase in demand for gas service it became necessary to enlarge the plant to supply it. To carry out this enlargement program the corporation added a new water gas plant consisting of water gas sets, each complete with generator, carburetter and superheater, two purifying boxes, a scrubber, relief gas tank of 700 cubic metres capacity, and the necessary blowers, exhausters, steam boilers, etc., required in the manufacture of this gas.



Aeroplane View of Manila Gas Plant, Taken Before the New Water-Gas Plant was Completed

To demonstrate the steady growth of the gas industry in Manila the following record of gas production and increase in number of consumers is shown :—

| *Year* | *Production* | *No. of consumers.* |
|---|---|---|
| 1913-14 | 1,183,000 cu. m. | 1700 |
| 1915 | 2,424,000 ,, | 2900 |
| 1916 | 3,404,000 ,, | 3400 |
| 1917 | 3,892,000 ,, | 4300 |
| 1918 | 5,176,000 ,, | 4600 |
| 1919 | 5,583,000 ,, | 5400 |
| 1920 | 6,745,000 ,, | 6400 |
| 1921 | 7,239,000 ,, | 7300 |
| 1922 | 7,608,000 ,, | 7600 |

The past two years the demand for gas service from those districts having no main pipes became so insistent that another enlargement of the plant became necessary. Beginning in the latter part of 1921 with the installation of a high-pressure booster system, in order to supply a better pressure to the northern part of the city, the following year, 1922, was one of steady construction. New building for additional water gas machinery, boiler house, purifier building, enlargement of the meter house and several other necessary buildings were erected. A new relief gas holder of 1,000 cubic metres capacity and 500-ton steel tanks for the storage of crude oil were erected.

New machinery and apparatus installed also included one new water gas set having hourly capacity of 1,100 cubic metres, two turbine air blowers, two steam-driven gas exhausters, three concrete purifier boxes, tar separator, scrubber, two new steam boilers and a new station meter. This enlargement program and construction activities will be continued during 1923.

A new main gas holder of 10,000 cubic metres capacity is now in the course of construction. The foundation, which rests on 1,400 piles 38 feet in length has already been completed. The holder will probably be completed and put into service during July or August, 1923.

With the new plant and equipment in operation, the laying of new pipes was begun January, 1923. At present the district of Santa Ana is being newly piped, and the piping in Tendo, Santa Mesa, Santa Cruz and San Lazaro districts is being considerably extended. Several of the well populated streets in these districts will be piped during this year. The 1922 improvement cost the corporation P.850,000, and it is estimated that P.300,000 will be spent this year.

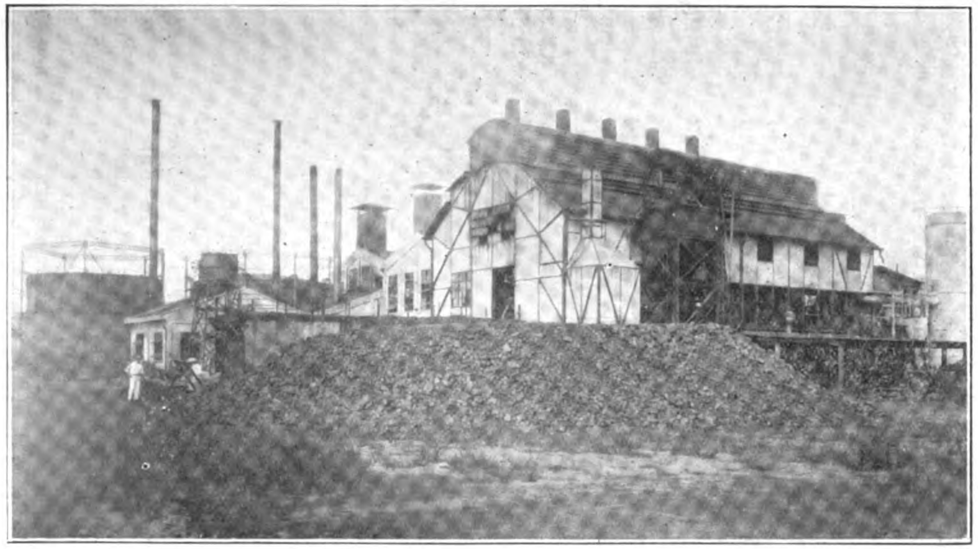
The corporation started business in 1913, with about 31 kilometres of main pipe which was increased to 80 kilometres before the end of 1914. The present length of the main pipe system is 110 kilometres. January 1, 1914, there were only 834 house supplied with 12,950 metres of house connections and with 114,122 metres of house connection pipe. A greater increase, however, is shown in house installations ; on January 1, 1914 there were 903 installations with 23,811 metres of installation pipe compared with 11,371 installations with 235,874 metres of installation pipe on January 1, 1923. The total length of pipe in house connections and installations is 350 kilometres.

It may be of interest to note that the raw materials, coal and crude oil, used in manufacture of gas must be imported. Coal is obtained from Australia and Japan, while crude oil comes from British North Borneo. Adequate supplies of these articles were somewhat limited during the war period causing some inconvenience. Now that conditions have changed and immense quantities of these essential raw products are available on short notice, better service and further expansion are assured. As an additional safeguard the corporation carries a generous surplus as a matter of protection against probable shipping difficulties, strikes of miners, etc.

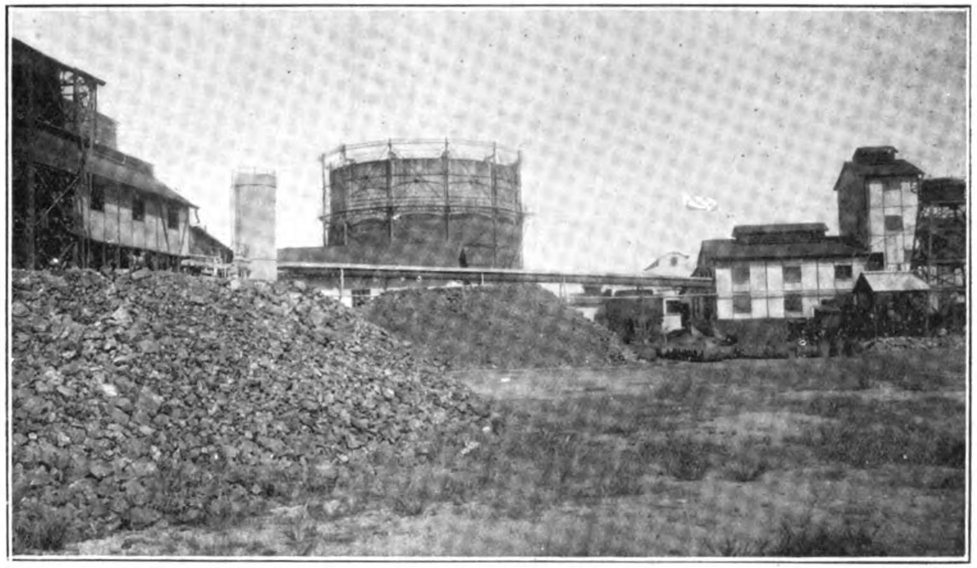
Because of its all-around efficiency gas is constantly gaining new ways of usage. Formerly most of the gas consumed was for cooking purposes in private homes. Later the leading hotels, clubs and restaurants seeing a greater efficiency in the use of gas had installations made. Candy manufacturers, tinsmiths, nickel and silver-plating works, bakeries, hospitals, convents, laundries, cleaning and dyeing establishments, tobacco factories and numerous

(Continued on page 389)

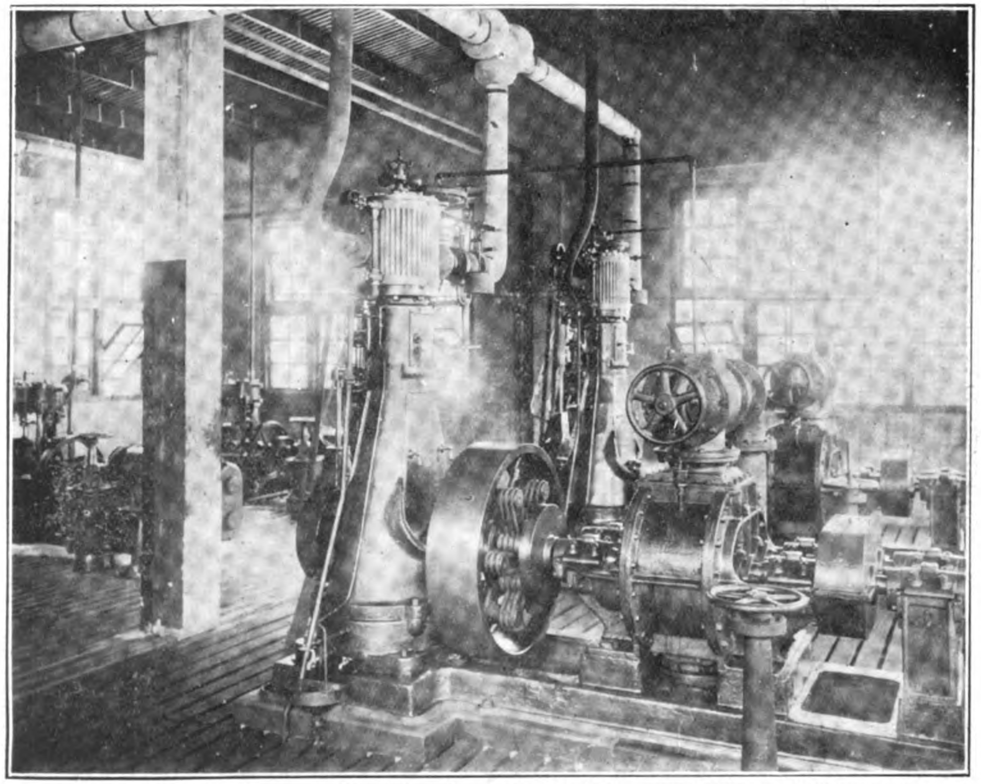
# THE MANILA GAS WORKS



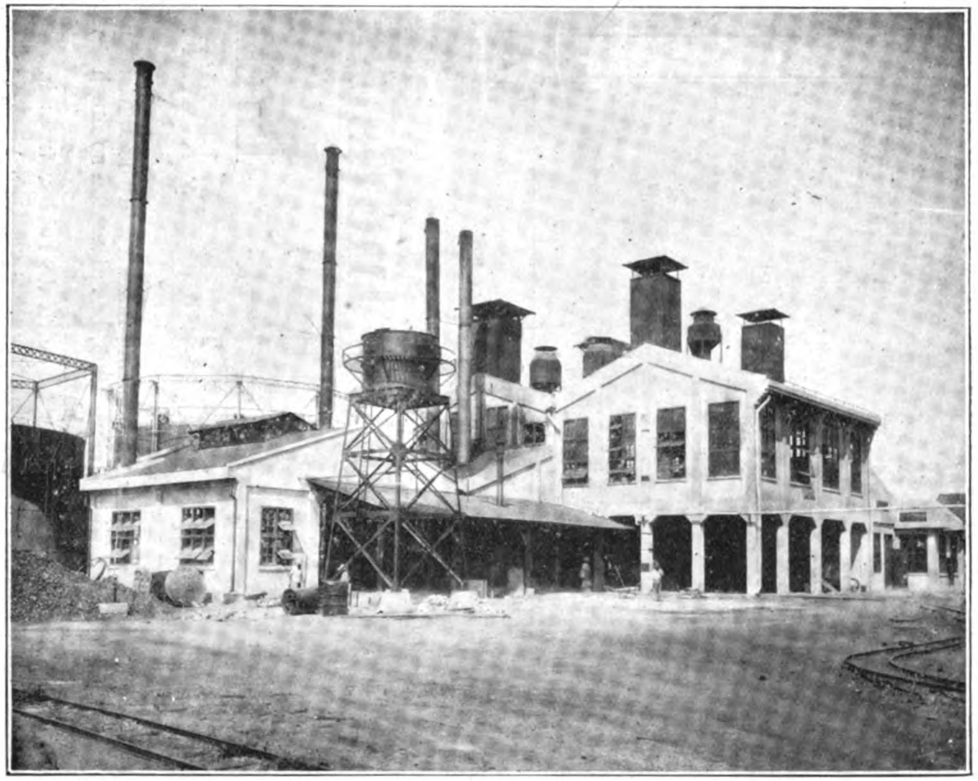
Coal Gas Plant



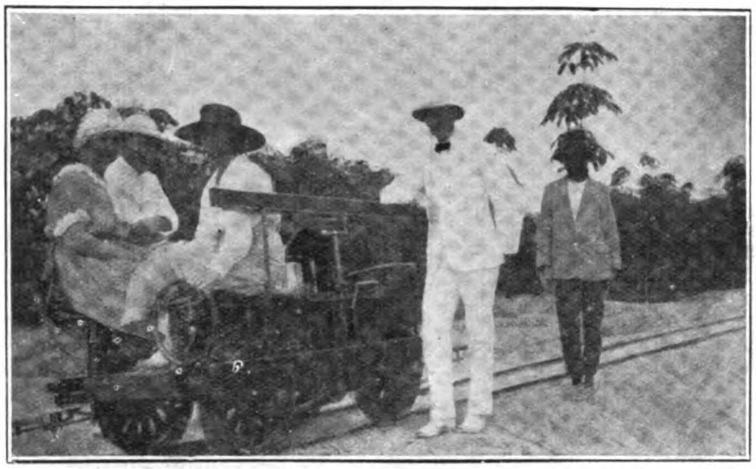
Apparatus House and Tar Tanks



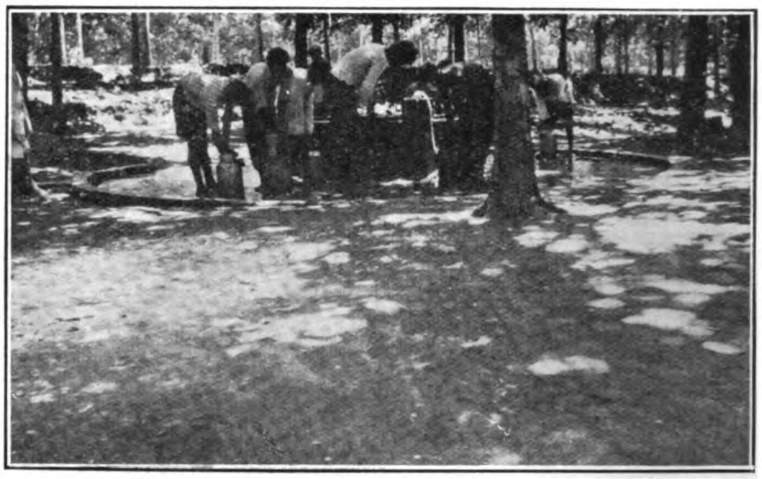
High Pressure Machinery: Pumping Gas under High Pressure Through 3,800 metres of Pipe to an Underground Governor Station



Carburetted Water Gas Plant and Boiler House. The Tower Tank in Foreground is the Storage for Boiler Fuel (Water Gas Tar)



Motor car for inspecting the Rubber Plantations near Kisaran, Sumatra, owned by the U.S. Rubber Company



Washing the tins used to collect the latex from the cups attached to the rubber trees

# The Rubber Industry in the Dutch East Indies

*By K. R. F. Blokzeyl*

THERE is certainly no planting industry in the Dutch East Indies which, since 1905, has attracted so much attention as that of rubber.

The first attempts to cultivate rubber trees in these colonies were made with ficus elastica, producing the so-called Assam rubber, and thereafter with other kinds, including Hevea Brasiliensis, which latter variety is now generally recognized as to produce the best quality of rubber. Castilloa elastica and various Manihot species were also introduced, viz., from Mexico and Latin America respectively, and although cultivation of these latter attained at some time considerable dimensions, the areas under same are to-day, as compared with Hevea, not worth mentioning.

It was short after the year 1905 when the planting of rubber in Java received its first great impetus, as the results obtained by neighboring countries at that time aroused considerable interest in the matter. Capital invested in the industry increased rapidly, resulting in the opening up of numerous estates, both in Java and in the other islands of the archipelago, and when in 1910 prices of rubber had risen to such an extent as to occasion a boom, many plantations changed hands and became the property of foreign (for the greater part British) companies, whereas a great number of coffee lands were converted into rubber plantations.

Tapping rubber trees: half Herring-bone system

After 1913, however, conditions became healthier and the development of the industry is since progressing undisturbed and on sound lines. The drop in the market prices which took place a few years ago, put an end to the all too rapid extensive development, but did not endanger properly organized enterprises which were left with an ample margin for profit. As a result of this, attention has been chiefly centred on the questions of how to reduce the cost of production in the rubber industry and of how to improve the product itself.

Rubber is planted both in Java and in the other islands of the Dutch East Indian archipelago (especially in Sumatra). As a rule, preference is given to flat, low lying land, but in Java we find plantations even as high as 2,000 feet above sea-level. At such a great altitude, the trees take longer to mature, but the growing of catch-crops is expected to counterbalance this disadvantage. For this purpose Robusta coffee, which can be cultivated without detriment to the main cultivation, and which comes into bearing about the third year after being planted, is usually chosen.

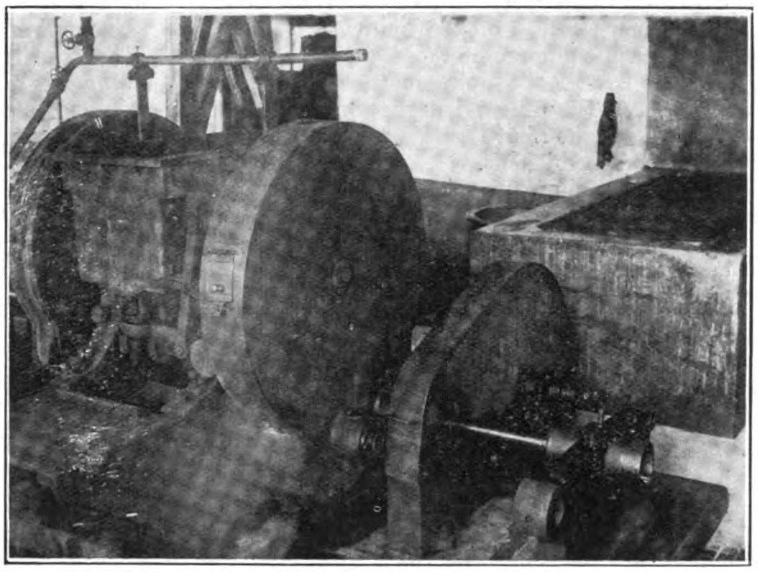
The department of agriculture in the Dutch East Indies has recently published the following figures showing the area planted with rubber, the production and the number of estates :—

HEVEA BRASILIENSIS.

| 1920. | Total acreage. Hectares. | Production. Kilos. | No. of Estates. |
|---|---|---|---|
| Java .. | 161,796 | 24,512,895 | 453 |
| Other islands | 201,486 | 37,427,853 | 452 |
| Total | 363,282 | 61,940,748 | 905 |
| 1920 | | | |
| Java .. | 157,949 | 27,258,245 | 451 |
| Other islands | 182,915 | 41,798,368 | 340 |
| Total | 340,864 | 69,056,613 | 791 |
| Ficus elastica and other kinds of rubber. | | | |
| 1920 | | | |
| Java .. | 4,658 | 33,791 | — |
| Other islands | 1,025 | 12,043 | — |
| Total | 5,683 | 45,834 | — |

For the growing of rubber, land is brought under cultivation in the usual way: clearings are made in the forest by felling and burning. Sometimes it is preferred to clear the soil completely of all tree stumps and dead wood for the reason that this method is the best preventative against the possible future appearance of the root moulds. After these preliminaries have been completed, holes are dug to receive the young plants. The seedlings are grown in nurseries where they remain for eight or nine months. By the end of this period they reached the thickness of about a finger and are transplanted to the plantation proper,

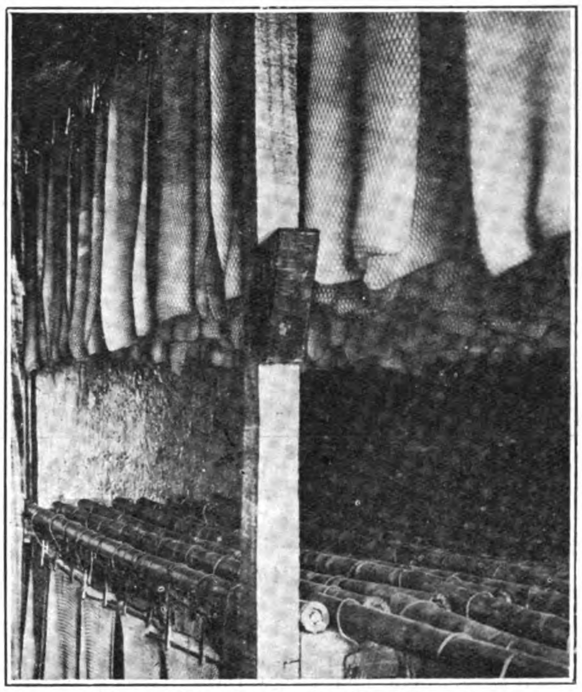
A Modern Smoke House on a Rubber Estate (East Java)



" Universal " washer used for the preparation of scrap, bark and earth rubber

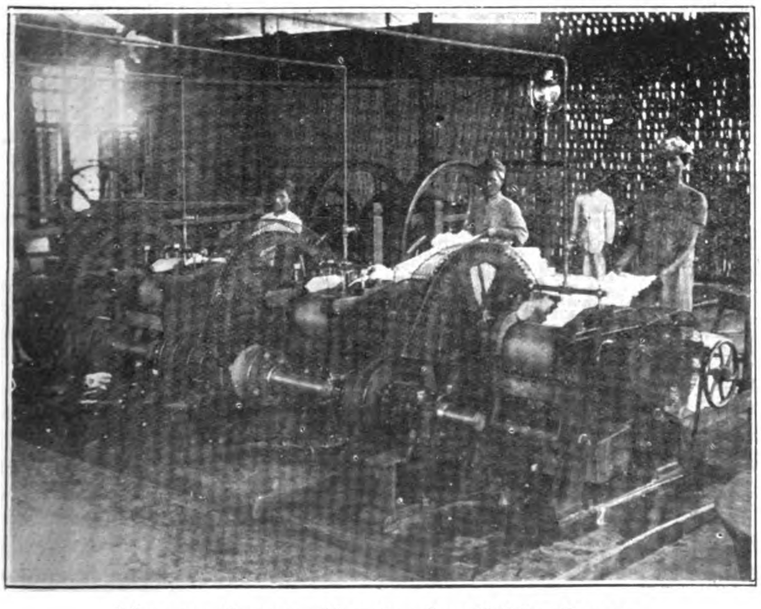
after they have been reduced to "stumps," i.e., after the tops and some of the finer roots have been cut off. Sometimes other methods of planting are persued. The seeds are then planted either directly into the gardens or in small baskets filled with earth. In the latter case, the seedlings are, at soon as they have sprouted, planted out basket and all.

The intervals at which trees are planted have greatly increased in the course of years. In old, densely planted gardens, thinning out occurs on nearly all the estates. In selecting the trees, the system is generally such that the trees with a small circumference are allowed to remain. On many other estates, however, the quantity of latex yielded by the different trees is taken as criterion. In thinning out, the planter often does not cut down the trees at once, but leaves them standing for half a year or even for one year, trying during that time to obtain from these trees as much latex as the can by tapping on two-quarters from two or more cuts. Sometimes the trees are cut at 6 to 8 feet, and the planter continues to tap the stem for some time.

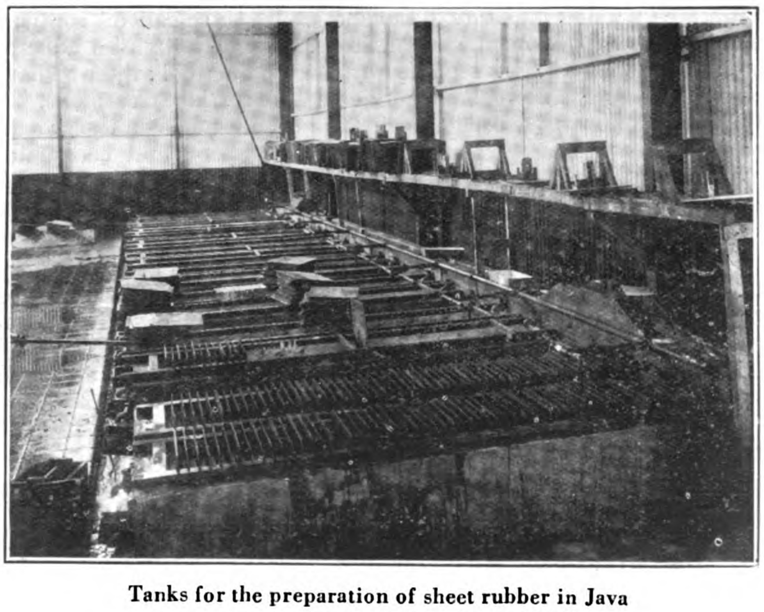


Sheet rubber hanging on bamboo poles in the a Smoke House

During the past decade there have been many tapping systems in operation, but in recent years methods have become far more conservative as regards severity of tapping. In selecting a system it is necessary to consider the financial side of the question and general health of the trees. The object aimed at in the former is to obtain the maximum yield of rubber at the minimum cost of production and in the latter to obtain the maximum amount of rubber with the minimum injury to the trees, and as conditions are quite different on many rubber estates, it is clear that not everywhere the same tapping system turns out to be the best and most profitable. Until some years ago, the so-called half-herringbone method was generally applied on one-third to one-fourth of the circumference of the stem, with four to six cuts, whereas on young trees the basal V, covering the half circumference, was applied. On other estates two-quarters were tapped



A battery of crepe rollers in a Java Rubber Factory



Tanks for the preparation of sheet rubber in Java

daily or every other day. Since that time, however, the number of cuts has been reduced on the majority of estates to two, covering one-quarter of the circumference, and sometimes to one-third of it.

In the matter of tapping methods, of course, much depends on the growth of the renewed bark, which again depends on fertility of the soil, height above sea-level, and the condition in which the gardens have been kept.

The best time for tapping is the early morning when the latex flows more freely than later in the day. The latex which is exuded from the tapping cuts is guided by the main channel to the spout which conducts it to a receptacle (cup) of glass, aluminium or glazed earthenware. After the tappers have bled all the trees assigned to them, i.e., on the average 300 pro man, they collect the contents of the cups in enamelled pails, which are brought to the factory.

Since one of the first requirements in the rubber industry is the observance of the strictest cleanliness, this should be borne in mind from the moment that the latex flows out of the wounds. For, there is not the least doubt that one very unpleasant feature which sometimes affects prepared rubber, namely, the appearance of colored spots in the wet rubber, in many cases, owes its origin to infection of the latex in the fields. Great care should be taken therefore, that everything in the fields is carried out in a scrupulously clean manner, and particular care should be taken that the main conducting channel and the spout are clean before the tree is tapped. For the same reason, only such cups have to be used as can be easily and thoroughly cleaned.

Young Hevea rubber trees interplanted with Robusta coffee as catch crop (West Java)

The tappers go back to the gardens, from time to time, in the afternoons, after their other work is completed, with a bucket of clean water to wash the cups. Where it is the custom with trees which have not stopped flowing, to place the cup, afrte emptying, under the spout again, great caer is taken that such cups are particularly carefully cleaned the next morning before tapping is commenced, because the latex of the previous day has partially decomposed in the cups by the action of organisms, so that from this cause an infection of the new latex may be effected which, in the preparation of sheets can bring about the formation of the well-known air-bubbles. For the rest this is a fault in latex from old trees, when these are tapped too high, and in latex from trees which have, two or three months previously, wintered, i.e., thrown off their leaves.

A certain portion of the latex does not flow off from the stem, but remains behind in the tapping wounds where it coagulates in thin threads along the edges of the ducts. These so-called "scraps" are collected about noon. A small quantity of latex also adheres to the thin strips of bark removed by the tapping tool; these "shavings" are also collected and subjected to further treatment. A further small quantity of latex drips from the wounds on the ground or is spilled from the cups by careless tappers, and coagulates where it falls. Even this spillage, the so-called "earth rubber" is collected and taken to the factory. The three grades, here described, are kept carefully apart during the process of curing.

When the pails containing latex have arrived at the factory they are there emptied into large tanks, in which the latex is allowed to stand for some time so as to permit of the sand and other heavy impurities settling before the liquid is passed through a coarse and afterwards through a fine sieve. The finest serviceable sieve for this work is one having 900-1000 meshes to the square inch. The straining must be done very carefully, especially if it is intended to make sheet rubber of the latex.

Already in the cups and in the pails the latex shows a tendency to coagulate. The lumps thus formed are taken out from the liquid latex and cured apart under the term of "lump rubber." This term also includes rubber which has coagulated prematurely at the factory. If these lumps are only treated with the necessary amount of care, it is possible to obtain from them crepe which is not much inferior to the first quality crepe. In order to achieve this, however, the working-off of the lumps must be started immediately after arrival at the factory.

From the pure fluid, the so-called "first latex," the best quality of trade rubber is prepared. In order to do this the rubber has to be separated from the liquid latex by coagulation. For this purpose acetic acid is used. The quantity and concentration of the acid required to produce complete coagulation, depend on the rubber contents of the latex which is to be coagulated. The thicker this is, the more acid is required, and the more diluted must it be. If, on the contrary, the latex is thin, less acid may be used, but the solution of acid must be stronger. Within one or two hours the latex has then been divided into a watery liquid and into soft white cake of rubber, possessing the consistency of cream cheese. If the color does not come up to the required standard of whiteness, a small quantity of sodium bisulphite or of a similar chemical is added as a bleaching agent.

Coagulation is effected either in large tanks, which are divided subsequently into partitions by means of frame work, orin small trays. The advantages of the tanks, which are becoming more and more used, especially in the case of large productions, are the saving in time and work which they effect, as well as the production of a more uniform rubber. They are made of cemented brickwork and the walls are lined with glazed tiles, or thick glass of exactly the same size as the surfaces to be covered. Care has been taken that the tiles fit closely together since the sheets are liable to adhere to the cement between the tiles. The partitions are, as a rule, made of aluminium or of wood which has been smoothly planed and which contains no coloring matter nor oil. Since, however, by long use of these wooden partitions the sheets are found to adhere to them, it is recommended to paint the wood with paraffin which has been liquified by heat.

It is of utmost importance that the acetic acid be evenly distributed throughout the latex. A large number of the faults exhibited by sheet rubber, may be traced to the fact that the acid and the latex were not well mixed together.

The coagulated cakes are taken out from their containing vessels next morning, care being taken that, in doing so, they are not doubled, or the edges curled over. Since the rubber is, in this stage, still very sticky, the cakes are laid down on tables which are covered with plates of thick glass. Here they are rolled out with a hand-roller. To ensure that sheets are rolled to the same thickness, use is made of a wooden frame or mould into which the sheet is placed.

After the sheets have been rolled out with the hand-roller, they may be placed one upon the other without detriment. In most cases they are placed into large bowls, e.g., Shanghai jars, which are filled with pure water, and here the sheets remain until they are to be put through the machines.

All this preliminary treatment of the sheets is sometimes omitted. And, indeed, it can with impunity be omitted, provided the coagulum tanks are so arranged that the serum can be run off in the afternoons.

After this has been done the cakes need only be swilled with water in order to free them of any remaining serum. This water must also, of course, be allowed to escape. The cakes are then left, dry, overnight, in the tanks. Owing to contraction of the rubber, much of the water which was closed up in the coagulum, is pressed out during the night, so that the cakes are quite hard enough the next morning to be rolled directly, without any preliminary treatment.

Large factories possess three or even four machines for rolling sheet rubber. Of these machines, two should have smooth rollers and there should be one or two printing machines. For the latter purpose, rollers with spiral grooves are coming more and more in favor. The spiral on each roller runs in the same direction and the pattern imprinted on the sheets somewhat resembles that made by a diamond mangle, but it is sharper, because the rollers of the diamond mangle are seldom set so truly that the ribs on one side of the sheet coincide exactly with those on the other side. Moreover, the sheets which are printed with the spiral-grooved mangles, appear to dry quicker.

In all the machines, the rollers must revolve at equal speed.

The rollers of one of the two smooth-rolled mangles are set wider apart than those of the other, whilst the rollers of the printing machine are still closer together.

In the case of small productions, one smooth-rolled and one printing machine has been found sufficient. All the sheets are first put through the smooth-rolled mangle, the distance between the rollers remaining constant. When the sheets have thus been mangled, the distance between the rollers is decreased and the sheets again put through. The diamond rollers remain always the same distance apart.

It is of great importance that all the sheets, after being mangled, are of the same thickness, because this has influence on the time required for drying them, and consequently on the speed with which they can be vulcanized.

Sheets of normal thickness are first put through the mangle once with the rollers wide apart, then once with the rollers closer together and, finally, once through the printing machine. Sheets which are too long, are previously cut into suitable lengths, though some people prefer to cut the sheets only after printing, thus reducing the number of processes through which the unfinished rubber has to pass, and thereby effecting a slight gain in time.

After the sheets have been passed through the machines, they are placed in clean water for some hours, or, better still, for a whole night, then brushed briskly and afterwards hung on racks to drip. This last process does not last more than two hours. Next the sheets are taken to the smoke-house and there hung up.

In order to prevent the sheets becoming unevenly smoked, they are to be shifted along the rods, from time to time, in such a manner that the same portion of the sheet does not always remain in contact with the support, otherwise, this portion will be lighter colored than the rest of the sheet.

The supporting rods from both the smoke and drying houses are regularly cleaned and washed with some disinfectant, and afterwards well dried.

The furnace or fireplace should be separated from the space in which the rubber sheets hang, by a fine grating which serves to keep back the ash particles or smuts which may be traveling along with the smoke.

The time requisite for the complete drying of the sheets varies, of course, with the temperature, the system of the smoke-house and with the degree of moisture in the atmosphere of the particular estate. A sheet of 3 millimetre thickness will be dry in eight to ten days if the temperature of 40 to 50 degrees Celsius, which is considered best, is maintained.

The sheets remain in the smoke-house, even after they are completely dry, for a few days.

For the manufacture of crepe rubber, it is customary to use a stronger solution of acetic acid in coagulating the latex than is used for sheet rubber, namely a 5 per cent. solution, although many factories prefer to work with a weaker solution. The latex and acid are thoroughly well mixed together with a broad wooden spoon or ladle. In most factories it is customary to allow the coagulated latex to stand until the next morning before starting to work it off on the machines.

For the manufacture of crepe, at least three different machines are required, viz., a crepe machine, the rollers of which are deeply grooved (preferably diamond or spiral pattern), a machine with shallow-grooved rollers, and a machine with smooth rollers. In all these machines the rollers revolve at uneven speeds. There is, as yet, much diversity of opinion regarding to the amount of difference which should exist between the speeds of the rollers. Some prefer only a slight difference in these speeds, viz., 5 : 6 ; whilst tohers advocate a great difference, i.e., 2 : 3; the latter class of people argues that the smooth rolled machine should work with the same difference in relative speeds as does the crepe machine. The object of this is that the small holes in the crepe may be quicker and more satisfactorily filled up. Those who prefer a small difference in the speeds of the rollers, usually carry out the crepeing operations in the following way :—

Equal quantities of rubber are put first five to six times through the deep-grooved machine, then twice or three times through the machine with shallower grooves, and finally once or twice through the smooth rollers. When four machines are in use, the rubber is put respectively 3, 2, 2, and 1 times through. If there are too many holes in the crepe, the piece is doubled and put so through the machine. It is usual, when the crepe is going for the last time through the machine, to put it through unfolded.

During its passage through the rollers, the rubber is continually cooled with water, otherwise there is the possibility that the quality will suffer and that the finished rubber will appear to be " tacky."

When the crepe has finally left the machines, it is cut into pieces of suitable dimensions. This is done by placing upon the crepe a board, having the required form and size. Then with a sharp knife, the crepe is cut to the shape of the board. The clippings or trimmings are again worked into crepe on the machines. The coolies in charge of the machines, however, soon learn, with practice, to roll the crepe so regularly that no trimming will be necessary.

The pieces of crepe are allowed to drip for a time and are then brought to the drying house.

Crepe rubber is usually air-dried, though there is no reason why it should not be dried by artificial heat provided it is not subjected to a greater heat than 40 degrees Celsius.

The drying house is well ventilated so that the moisture-ladey air can easily escape. The necessity for drying the crepe quickln arises from the fact that so long as it remains wet, it provides an excellent feeding ground for moulds and bacteria which cause colored spots to appear on the finished rubber and give it, therefore, a less attractive appearance. These organisms are not able to develop on dry rubber.

Under normal circumstances, crepe of 2 millimetres thickness is dry in about seven days.

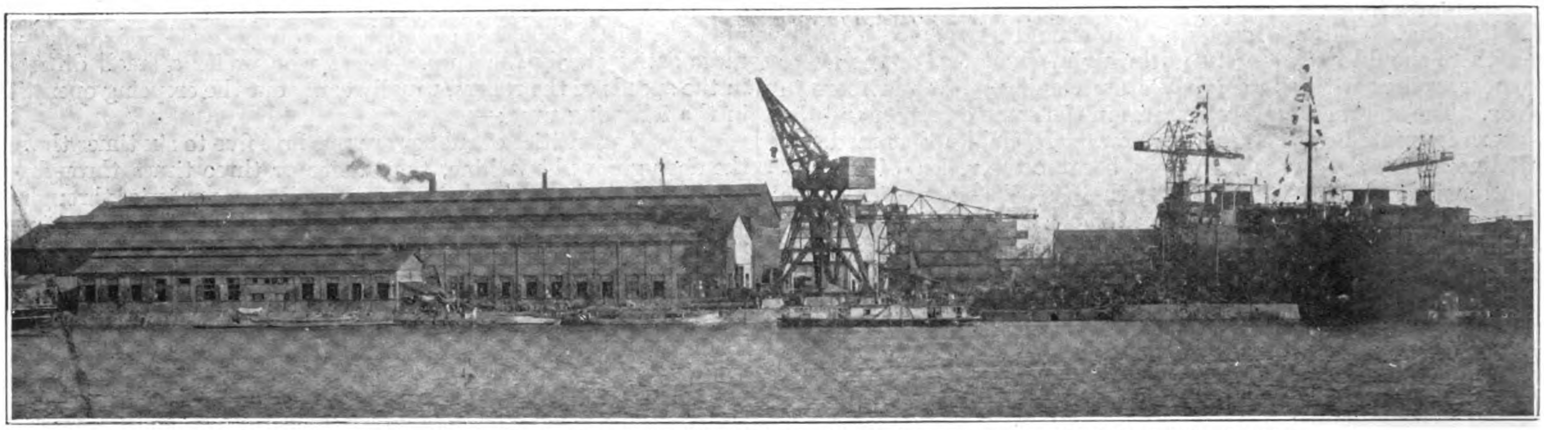
Both crepe and sheet rubber are packed in the cases only when perfectly dry, otherwise there is the danger that the rubber will mould in course of transport or that, on arrival at the market, it would cleave so tightly together that it would be impossible to separate the pieces from each other. For the same reason the cases are stored in a dry place, and in no case they are put down on cement or earthen floors.

In Java, where labor is cheap and plentiful, the cost of production is very low, and with rubber selling at only 9 or 10 pence a pound f.o.b. Batavia, there is little distress. On the east coast of Sumatra the estates are almost entirely first class and are controlled by properly financed companies. They are faced with a higher cost of production than in Java, because here, as in British Malaya, coolies have to be imported, and recruiting expenses are very heavy. This factor has prevented many estates from closing down under the unfavorable market situation during 1921-22.

The following table shows the quantities of rubber exported from Java and the other islands of the Dutch East Indian archipelago during recent years. The figures show how great is the significance of the industry for the world's rubber market :—

| Year. | Exports from Java. Metr. tons. | Exports from other islands. Metr. tons. | Total exports. Metr. tons. |
|---|---|---|---|
| 1914 .. .. | 3,811 | 6,475 | 10,286 |
| 1915 .. .. | 7,509 | 12,380 | 19,889 |
| 1916 .. .. | 13,944 | 19,672 | 33,616 |
| 1917 .. .. | 18,843 | 26,775 | 45,618 |
| 1918 .. .. | 17,311 | 26,739 | 44,050 |
| 1918 .. .. | 35,263 | 54,460 | 89,723 |
| 1920 .. .. | 31,190 | 59,101 | 90,291 |
| 1921 .. .. | 29,350 | 44,051 | 73,401 |
| 1922 .. .. | 31,659 | 72,368 | 104,027 |

It will be noticed that the exports of rubber from the Dutch East Indies have increased tenfold in these nine years. The industry, therefore, holds a position of paramount importance. That financiers are confident of the future of this industry is proved by the large amount of foreign capital which it has attracted.

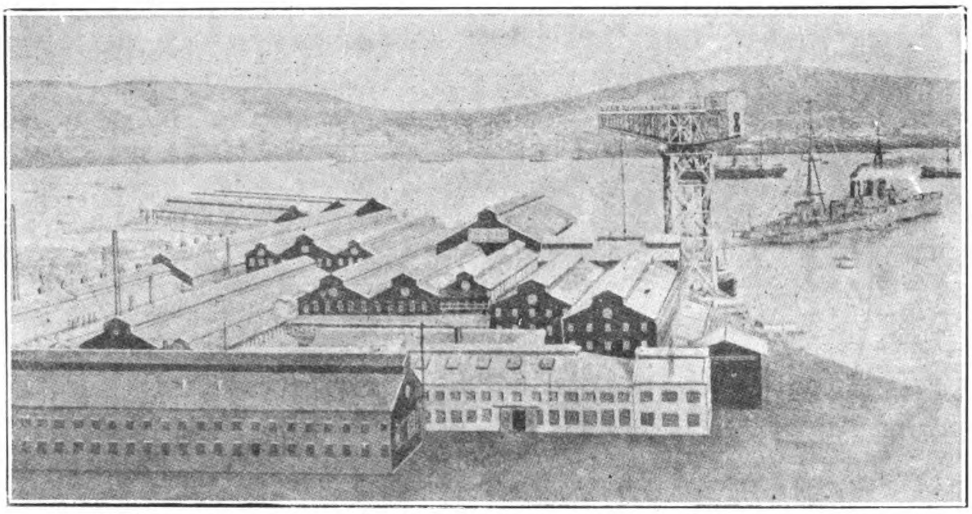


The Ishikawajima Shipyard at Tokyo, one of the oldest and best known Japanese Builders of Machinery

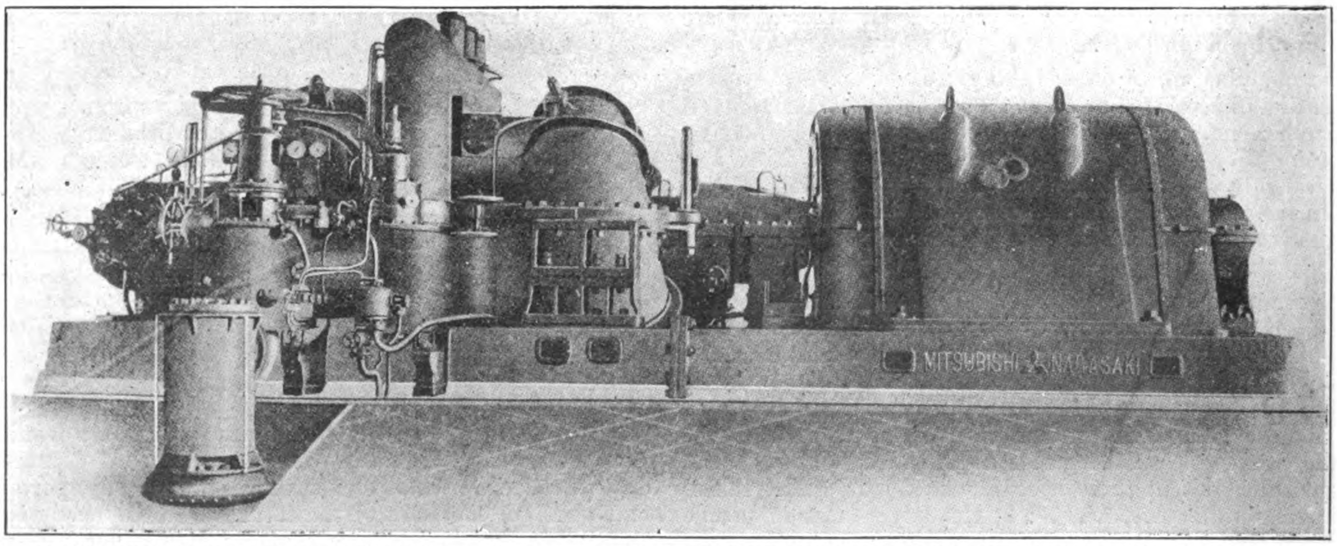
# Machinery Manufacture in Japan

THE development of the engineering industries in Japan has reached the point where an association of 300 member firms have recently requested the government for tariff protection against foreign competition. Many of these machinery manufacturers are turning out motors and engineering products which can no longer be decried as imitations of foreign patterns. The Japanese engineer has kept abreast of the times and although it is true he has visited all countries seeking ideas and a knowledge of up-to-date methods, he does not adopt them all by any means. As Mr. Elmer A. Sperry, the head of the Sperry Gyroscope Company recently said "Japan is not a nation of copyists. The Japanese think for themselves with quicker mental reactions than the Anglo-Saxons. Their methods of construction are the latest and in some cases more advanced than in America. For every idea they adopt from America they reject a hundred."

That this is true is seen in the many types of prime movers, steam, gas and oil engines, steam generators, turbines, large gas engines, and especially in the electrical machinery and accessories, now being manufactured in Japanese-owned plants by Japanese workmen under Japanese supervision. All this is of comparative recent growth, for although remarkable progress was made in the engineering industries in the latter part of the last century, it was not until the Russo-Japanese war that real advances marked the growth of the industry. The manufacture of modern machinery in Japan dates from the seventies, and at the industrial exhibition held in Tokyo in 1877, the Ishikawajima Shipbuilding Company exhibited a marine steam engine and the Tokyo Electric Company a gas engine completely built at their respective works. Both were extremely crude as measured by the standards even of those days, but they indicated that private enterprise was even then attempting to develop the manufacture of prime movers. After the war

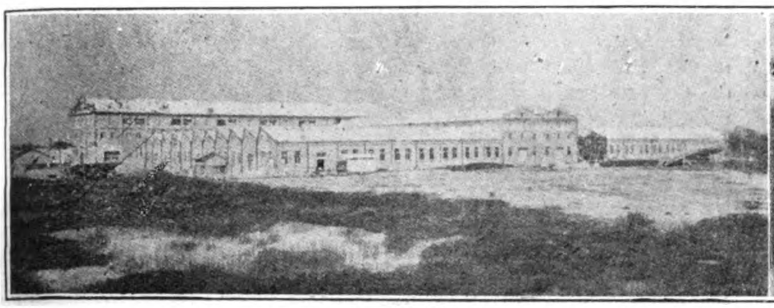
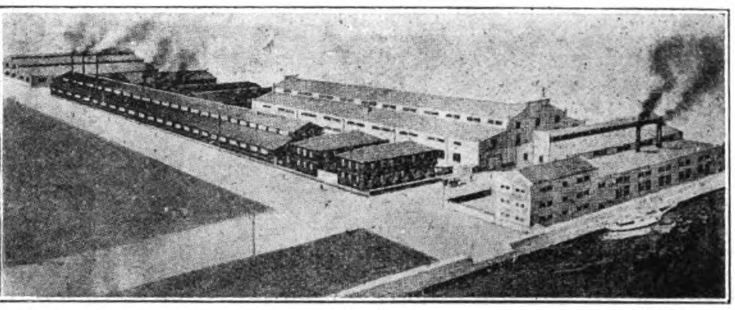


Machinery Department of the Nagasaki Works of the Mitsubishi Zosen Kaisha





12,500 K.V.A. Turbo-Alternator Set built at the Nagasaki Works of Mitsubishi Zosen Kaisha for the Osaka Electric Light Co.

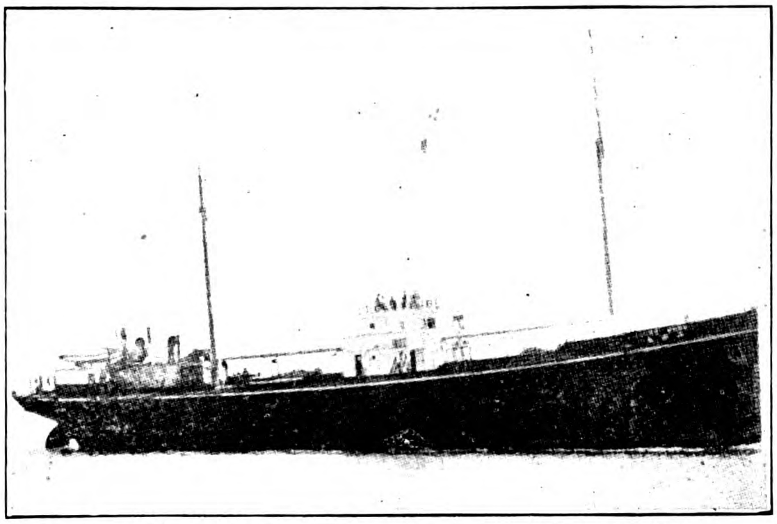



THE NIIGATA ENGINEERING WORKS

The New Diesel Engine Works at Kamata — The New Tokyo Works

with China, the regulation for the encouragement of the shipbuilding industry providing a bonus of Y.5 per horse-power for each prime mover manufactured in the country, stimulated the shipyards to manufacture steam engines and encouraged the establishment of many new power machinery manufacturers. Among these were the Hatsudoki Seizo and the Arakawa Seisaku companies organized in January 1902 and the Dengyosha Gendoki Seizosho in 1910. In addition to these three, there existed at the outbreak of the great war the Nagasaki and the Kobe yards and shops of the Mitsubishi Shipbuilding Company, the Kawasaki Dockyard, the Kameido Works of the Hitachi Engineering Works, Ltd., one of the Kuhara enterprises, and the Ebara Siesakujo both established in 1912. The largest work turned out by any of these shops was water turbines of 1,000 horse-power, and steam engines under 1,000 horse-power. Gas engines of 300 to 400 h.p. were then the limit, the total production of all the works in Japan in 1913 being estimated at Y.100,000 in water turbines and Y.6,000,000 in steam generators and engines of all kinds.

As in the case of the two previous wars, by cutting off importations the great war forced the establishment of many new machinery manufacturers and great extensions to the then existing plants, so that by the end of 1921 there were 124 concerns manufacturing power machinery, including those making pumps and cranes. Of this total, the number making steam engines, boilers and pumping machinery was about 75, with 45 devoted to the manufacture of internal combustion engines. There were also several plants exclusively engaged in the manufacture of water turbines and cranes. Before the war the total number of workmen engaged in the industry was only 988, while at the end of 1919, there were 13,000, by but the end of 1920 the number had fallen to 10,000.



Motor Ship "Jiro Maru," propelled by a 4-cylinder 360 H.P. Niigata Marine Oil Engine

The following list gives the names of the leading power machinery manufacturers, products and number of workmen employed at the end of 1920 :—

*Japanese Power Motor Manufacturers 1920.*

| Name | Manufactures | Number of Workmen |
|---|---|---|
| Nagasaki Shipbuilding Yard of Mitsubishi Co. ... ... | Marine boilers, steam engines, water turbines, pumps, etc. | *13,500 |
| Kobe Shipbuilding Yard of Mitsubishi Co. ... ... | same | 6,800 |
| Kawasaki Dockyard ... ... | same, and Diesel engines | 12,000 |
| Hyogo branch of the Kawasaki Dockayrd ... ... ... | Motors for aeroplanes | 6,703 |
| Kameido Works of the Hitachi Engineering Co. ... ... | Water turbines, steam engines and boilers, pumps, cranes, etc. | 644 |
| Kamata Works of the Niigata Iron Works ... ... ... | Diesel engines, kerosene motors | 500 |
| Hatsudoki Mfg., Co., Ltd. ... | Suction gas engines, oil engines | 526 |
| Honshiba Workshop of the Ikegai Iron Works ... ... | Diesel engines, kerosene engines, motors for aeroplanes | 280 |
| Mitsubishi Internal Combustion Engine Mfg. Co., Ltd. ... | Diesel engines | 749 |
| Kobe Steel Works ... ... | Diesel engines, boilers, steam engines, pumps | 2,024 |
| Dengyosha Gendoki Mfg. Co. ... | Water turbines, Pelton water wheels | 650 |
| Arakawa Engineering Works ... | Water turbines, pumps, cranes | 500 |
| Ebara Engineering Works ... | Centrifugal pumps, water turbines | 90 |

(* includes employees in other lines).

The production value of the Japanese power machinery manufacturers for 1914, 1919 and 1920 follows :

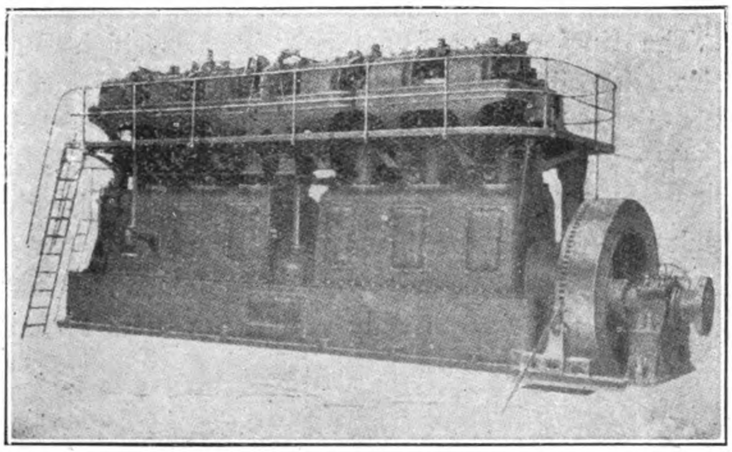
| Type Equipment | 1914 | 1919 | 1920 |
|---|---|---|---|
| Boilers, steam turbines .. | Y.5,000,000 | Y.24,000,000 | Y.13,000,000 |
| Steam engines .. .. | 1,000,000 | 14,000,000 | 5,700,000 |
| Pumps and blowers .. | 1,000,000 | 6,000,000 | 6,500,000 |
| Internal combustion engines .. .. | 1,000,000 | 8,000,000 | 8,000,000 |
| Water wheels .. .. | 1,000,000 | 2,400,000 | 4,500,000 |

With the installation of modern tools and education of the mechanics the products became more and more finished, comparing favorably with the best importations from abroad.

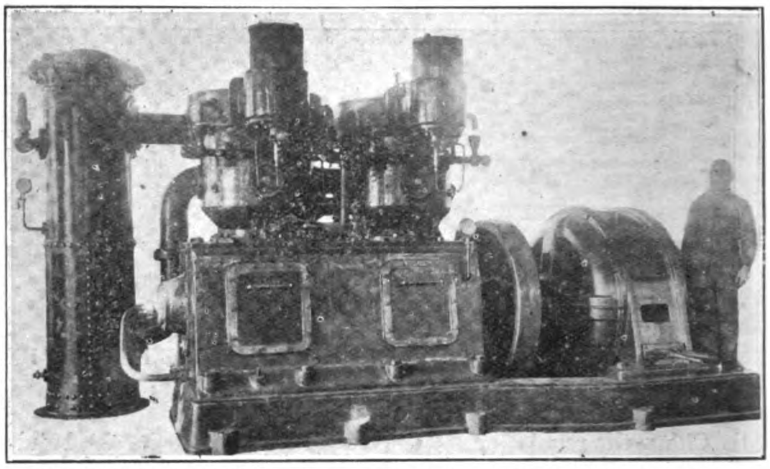
In the matter of steam generators, including high pressure water-tube boilers of large capacity for battle-ships, the Kwasaki and Mitsubishi yards have been able to fully meet the severe tests and requirements of the navy department and supply its needs. The Kisha Seizo Company has also entered this field with a 600 h.p. Takuma water-tube boiler. Vertical, cylinder and multitubular boilers are produced in all sorts of small shops to an extent that they fully meet the domestic demand. The Mitsubishi and Kawasaki companies were also enabled to make large capacity steam turbines for the Japanese navy with complete success, while at the Nagasaki Works of the former company, steam turbo-generating sets of 12,500 k.v.a. have been built for the Osaka, Tsingtau, and other large electric lighting plants. A start was also made in the manufacture of gas engines of 500 h.p. and over.

The same progress has been made in the manufacture of Diesel engines and we find the Mitsubishi Internal Combustion Engine Company holding the manufacturing rights of the Vickers patents, the Kawasaki Dockyard the Fiat rights, the Kobe Steel Works with the Lungstrum and the Niigata Iron Works with Mirrlees, Bickerton & Day patents. The first three companies have supplied the Japanese navy with large type engines of 600 to 1,000 h.p., while the Niigata Iron Works is engaged principally in the manufacture of small and medium sized marine motors.

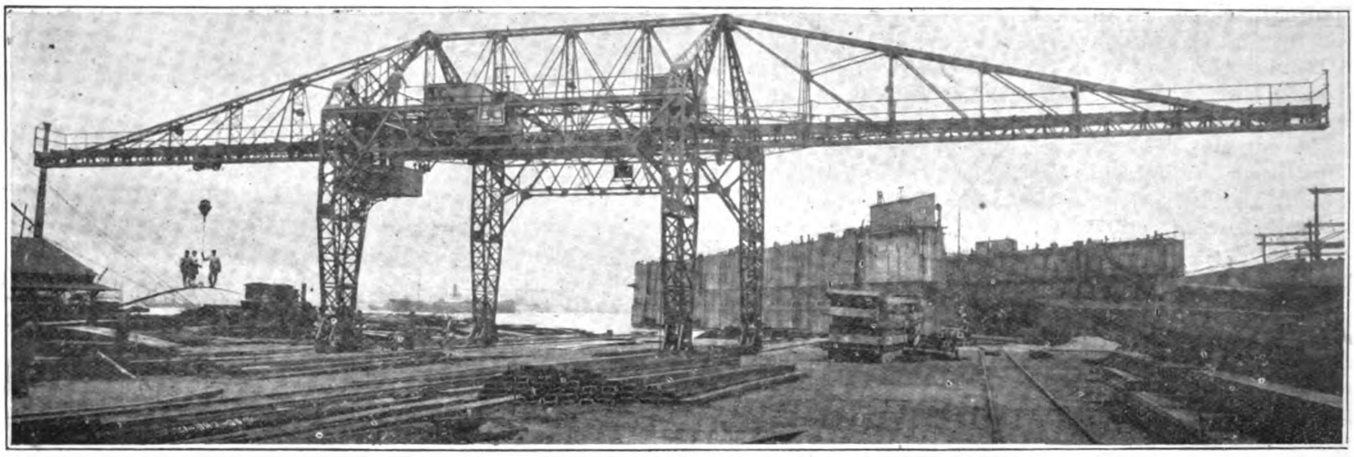
Towards the end of 1917, a perfect water turbine with a capacity of 31,000 h.p. was produced ; since then, many 6,000 to 7,000 h.p. and even 10,000 h.p. water turbines have been made in Japan, while the production of governors and pressure regulators has reached a point where they can stand comparison with foreign manufac-



A 750 B.H.P. "Niigata-Diesel" Engine. Built at the Kamata Works



250 H.P. Vertical Air Compressor made by the Hidachi Engineering Works for the Saseho Naval Station



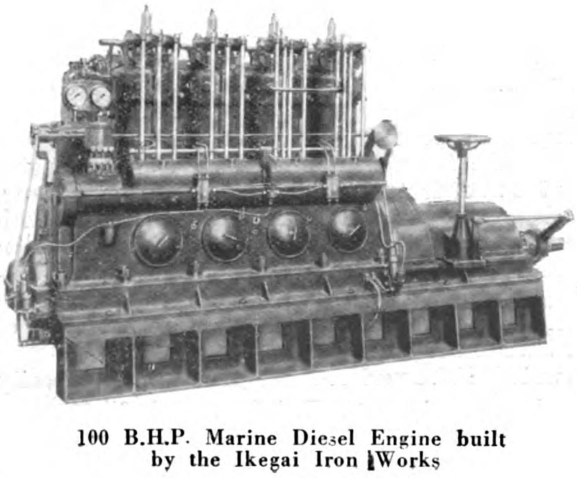
Fire Ton Cantilever Goliath Crane made by the Hidachi Engineering Works for the Kobe Yards of the Mitsubishi Dockyard and Engine Works, Ltd.

tures. Great progress has also been made in the manufacture of centrifugal and turbine pumps of several stages and the production of centrifugal pumps feed water is now being undertaken.

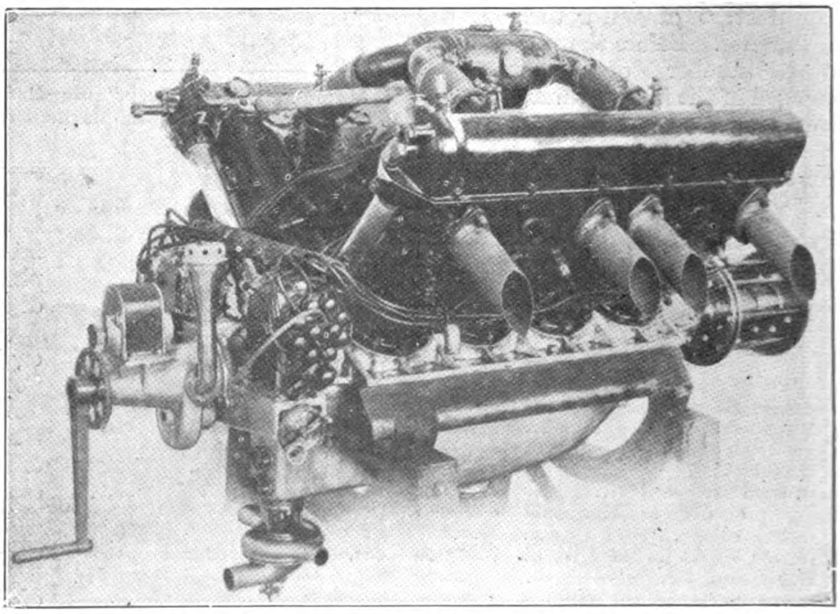
Practically all the domestic demand for medium and small size power machinery can be met by home-made machines to-day. The rapid industrial development as the result of the war has compelled machinery buyers to insist on better equipment, with the result that the Japanese manufacturers have been forced to improve their methods and the quality of their products. Notwithstanding these general improvements all along the line in the Japanese engineering industries, it is still difficult for the Japanese manufacturer to produce high power steam turbines, gas engines, water-tube boilers and other plant, of high efficiency and complicated structure. These have largely been imported from other countries, as shown in the following table of imports of foreign machinery in recent years :—

| | 1914 | 1920 | 1921 |
|---|---|---|---|
| Boilers and parts thereof.. | Y. 945,000 | Y.7,294,000 | Y.9,116,000 |
| Steam turbines .. | 163,000 | 1,702,000 | 2,292,000 |
| Steam engines .. .. | 453,000 | 492,000 | 391,000 |
| Oil and gas engines .. | 366,000 | 4,771,000 | 1,111,000 |
| Water turbines of all kinds | 322,000 | 779,000 | 1,600,000 |
| Total .. | Y.2,249,000 | Y.15,036,000 | Y.14,511,000 |

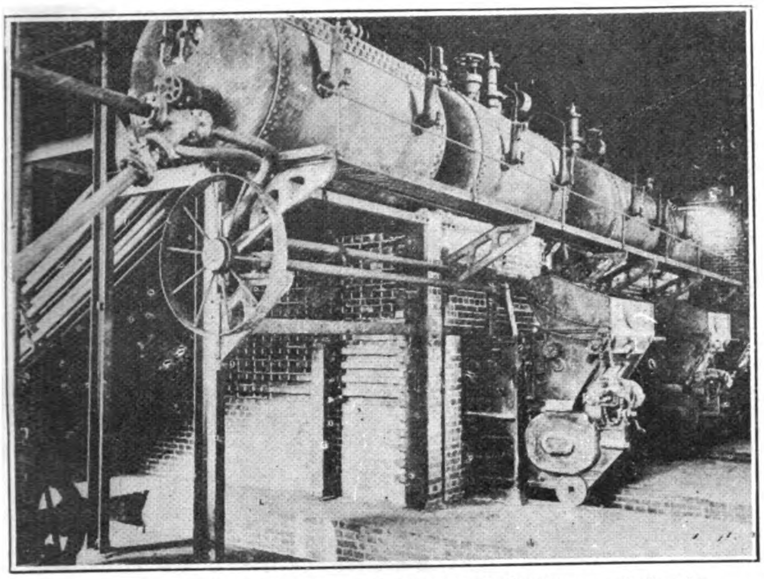
Imports of steam engines are not particularly active, as the Japanese shops can now compete with the best foreign makers, and in recent years have built up a considerable export trade as the table on next page shows.



100 B.H.P. Marine Diesel Engine built by the Ikegai Iron Works



300 H.P. Mitsubishi ("Hispano-Suiza") Aero-Motor made to the Nagoya Works of the Mitsubishi Internal Combustion Engine Co., Ltd.



Takuma Water Tube Boilers with Automatic Stokers made by the Kisha Seizo Kaisha, Osaka Works

EXPORTS OF STEAM ENGINES, PUMPS AND CRANES.

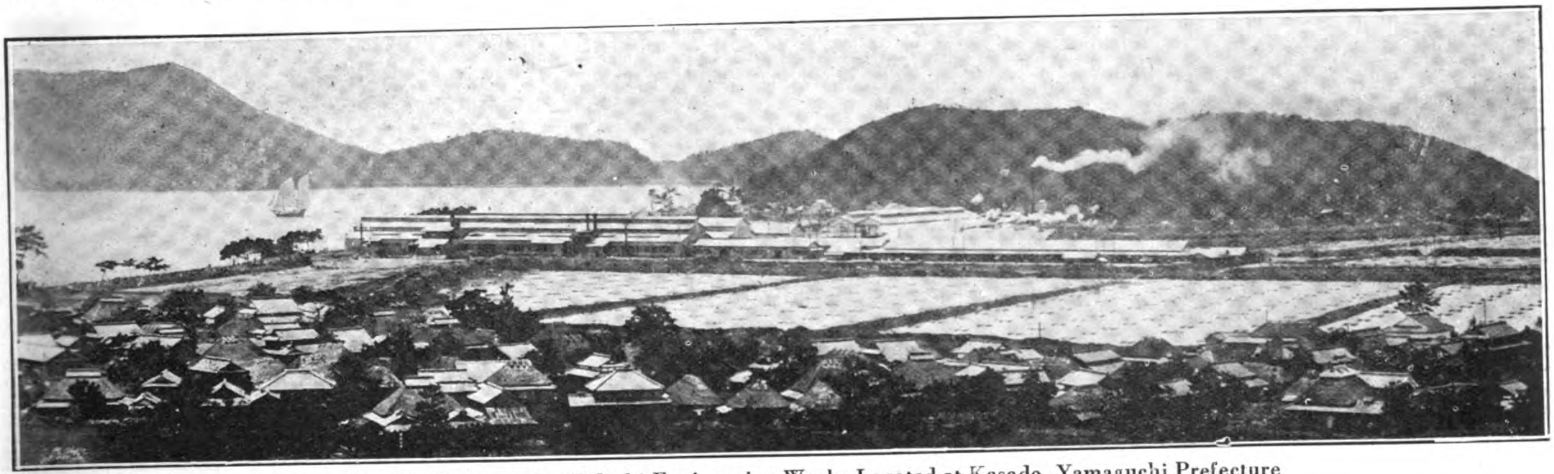
| | Boilers and parts | Pumps | Cranes |
|---|---|---|---|
| 1917 .. .. | Y.514,000 | — | — |
| 1918 .. .. | 698,316 | — | — |
| 1919 .. .. | 1,175,258 | Y.378,508 | — |
| 1920 .. .. | 371,470 | 293,756 | — |
| 1921 .. .. | 591,158 | 297,261 | Y.114,201 |

An investigation made at the end of 1920 disclosed that about 82 per cent. of the boilers installed in mines, factories and other industrial establishments in Japan were of domestic manufacture. Water-tube boilers are, however, practically all of foreign make.

Japan is naturally handicapped in the manufacture of power machinery, by the lack of raw materials which must be imported.

INSTALLATIONS OF BOILERS ACCORDING TO TYPE AND MANUFACTURING COUNTRIES.

| | Factories | Mines | Others | Total |
|---|---|---|---|---|
| (1) Water Tube Type Boilers : Made in | % | % | % | % |
| Japan ... ... ... ... ... | 161 | 47 | 8 | 216 |
| Other countries ... ... ... | 888 | 230 | 22 | 1,140 |
| Total ... ... ... ... | 1,049 | 277 | 30 | 1,356 |
| (2) Multiple Tube Boilers : | | | | |
| Japan ... ... ... ... ... | 4,093 | 531 | 412 | 5,036 |
| Foreign countries ... ... ... | 162 | 69 | 41 | 272 |
| Unknown ... ... ... ... | 170 | 113 | 21 | 304 |
| Total ... ... ... ... | 4,425 | 713 | 474 | 5,612 |
| (3) Lancashire Type Boilers : | | | | |
| Japan ... ... ... ... ... | 1,167 | 2,210 | 61 | 3,438 |
| Foreign countries ... ... ... | 399 | 537 | 5 | 941 |
| Unknown ... ... ... ... | 89 | 43 | 2 | 134 |
| Total ... ... ... ... | 1,655 | 2,790 | 68 | 4,513 |
| (4) Cornish Boilers : | | | | |
| Japan ... ... ... ... ... | 4,548 | 936 | 583 | 6,067 |
| Foreign countries ... ... ... | 76 | 2 | 3 | 81 |
| Unknown ... ... ... ... | 316 | 31 | 11 | 358 |
| Total ... ... ... ... | 4,940 | 969 | 597 | 6,506 |
| (5) Vertical and Others : | | | | |
| Japan ... ... ... ... ... | 1,921 | 216 | 603 | 2,440 |
| Foreign countries ... ... ... | 113 | 26 | 175 | 315 |
| Unknown ... ... ... ... | 148 | 95 | 72 | 315 |
| Total ... ... ... ... | 1,882 | 338 | 850 | 3,070 |
| Grand Total : | | | | |
| Made in Japan ... ... ... | 11,751 | 3,940 | 1,667 | 17,358 |
| Made in foreign countries ... ... | 1,638 | 865 | 246 | 2,749 |
| Unknown ... ... ... ... | 728 | 282 | 106 | 1,116 |
| Total ... ... ... ... | 14,117 | 5,087 | 2,019 | 21,223 |

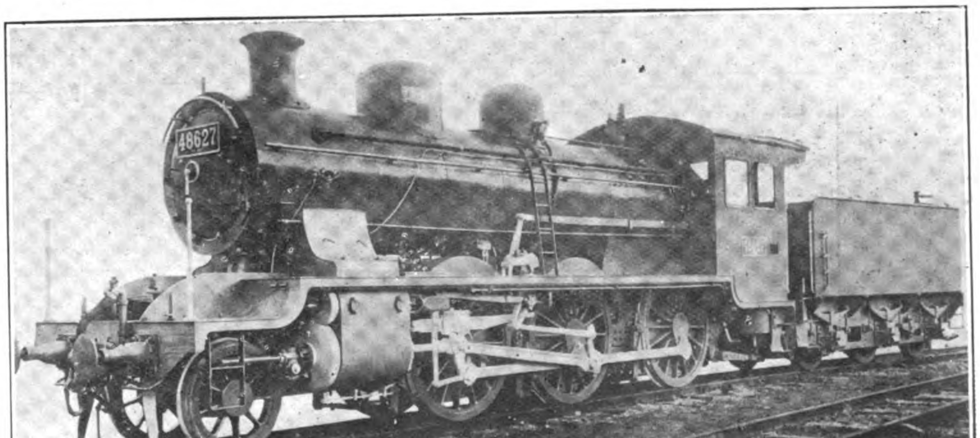


The Locomotive Shops of the Hidachi Engineering Works Located at Kasado, Yamaguchi Prefecture

Here workmen are not as highly skilled or efficient as those of older manufacturing countries, and any great development of the industry is going to be difficult until her mechanics as a class are better trained in the use of modern automatic and labor-saving devices. The demand for Japanese machinery has recently shown a remarkable decrease, causing such concern to the manufacturers that they have asked the government for protection. The following table shows the percentage of domestic and foreign boilers installed in Japanese industrial works :—

INSTALLATION OF BOILERS IN JAPAN

| Made in | Installed at Factories | Mines | Others | Total |
|---|---|---|---|---|
| | % | % | % | % |
| Japan ... ... ... | 84 | 78 | 83 | 82 |
| Foreign countries ... | 12 | 17 | — | 13 |
| Unknown ... ... | 4 | 5 | 5 | 5 |
| Total ... ... | 100 | 100 | 100 | 100 |

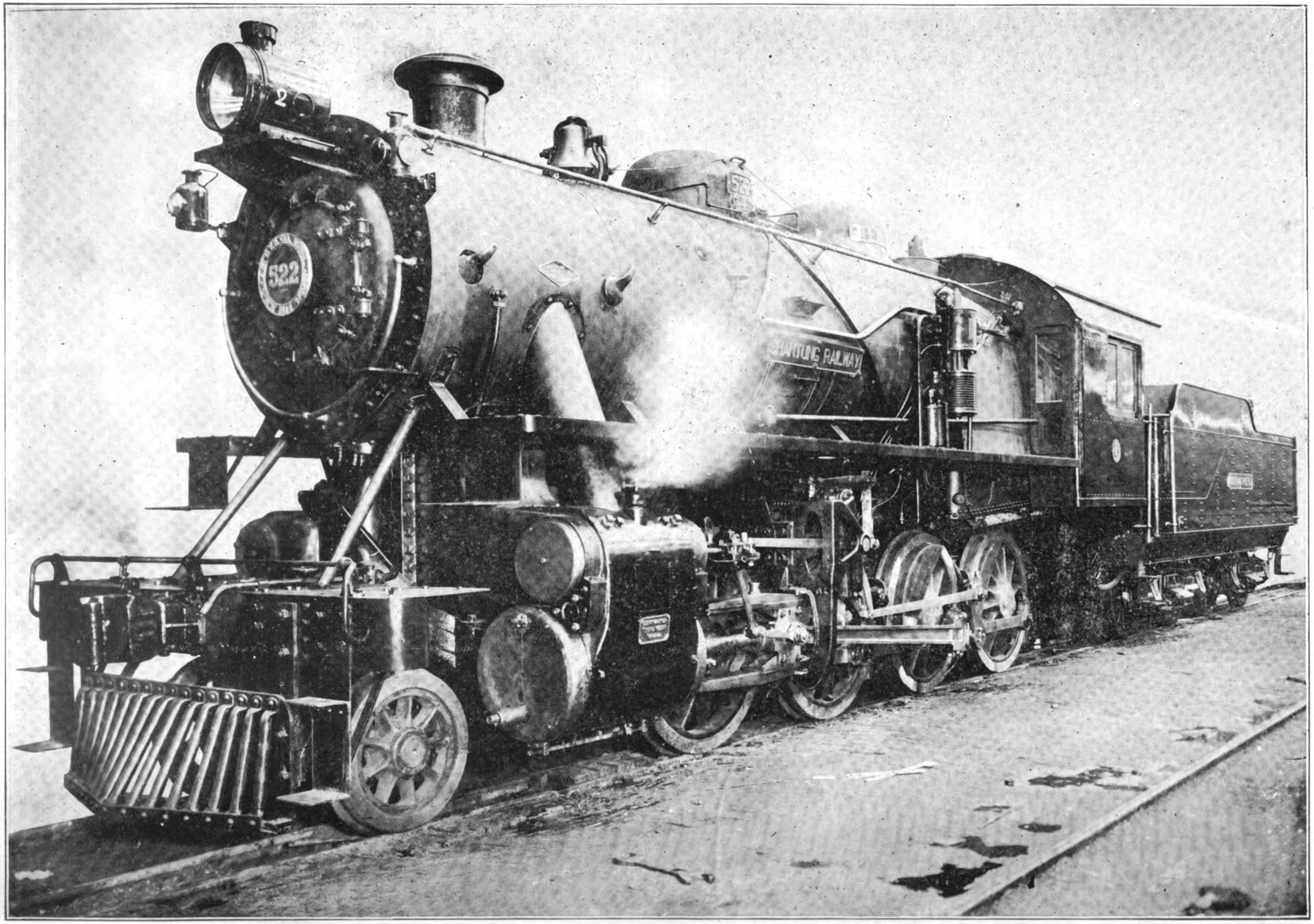



Locomotive for the Imperial Japanese Railways built at the Kasado Shops of the Hidachi Engineering Works

# JAPANESE-BUILT LOCOMOTIVES FOR A CHINESE RAILWAY

**Type of Four Consolidation Freight Locomotives for the Shantung Railway, built at the Hyogo Works of the Kawasaki Dockyard Company, Ltd.**

Gauge, 4-ft. 8½-in.; Cylinder, 21-in. by 26-in.; Driving wheel diameter, 54-in.; Boiler pressure, 180-lbs. per sq. in.; Grate area, 40.8 sq. ft.; Heating surface, 1 907 sq. ft.; Superheating surface, 436 sq. ft.; Wheel base, engine, 23-ft. 8-in.; Engine and tender, 53-ft. 8¼-in.; Weight in working order, engine, 159,500-lbs., tender, 104,700-lbs.; Maximum tractive force, 32,500-lbs.; Tender capacity, water, 5,000 gallons; Fuel, 8 tons.



# Short Sketches of Japan's Machine Makers

## The Ikegai Iron Works

THE Ikagai Iron Works, makers of machine tools, cutters, gauges, Diesel engines, oil motors, and gasoline engines, stands in the front rank of Japan's great machinery makers. Its products have an international reputation being exported all over the Far East, Russia, and other parts of Asia.

The works are the outgrowth of an enterprise established in August 1890, under the direction of Mr. Shotaro Ikegai, president of the company, which to-day bears his name. The present factory was built in April 1901, since when there have been contant improvements and changes in the equipment, until it is now one of the best equipped modern establishments in Eastern Asia. The present company was organized in April 1913, with a capital of Y.500,000, but so successful was the company's operations during the years of the war that the capital was increased to Y.1,000,000 in June 1915, and in April 1920, to its present figure, Y.6,000,000. In order to meet the war demands, a new factory was built in Tokyo city, in 1916, for the exclusive manufacture of internal combustion engines, and so marked had been its success that " Ikegai " is accepted by exacting engineers in Japan as a guaranty of good workmanship and high efficiency ; a splendid reputation.

The annual production of the company's factories is valued at something like Y.2,500,000 for high-class machine tools, and Y.2,000,000 for internal combustion engines.

During the European war the works were crowded with orders for the Japanese army and navy, and in fact, about 90 per cent. of the present production is absorbed by the military departments, leaving little for export. However, considerable sales were made to Russia, England and Mexico ; the Russian government alone ordering 580 gasoline engines. The " Ikegai " Diesel engines are used on practically all the fishing boats in northern Japanese waters ; 90 per cent. of the fishing vessels of the country are equipped with Ikegai engines, and 10 per cent. with those of foreign make.

The following equipment of the factories is the most modern of its kind :—

| *Machine Description* | *Number* |
|---|---|
| Lathes, 6′ wide, 40′ long | 171 |
| Planers, less than 6′ wide, 25′ long | 14 |
| Slotting machines, largest bore, 10″ | 5 |
| Shaping machines, largest bore, 20″ | 21 |
| Drills, largest diameter, upright 30″, radius 6′ | 36 |
| Borers, largest spindle, diameter 4″ | 19 |
| Milling machines, largest plant No. 4, vertical No. 3 | 40 |
| Gear cutters, largest 77″ | 10 |
| Grinders, largest diameter, 20″, 14′ long | 45 |
| Screw machines | 14 |
| Casting machines | 1 |
| Other machinery | 73 units |
| Electric motors, total H.P. 650 each | 48 |

The Ikegai engineering staff numbering 160 is noted throughout Japan for initiative in designing, inventing and obtaining new patents, which total 21 for machine tools, 17 for internal combustion engines, and two for new methods of making internal combustion engines, in all forty patents holding the record for efficiency in Japan. The number of officers and employees of the company is 650.

The head office of the company is located at No. 2, Mita Shikoku-machi, Shiba Ku, Tokyo. Its capital is Y.6,000,000, of which Y.3,400,000 is paid up. The officers are: President: Shotaro Ikegai ; Vice-President : T. Chiba ; Directors : K. Ikegai, J. Chiba and S. Ikegai ; Auditors : S. Imai, M. Chiba, N. Chiba and K. Chiba.

## Niigata Iron Works.

The Niigata Iron Works were originally started as a subsidiary of the Japan Oil Company to build well drilling machines and supplies to be used in the oil fields of Niigata. They were enlarged time after time, until in 1910 they reached a point where it was considered best to operate them, as an independent concern, with a capital of Y.2,000,000. In 1918, the head office was removed to Tokyo, and the capital increased to Y5,000,000.

In November, 1918, the company purchased the manufacturing rights to the Diesel engine patents of Mirrlees, Bickerton & Day, Ltd. of England, and a new factory was built at Kamata near Tokyo for their manufacture. This factory is 1,755 *tsubo* in area, its machine tool works occupies 243 *tsubo*, the casting room 1,075 *tsubo*, and the woodworking room 80 *tsubo*. There are 95 electric motors in use in the mill, with a total capacity of 1,029 h.p., and some 280 machinery units, besides 12 electric cranes, and four pig iron reduction furnaces. These works were designed to be the most up-to-date, and efficient mill in Japan, but owing to the industrial depression it has never had an opportunity to show its efficiency by running at production capacity. As a matter of fact, the depression has been particularly hard on the Niigata Iron Works, because many advance orders for Diesel engines received in 1918 and 1919, were cancelled at the beginning of the slump, and the huge factory at Kamata has been lying almost idle for more than three years. In recent months there has been a gradual increase in the number of orders received, and the Niigata Diesel engines are beginning to make their appearance in larger numbers on the domestic market. Competition is severe with the older established Ikegai Tekkojo, but the Niigata directors believe that given half an opportunity they can meet all competition, as despite the difficulties in getting its factory into operation, it has one of the most efficient staffs in Japan.

The head office of the company is at No. 3, 1 Chome, Yurakucho, Kajimachi Ku, Tokyo. The officers are: President: Kyukan Naito ; Managing Director: K. Sasamura; Directors: S. Honma, S. Kagitomi and S. Yamaguchi ; Auditors : H. Kusumi, C. Nakano and K. Saito; Technical Adviser: R. Onuki ; Chief Engineer of Tokyo and Kamata Mills : G. Moto ; Acting Chief of Niigata Mill : H. Suzuki ; Staff : including engineers, officers, etc., 170 ; Workmen : 2,000.

The mills belonging to the Niigata Tekkojo are :—

Tokyo : Tsukishima, manufacturing exclusively machine tools. Area, 2,300 *tsubo*.

Kamata : Kamata Mura, Tokyo Prefecture ; internal combustion engines exclusively. Area, 30,000 *tsubo*.

Niigata : Irifune Cho, Niigata City ; Shipbuilding. Area, 22,000 *tsubo*.

Niigata : Yamanoshita, Niigata City ; Oil well machinery and supplies ; 21,000 *tsubo*.

Nagaoka : Nishi Kanda, Nagaoka City ; 800 *tsubo*.

Kashiwazaki Branch Works : Kashiwazaki-machi, Niigata City, 1,000 *tsubo*.

Tsuchizaki Branch Factory : Port Tsuchizaki, Akita Prefecture, 1,600 *tsubo*.

## Osaka Iron Works

In 1881, Mr. Ryutaro Hanto established the Osaka Iron Works, as a private concern, and was operated as such until April 1914, when it was re-organized as a joint stock company. In June, 1919, it purchased the entire business and equipment of the Bingo Dockyard Co., operating it as a part of its Innoshima Works. In December, 1920, it acquired the Harada Shipbuilding Company's Harbor Construction Works, and established it as an independent factory. The shipbuilding capacity of the Osaka Iron Works by this purchase was increased to over 200,000 tons a year.

Experience of more than 40 years in construction has perfected the technical ability of this company, and together with it up-to-date machine equipment has made it one of the most important shipbuilding concerns in all Japan. In the construction of fishing vessels, light draught steamers, cargo vessels and dredges, this company is recognized as among the best in the country.

The Osaka Iron Works has also built warships, destroyers, cruisers, steamships, dredgers, deap sea fishing vessels, light draught steamers, railway cars, locomotives, electric machinery, land and marine steam engines and boilers. It engages in the repair of

vessels, machinery, makes cast iron tubes, bridge materials, and operates a salvage department as well.

The principal works are located at;

Sakurajima Factory: Sakurajima, Nishi ku, Osaka. Chief of Works: M. Fuse.

Harbor Construction Works: Nishi Irifune Cho, Osaka. Chief of Works: K. Hattori.

Innoshima Works: Tsuchiu Machi, Mishirabe Gun, Hiroshima Prefecture. Chief of Works: K. Sasaka.

The Sakurajima Factory and the Harbor Construction Works have two docks and seven slips, besides all necessary workshops. Both factories are engaged in the manufacture of steam engines and boilers, and other types of machinery, as well as in ship construction and repairs. Their equipment is complete, both for shipbuilding and machine making.

The Innoshima Works almost ideal, are used exclusively for the repair of ships. However, since the works were purchased by the Osaka Tekkojo, five new slips have been built, and the works operated for the construction of ships. This factory has a branch at Sannosho.

The Sakurajima Works have a total area of 79,000 *tsubo*, with buildings occupying 15,760 *tsubo*. The Harbor Construction Works occupy 2,670 *tsubo*, while the Innoshima Works, covers 110,860 *tsubo*, with buildings occupying 20,604 *tsubo*. The number of workmen in the shipbuilding department is 3,000, and in the machinery department, 2,500.

The head office is located at No. 2, 2 chome, Hamadori, Dojima, Kita Ku, Osaka City. The stock company organized in March, 1914, is capitalized at Y.12,000,000, of which Y.10,500,000 is paid up. It has reserves of Y.13,355,000. Its officers are: President: Juntaro Yamamoto; Managing Directors: K. Shimomura and H. Taumura; Director and Chief Engineer: Y. Emura; Directors: H. Muraki; Auditors: H. Nishimura and R. Hara.

## Wakayama Iron Works

The Wakayama Tekkojo (Ltd.) specializes in the manufacture of machine tools. Originally founded as a private concern by Mr. Takisaburo Wakayama in April, 1899, it was re-organized as a joint stock company in June, 1920, with a capital of Y.2,000,000, of which Y.1,000,000 is paid up. Its principal manufactures are: lathes, planes, shapers, slotting machines, radial drills, borers, milling machines, high-class machine tools, and castings.

The engineers of the company have all been trained abroad, and many promising employees have been sent to America and Europe to perfect their knowledge of the company's manufacturing needs. The Japanese government, army, navy and railway departments and the Yawata Iron Works are its best customers. The works has has been awarded many first prizes at various great exhibitions for the excellence of its machines.

The machine manufacturing department is equipped with: Lathes, 6 to 30 feet; planers, 4 to 25 feet; shapers, from 16 to 32 inches; radial drills, from 3 to 7 feet; milling from No. 1 to No. 3 by 3½; boring grinders, gear hoppers, gear cutters, gear shapers, slotters, millers, etc. In all, 126 units.

In addition, there is one 10-ton traveling electric crane.

The casting room is equipped with one furnace each of 2, 3 and 5 tons, one 10 inch blower, a 10-ton traveling electric crane, two hand operated 3-ton cranes, two drying furnaces, two sandblasts, and two moulding mills.

The gorging workshop has one-quarter ton hammer, two forge furnaces of 4 and 8 feet, and a blower with a diameter of 6 inches.

The mill regulating quality is equipped with two carbonite furnaces, one red bath furnace, three oil bath furnaces, one compressor, etc.

The moulding workshop contains, two 24-inch woodplaners, one 15-inch hand feed planer, one 36-inch hand saw, one 24-inch circular saw, one Benjamin cross cut saw 24 feet; and two 6 feet wood lathes. The transformer stationis equipped with three 50 kilowatt transformers.

The normal annual production is valued at Y.1,800,000, but working at full capacity the mills can produce machines valued Y.3,000,000.

The head office of the Wakayama Tekkojo is located at Minami Ongashima Cho, Nishi Ku, Osaka City. The Representative of the Company is Takisaburo Wakayama; chief engineers: K. Matsubo, B. Matsumoto, G. Hoshino and K. Tsuji.

## Kisha Seizo K.K.

The founder of the Japanese railway system, the late Count K. Inouye, established the Kisho Seizo K.K., with the aid of leading business men and officials in 1896, and until the time of his death in London in 1910, retained the position of president of the company.

The principal factory of the company is in Osaka where there is better facility for transportation by land and sea than in any other city in Japan. In July, 1901, the company took over the Hiraoka Mill at Kinshicho, Hongo-ku, Tokyo city, and established it as its Tokyo branch factory. Ever since, in both mills, there has been continuous extensions and improvements of equipment going on.

The principal products of this company are locomotives, passenger, freight and electric cars, bridge materials, brakes, and all kinds of railway supplies. Half of the locomotives in use in Japan have been manufactured by this company. The locomotives for the special express train, type 4-6-2, in use since 1921, were manufactured entirely by the Kisha Seizo K.K. Since the summer of 1922, the company has been busy with orders for locomotive received from the Shantung and Chosen Railways, showing that its products are of the highest efficiency and quality.

In 1915, the manufacture of machine tools was commenced and despite the short time which has elapsed, their specialties have found great favor and merit, because of excellent workmanship and finish. The vertical milling machine exhibited at the machine tool exhibition at Osaka, under the auspices of the imperial department of agriculture and commerce, obtained the first prize for excellence of design and performance.

The "Takuma" type water-tube boiler manufactured by this company and patented in Japan, United States and Great Britain, is recognized by all engineers as particularly effective in fuel economy, ease of transportation, low price, and efficiency.

The company's factories have a capacity of:—

| | |
|---|---|
| Large type locomotives, annual production ... ... | 150 |
| Light locomotives ... ... ... ... ... ... ... | 60 |
| Passenger cars ... ... ... ... ... ... ... | 150 |
| Freight cars ... ... ... ... ... ... ... | 15,000 |
| Electric cars ... ... ... ... ... ... ... | 100 |
| Steel bridge girders, and beams ... ... ... ... | 18,000 tons |
| Machine tools ... ... ... ... ... ... ... | 250 units |
| Takuma boilers ... ... ... ... ... ... ... | 10,000 h.p. |
| Railway points ... ... ... ... ... ... ... | 1,000 sets |

The main factory at Osaka covers 36, 162 *tsubo*, the Kinshicho mill 8,039 *tsubo*; the Fukagawa (Tokyo) branch mill, 4,412 *tsubo*, and the Sunamachi Mill (Osaka) 68,440 *tsubo*; the Kawasaki Branch Workshop 329 *tsubo*.

Its head office is located at Shimaya Machi, Nishi Ku, Osaka. The company is capitalized at Y.6,000,000, all paid up. The officers are: Directors: Seigo Hasegawa, (Dr. Eng.), S. Imamura, H. Kuzuno, Baron Kishichiro Okura and T. Tanabe; Auditors: M. Shibusawa and Y. Aoki.

## Arakawa Seisaku Jo

The Arakawa Works, formerly called the Yanagishima Seisaku Jo, were established by Takata Shokai in 1907. In 1918 it was organized as the Kabushiki Kaisha Arakawa Seisaku Jo, taking over the Yanagishima works, and when the factory on the banks of the Ara River, near Tokyo, was completed, the removal was made.

This company is especially well known for its centrifugal and spiral pumps, water turbines, turbo-blowers, and fans of all kinds, cranes, boilers, mining, and chemical machinery and railway materials. The most recent feature of this company's manufacture is a coal handling and conveyor apparatus.

The factory consists of a forge room of 93 *tsubo*, boiler works of 368 *tsubo*, machinery and finishing works of 429 *tsubo*, casting room of 306 *tsubo*, wood working room of 100 *tsubo*, and warehouse of 195 *tsubo*.

The machinery equipment is as follows: Electric motors, with capacity of less than 60 h.p. each, 18. Electric power is supplied by the Rokyo Dento K.K., 300 k.w. The woodworking room is equipped with a 16-ft. by 6-in. woodplaner, a 16-in. band saw, circular saw, wood lathe, etc.

The casting room contains a 1½, 2 and 4-ton cupola crucible furnace for gun metal, sand drying room, and a 30-inch turbo blower, cranes, etc.

This company has also a can-making department equipped with shearing and punching machines, pneumatic riveter, plate bending

roller, and a 7½ h.p. blower. The finishing works are equipped with lathes, surface lathes, horizontal boring machines, etc., numbering 71 in all. There are about 500 workmen employed all the year round.

The Arakawa Seisaku Jo's factory is located at 3360 Okumachi, Kita Toyoshima Gun, Tokyo Prefecture, and its office is at No. 1, 3 chome, Yuraku Cho, Kojimachi Ku, Tokyo, care Takata Shokai. It is capitalized at Y.1,000,000, all paid up. The officers of the company are: President: Kamakichi Takata; Directors: S. Iwasaki, Y. Ikeda and R. Takata; Auditors: K. Matsuda and S. Matsumoto.

### Karatsu Iron Works

Originally a department of the Takeuchi Mining Co., in 1909, the Karatsu Tekkojo was established as an independent corporation, with a capital of Y.2,000,000, of which Y.500,000 is paid up.

This company engages principally in the manufacture of machine tools, precision instruments and parts thereof, as well as electric motors. The president, Mr. Toshisuke Takeo, a well-known mechanical engineer, has established a reputation in Japan for the excellence and severe testing of the company's specialties before being placed on the market. The chief merit of this company's machinery is its accuracy.

The works occupy a site of 6,800 *tsubo*, of which 1,900 *tsubo* is covered with 24 buildings. The works are equipped with lathes, planers, boring mills, boring machines, grinders, cupolas, drills, shapers, milling machines, gear cutters, slotters, pneumatic hammers, cranes, pumps, air compressors, shears, rolling machines, presses, punching machines, engines, dynamos, moulds, etc., to the number of 180. There are 400 workmen employed.

The total annual production of the factory is valued at Y.1,000,000, but annual sales have reached Y.1,150,000. The navy and military arsenals, shipbuilding companies, and arms manufacturers are its principal customers.

The selling branches are:

(1) Karatsu Tekkojo, Business Office, 7th Floor, Marunouchi Building, Tokyo.

(2) Osaka Branch, Takeuchi Mining Co., No. 3, 2 chome, Minami dori, Edobori, Nishi Ku, Osaka City.

The Officers of the Karatsu Tekkojo are: President and Engineer-in-Chief: T. Takeo; Directors: J. Kondo and H. Matsumura.

### The Oi and Hamamatsu Shops of the Imperial Railway Department

The Oi Shop of the Imperial Government Railways is mainly engaged in repairing passenger and freight cars, and electric cars. The Hamamatsu Shop is operated exclusively for the repair of locomotives.

The Oi Shop, in addition to repair work, constructs sleeping, dining and observation cars, at the rate of one or two carriages a month. Besides, it repairs petty supplies required by stations and on the lines of the railroad. The number of carriages repaired during the year ended March 31, 1923, was 1,236 passenger cars, 6,427 freight cars, and 831 electric cars. The average number of carriages in the shop per day was 23 passenger cars, 18 electric cars, and 57 freight cars.

The reconstruction and repair of locomotives is the chief business of the Hamamatsu Shop. In addition, some miscellaneous repairing is often undertaken. The number of locomotives under the supervision of this shop is more than 600, all included in the district around Tokyo, Iidamachi, Hamamatsu, Nagoya, Maibara, Tsuruga, Fukui, Kanazawa, Nakatsugawa. The number of locomotives repaired during the year ended March 31, 1923, was 509, the daily average in the shop amounting to 11.

The Oi Shop has an area of 88,000 *tsubo*, with 12,000 *tsubo* covered with buildings, and six miles of switch lines within the yards. The number of machines installed is 550, operated by electricity, steam and compressed air. The works receive current from the Yanokuchi Power Plant, belonging to the railway department, at a pressure of 11,000 volts, 50 cycles, three-phase alternating current, stepped down to 3,300 volts by three 150 kva. transformers, at the works, and is again transformed into direct current of 500 volts by a 250 k.w. generator, from which the power is distributed over the shops. Most of the machinery is operated at this voltage, but a recent addition is operated by a 200 volt three-phase alternating current. When the voltage used on the government railway suburban lines around the city of Tokyo is changed, the greater part of the machinery in this workshop will be operated by this current. Preparations are now being made to enable this change to be made in the least possible time. The amount of electric power now consumed each month is 55,000 kilowatts.

Steam power by five Cornish boilers, and one Takuma type water-tube boiler, operates six steam hammers and one or two other special machine in the tempering works and supplies steam for heating the shops. The boilers are fitted with apparatus for burning coal dust.

The casting mill is equipped with one 1-ton and one 3-ton furnace, which turn out something like 136 tons of pig iron a month. At the same time, three furnaces turn out 6½ tons of gun metal castings a month.

### Hamamatsu

The Hamamatsu Shop has an area of 68,000 *tsubo*, of which 6,600 *tsubo* is covered with buildings. The switching track is 4 miles, 66 chains long, and there are 470 machinery units installed. The plant is operate like the Oi Shop, by electricity, steam and compressed air. The monthly consumption of electric power is 158,000 kilowatts.

Steam produced by two Babcock and Wilcox boilers, is used chiefly in operating the machinery in the smithy. Among these there are seven steam hammers. Compressed air is produced by a 250 h.p. electric driven air compressor, at a pressure of 100-lb. per sq. inch. Hydraulic power is used almost exclusivelyfor the riveters.

The setting up room, together with the lathe room are built in one reinforced concrete building, equipped with two 40 tons lifting cranes, one 20 tons, one 10 tons, one 15 tons, and two 5 tons cranes. The casting mill has two furnaces, with capacities of 2 and 5 tons, with an average monthly production of 133 tons. Three brass furnaces turn out approximately 24 tons of gun-metal castings a month.

There are 1,400 employees at the Oi Works, and 1,200 at the Hamamatsu works, exclusive of 200 members of the office staff at Oi.

## Praise for Japanese Engineers

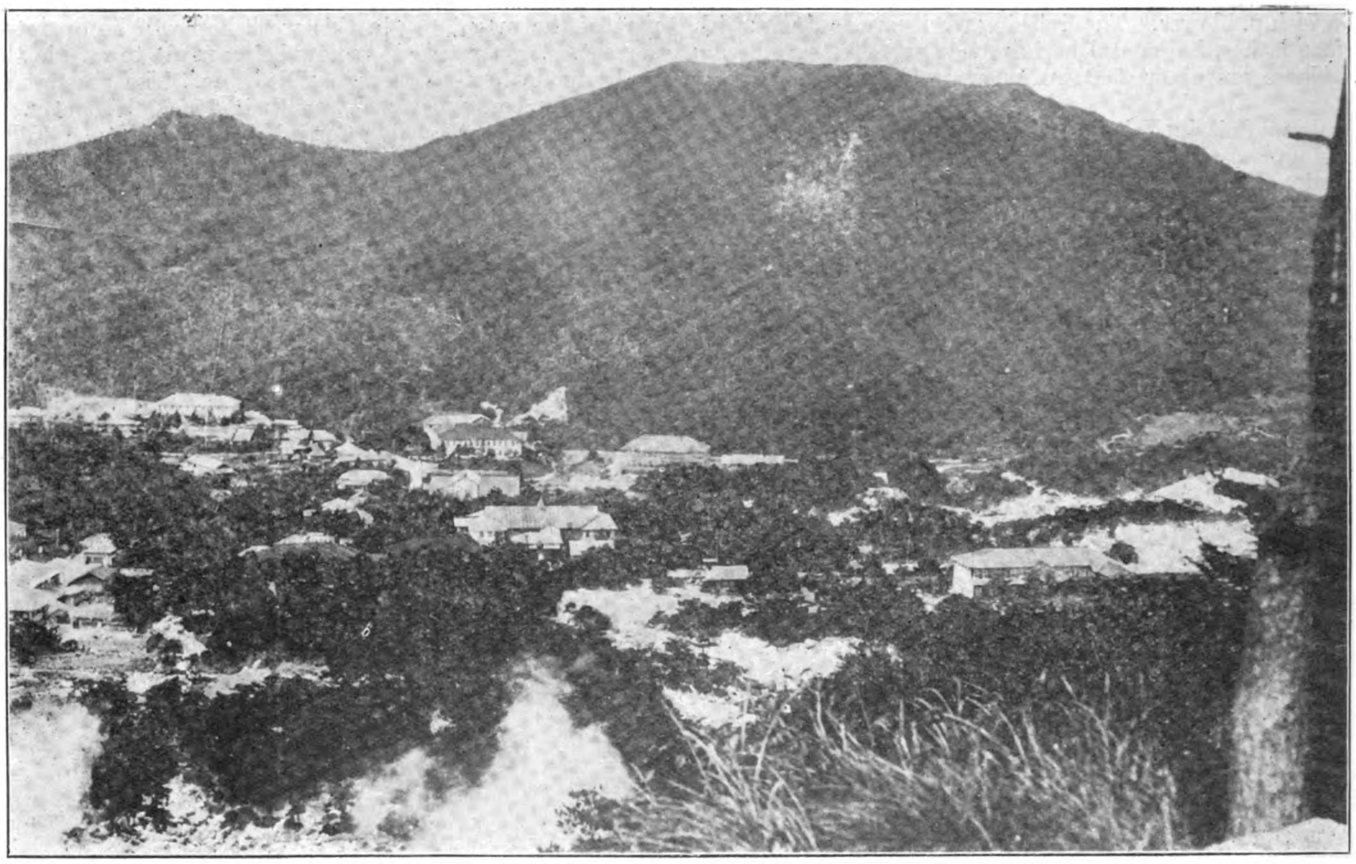
Elmer A. Sperry, head of the Sperry Gyroscope Company, who recently made an extensive trip in Japan, as the spokesman of American engineers, declared in an address on his return to Brooklyn, that the report that the Japanese had a feeling of unfriendliness and antagonism toward the United States was nothing but propaganda. He said friendship and goodwill were the dominating features in Japan's relations to the United States.

"The Japanese engineers, particularly," said Mr. Sperry, "have placed American engineers on a pedestal and they were overcome by the warm tribute from America's engineers which I carried to them. Japan is not a mation of copyists. The Japanese think for themselves, and think quicker than we do. It is said they come here for their ideas and carry them away for use in their own land. Since I have visited them I have realized that for every idea they adopt from us they reject 100."

Mr. Sperry characterized the Japanese as earnest workers possessing quicker mental reactions than the Anglo-Saxons. He declared that Japan's curve of advancement is twice as great as ours.

"Japan is not a land of paper houses as it is sometimes pictured," said Mr. Sperry. "Its buildings are huge stone structures which will stand for thousands of years, provided, of course, earthquakes do not obliterate them. Japan surprised me. I found it literally a mass of mountains with only one-eighth of the land tillable. I can't understand how a race ever grew there, and yet their minds work marvels. Their methods of construction are the latest and in some cases more advanced than ours. Their big shipyard is five times the size of any of our yards over here. They are the biggest gun manufacturing people in the world. Over here we engineers take pride in the fact that Brooklyn Navy Yard has the largest horizontal boring mill in the country, but the Japanese have one which is the largest in the world.

"The Japanese engineers were overcome when I bore to them the tribute from American engineers. They did not realize we knew they existed. It is already arranged for American and Japanese engineers to come into a closer relationship and understanding and the combination will accomplish great things."



General View of Unzen

# UNZEN

## The Summer Playground of The Far East

WITH the coming of summer, foreign residents in the Far East are looking for a place to enjoy their well-earned vacations. Tsingtau, an old favorite watering place, is considered by many as too unsafe at the present time ; Peitaiho in the Chihli-Fengtien war-zone, was recently raided by unpaid soldiery ; Kuling and other interior resorts will have to be guarded, so it can be fairly said that foreigners are not so keen this year to spend their vacations in places where they may be exposed to the fury of the bandit pest which makes life and travel unsafe outside the most important treaty ports. Repulse Bay in Hongkong is favored by many because of the security offered, in addition to the most charming surroundings and opportunity for excursions. But this resort has its limitations ; it cannot cater to the vast number who will seek relaxation and recreation during the summer that is now upon us. There remains Dairen and Port Arthur with their splenadid beaches and accommodations, or the Diamond Mountains in Korea, but again the capacity of these resorts is limited and to obtain rest with security the foreigner must turn to Japan.

Amongst the many admirable health restors and playgrounds in this charming empire, the nearest and most convenient to the China coast is located at Unzen, not far from Nagasaki. To meet the demand for rapid transportation the N. Y. K. is now operating two up-to-date express steamers (the *Nagasaki Maru* and *Shanghai Maru*) which makes the trip between Shanghai and Nagasaki in 28 hours. Unzen, only a day and half distant from Shanghai by these luxurious steamers, is each year becoming more and more a favorite place for the health seeker and to popularize and bring its advantages forcibly before the Shanghai public the N. Y. K. recently invited the newspapermen and their wives of this port to visit the resort.

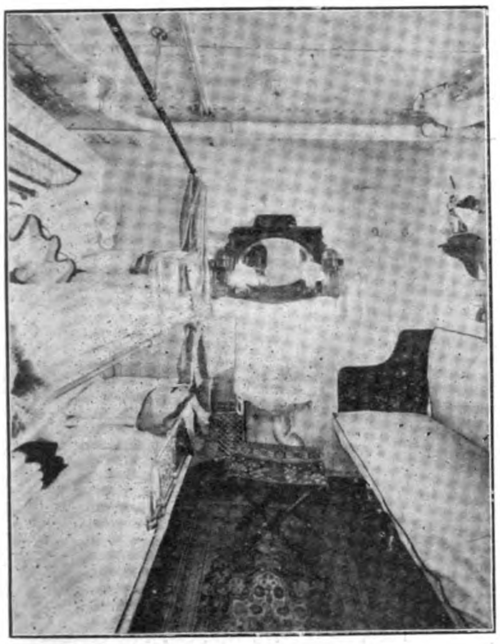
### Unzen

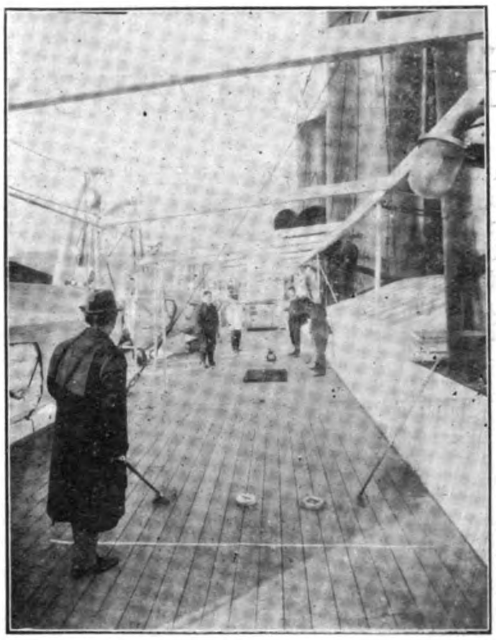
In the middle of the Shimabara peninsula, which lies about twenty miles to the east of Nagasaki, rises a range of mountains called Unzen-dake. This range consists of several peaks, known as Fugen, Kunimi, Myōken, Yatake, Nodake, and Takaiwa, the

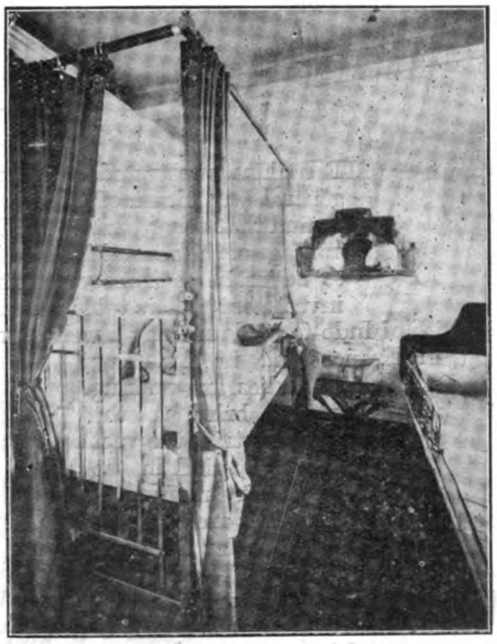
Golf Course

Tennis Court

One of the Solfataras


First Class Two Berth Cabin


Boat Deck


First Class One Berth Cabin

first mentioned being the highest and standing 4,461-ft. above sea-level.

Amidst these peaks lies a horse-shoe-shaped plateau on which a golf course has been laid out. There are nine holes and the length of the course is 2,604 yards. Grass-covered and sprinkled with azaleas bushes, the links are very attractive, especially in May when flowers of many varieties are in bloom.

Unzen park is situated on a plateau in the centre of the range and is 2,400-ft. above the sea-level. It contains numerous solfataras and fumaroles from which issue steam and gases, in some cases to a considerable height. They are known locally as *jigoku* (hells) and some are the fine spectacles. There are seven hotels in the park.

Unzen is an ideal summer resort. The air is pure and refreshing and every place on which the eye rests is green. About half-a-mile below the plateau is another group of fumaroles, called *kojigoku* (small hell), in which hot water bubbles.

About 6⅜ miles lower down stands Obama, a village on the seacoast noted for its saline hot springs. Here are several inns and one hotel.

To reach Unzen from Nagasaki two routes may be taken, one involving a sea journey, and the other going overland. Choosing the latter, the journey is made by rail from Nagasaki to Aino, changing cars at Isahaya.

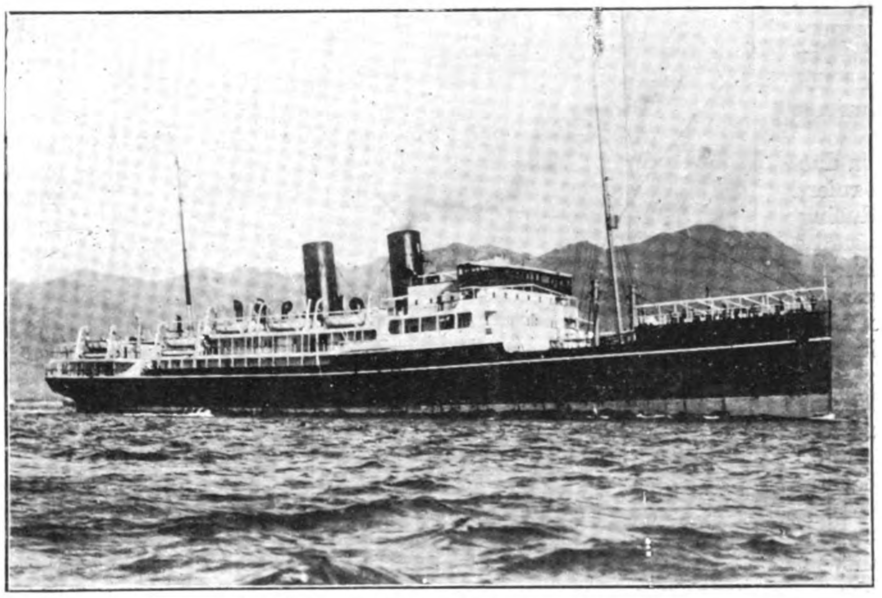
From Aino, motor 'bus is taken to Chijiwa, via the Chijiwa slope, and then on to Obama, via Koba which is a junction to Unzen, and via Tomitsuzaka, giving a beautiful coast scenery.

Chijiwa is situated about four miles from Aino, and about 8½ miles from Unzen. An attraction of Chijiwa is its sea-bathing which can be enjoyed on a fine sandy beach sheltered by a beautiful ridge of pine trees. The road from this village to Unzen lies along the beautiful valley of the river Chijiwa which has its source at Unzen, turning off from the high road at Koba is now opened.

The ascent by this route can be made by motor cars, and is about 3½ miles shorter by overland than by the Obama route.

To reach Unzen by sea, ricsha or motor 'bus

(*Continued on page 397*)


N.Y.K. Expres Steamer "Nagasaki Maru"

Smoking Room

Social Hall

Dining Saloon

# Siam Advancing

WITH China prostrated by reason of civil war and a general breakdown of guarantees, it is not surprising to find that other parts of the Far East are taking advantage of the general interest in this part of the world, to advertise their resources and the opportunities for investment unders table conditions. We find the authorities of Indo-China launching a well-defined campaign of education in France and in America; the Dutch East Indies are making strenuous efforts to bring to the attention of other countries the vast possibilities awaiting capital in the development of their many resources; the Philippines are enjoying a revival of interest under the competent rule of General Wood, while Formosa and Korea have embarked upon extensive programs for the betterment of industries and transportation. Siam is forging ahead with a comprehensive scheme for the construction of roads and railways, irrigation systems, forestry, mining and general industrial development and is commanding general admiration for the manner in which these are being pushed to completion. All parts of the Far East other than China enjoy the confidence of the money markets and have succeeded in floating loans for productive purposes, opening vast markets for foreign materials and increasing the general prosperity in the various countries.

The King and Queen of Siam

Much of Siam's progress is due to the intelligent attitude of a ruler, alive to the necessity of introducing foreign capital that will eventually benefit his people. He welcomes serious investigators and encourages legitimate enterprises. Aside from being interested as a ruler in the general welfare of his country, the King of Siam is personally and financially interested in many commercial enterprises for the development of national resources. With the reputation of being one of the most enlightened and benevolent crowned heads of the world, his personality is one of the great assets of Siam. Thoroughly conversant with European politics and several languages, he is specially equipped for the arduous task of leading his people along the highway to national prosperity. He is said to be a good listener and gives careful attention and consideration to all proposals.

The King of Siam is at present considering the investment of a part of his private fortune in the establishment of a Siamese shipping company that will provide the trade of the country the foreign connections now lacking. It appears that considerable dissatisfaction exists with present shipping arrangements under foreign control. The complaints of discrimination and lack of attention on the part of the shipping lines serving Bangkok, convinced the king that much trade was being lost through inadequate ocean transportation, and it is now planned to purchase the necessary tonnage in order to maintain lines deemed essential to the development of the rice trade The proposed new navigation company will at first operate time chartered vessels, and if the venture proves profitable, sufficient tonnage will be bought outright and operated under the Siamese flag.

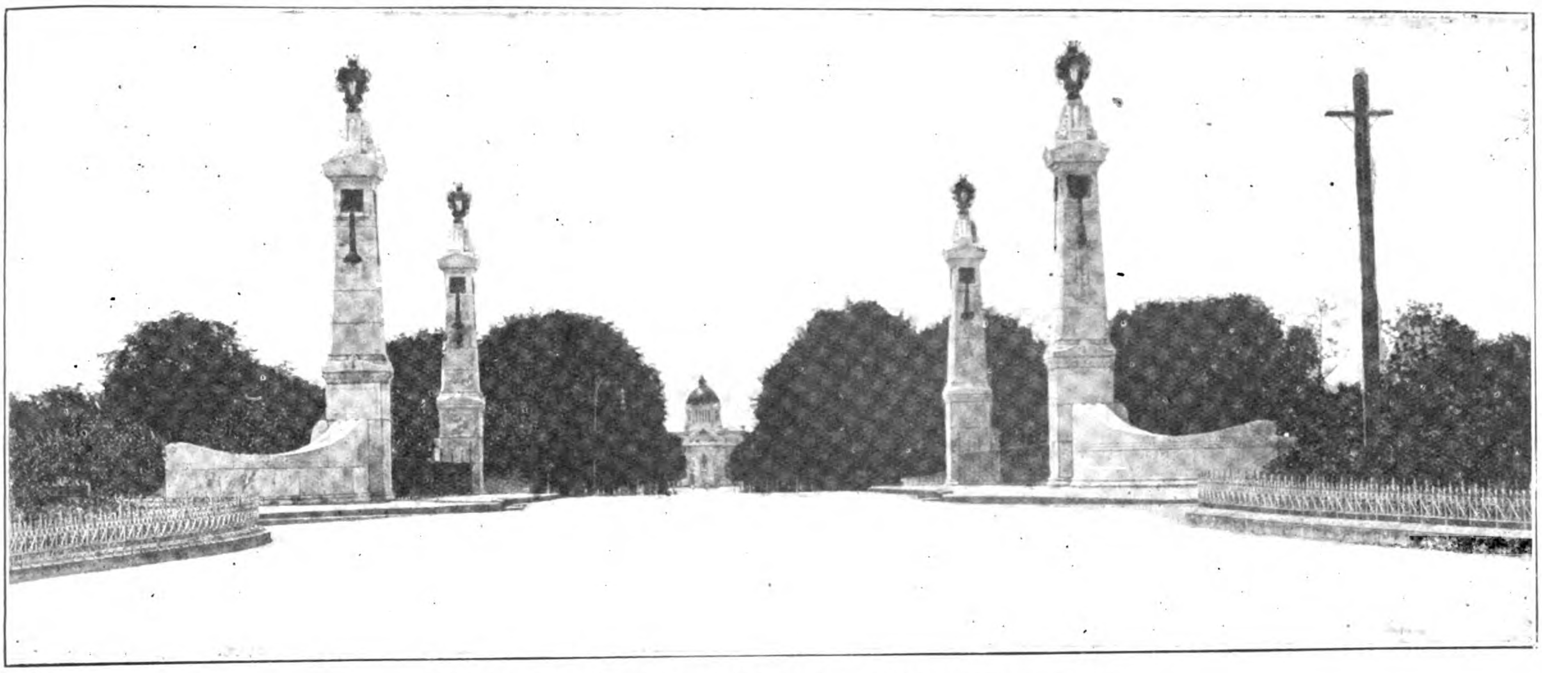
Considerable rice business in Shanghai and North China has been lost to Siam owing to the lack of transport. One of the proposed lines will cover the Chinese ports, while other lines will be operated to the West Indies and Europe. The same difficulty has been experienced by Siam in competing with other rice-producing countries for cargo space, with the result that a large volume of business has been lost in important rice transactions.

The promoters of the shipping company believe that the movement of tonnage in Siam and the volume of imports and exports will fully justify the investment and advance the national interests. The total tonnage entering the port of Bangkok during the Siamese year 2464 (equivalent to the Christian Era, April 1, 1921 to March 31, 1922) was 984,199, or 957 vessels. The rice trade, upon which the country relies largely for its prosperity, showed an export of 21,000,000 piculs or nearly 1,300,000 tons valued at Ticals 138,231,000 or £13,000,000. In addition, Siam exported teak wood to the value of Ticals 7,111,000 and other commodities valued at Ticals 13,601,000.

These figures show that the trade situation in Siam hinges largely upon the rice crop and the ability to market the product in competition with the other great rice-producing countries, Indo-China and Burma. Fortunately, the rice-crop in Siam for the past two years has been excellent, last year bringing a bumper crop. The foreign demand for rice. especially in British India and China, has naturally a great influence on the prosperity of the country, as also the harvests of competing countries. With assured transportation and reasonable freights, the outlook for Siamese exports is considerably brightened. It is to assure this that the king is encouraging through his private purse the establishment of a purely Siamese fleet of ocean carriers.

Siam has been exceptionally fortunate in the matter of finances under the wise rule of the present king and his father, and to-day the government budget just about balances; the revenues for 1920-21 being Ticals 86,105,575 and the expenditures 86,128,899 while for 1921-22 the revenue was estimated at Tsc. 77,800,000 with expenditures at 82,032,582, an estimated deficit of over four millions. The national debt of Siam arises from four loans contracted, respectively, in 1905, 1907, 1909 and 1922, all for productive purposes and mainly for railway construction. The total debt to 1922 amounted to £8,837,840 made up of a balance of £810,220 on the $4\frac{1}{2}$ per cent. sterling loan of £1,000,000 issued in 1905, £2,547,620 of the $4\frac{1}{2}$ per cent. £3,000,000 loan issued in 1907, £4,480,000 of the 4 per cent. loan from the Federated Malay States of £4,750,000 issued in 1909 and £1,000,000 of the 7 per cent. loan of £2,000,000 contracted through the Hongkong and Shanghai Banking Corporation in 1922. The first two loans are being repaid according to the amortization schedule and interest charges on the others are being met. In view of the railways and other public works and assets of the government, the amount is most reasonable and shows Siam to be in a strong financial position.

The average of imports over a period of five years shows Tcs. 123,932,615 and exports of 138,752,300.



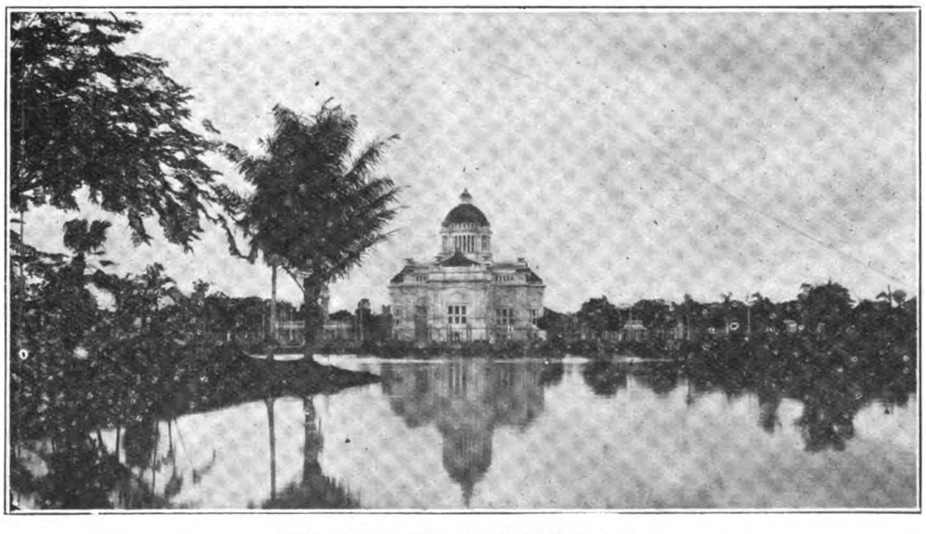
A Modern Bangkok Street : Approach to the Marble Throne Hall

# Siam State Railways

## Report for 1922

ADMINISTRATION:—Commissioner General and Chief Engineer, General H.R.H. Purachatra, the Prince of Kambeang Beja ; Asst. Commissioner General and Chief Mechanical Engineer, H.S.H. Mom Chow Chalart ; Chief of Technical Services, G. Canova ; Chief Engineer of Ways and Works, R. F. Smyth ; Traffic Superintendent, H.E. Phay Prasiddhi Salakara. The total staff and labor of all classes in the department was at the close of the year ending March 1922 for the railways 13,655 of which 10,489 are Siamese and 24 Europeans. The total length of the state lines opened to traffic is 2,370 km. and the length of these lines under construction is 526 km. The total capital outlay is to date Tcs. 131,220,610 with an average capital cost per kilometre of open line of Tcs. 55,367.

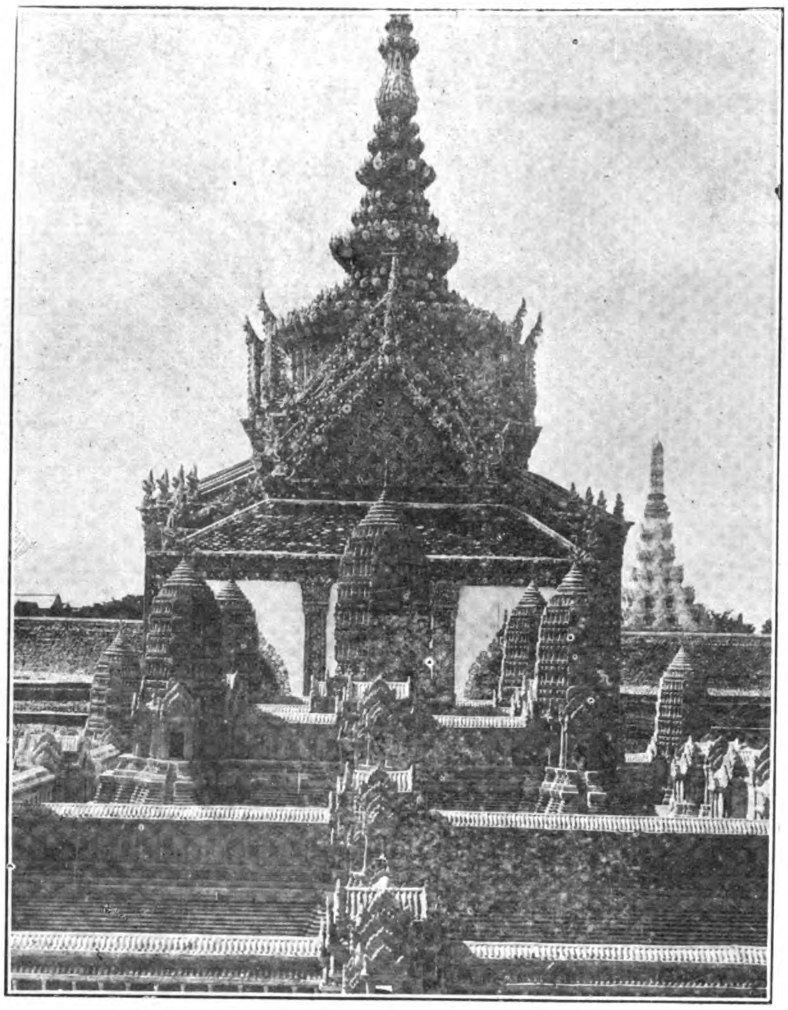
*Korat Line.*—The first line built in Siam is the Korat line 264 km. long which was started in 1892 and opened to traffic at the end of the year 1900. This line runs over the central paddy plain of Siam with a very gradual rise of some 18 metres in all up to Gengkoi 125 kilometres from Bangkok. At this point the rail level is 22.52 m. above M.S. L. and from here the line starts to climb up the watershed at the edge of the well-known Korat plateau. The governing gradient was fixed at 23.6 per cent. and the minimum radius for curves was 200 m. The highest level on this line is 399.31 m. M.S.L. and is at 170 km. and therefore a climb of some 377 m. was accomplished in a distance of 45 kilometres. This part of the line is full of curves winding in and out amongst the mountains. No great difficulty was encountered during construction even in this most difficult section. But owing to the climatic conditions malaria, raging on the district Gengkoi-Lat Bua Kao, accounted for many deaths among the labor as well as the officials. From this point the line is right on the Korat plateau and the gradient slopes gently down towards Korat 189 m. above M.S.L. This line is now being extended 311 kilometres furher to Ubol Rajdhani a town not far from the Mekong River. Twenty kilometres of this new extension Korat-Tachang is now opened to traffic. The third rail on the Bangkok-Korat section has been completely laid and now metre gauge as well as broad gauge trains can run on this line.



The Marble Throne Hall, Bangkok

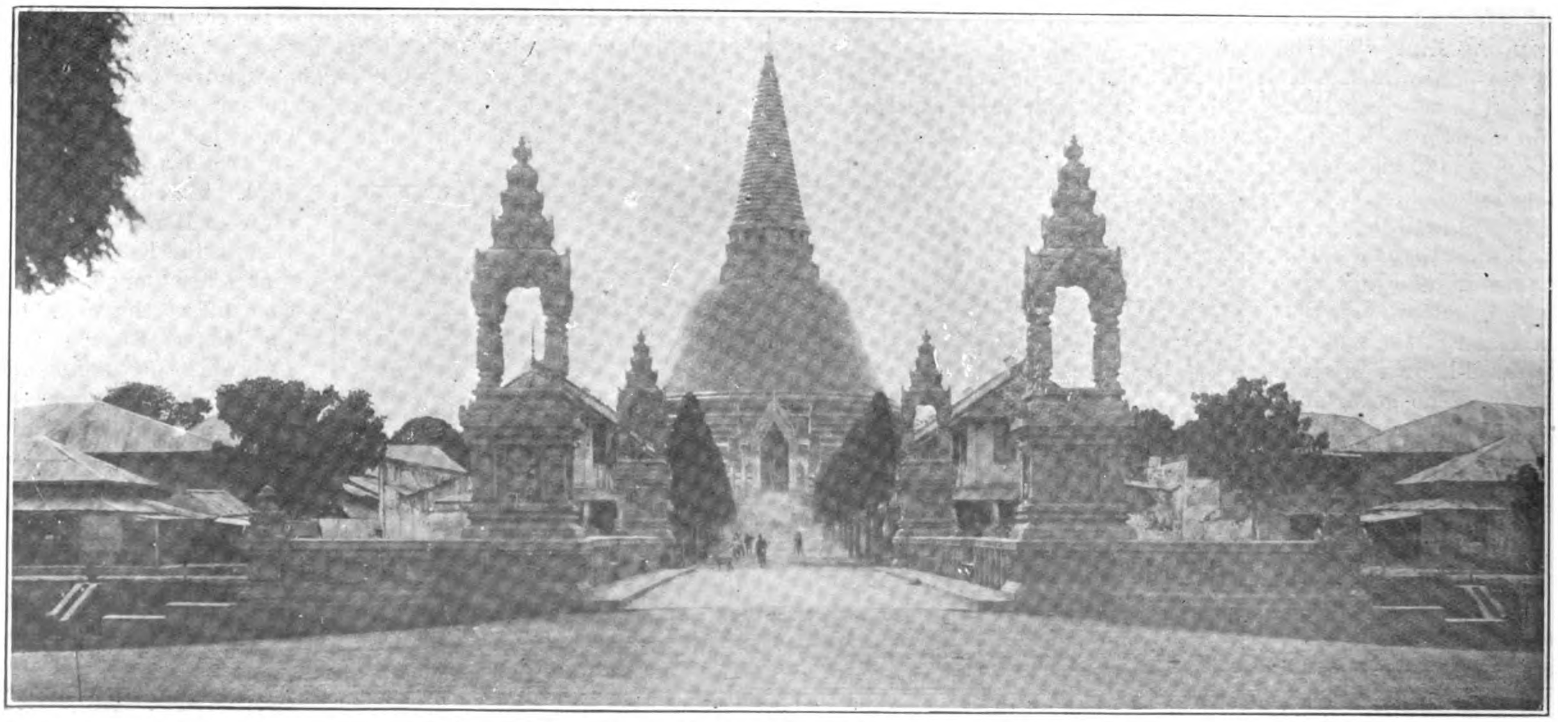
*Northern Line.*—During the year 1897 the construction of the Chiengmai line was taken in hand and as soon as each section from Ban Phaji northwards was ready it was handed over to the traffic. The first section to Lopburi commenced to carry passengers and goods on the 1st of April, 1901 while the whole line was completed on the 1st of January, 1921. This line branches off from Ban Phaji junction on the Korat line 90 km. from Bangkok and runs due north parallel to the Menam River up to Utaradit (394 km.) and thence to Chiengmai a distance of 750 km. from Bangkok. From Ban Phaji to Utaradit the line runs along the central rice-producing plain of Siam passing on its way the important town of Paknampoh, Pichit, Pitsanuloke and Ban Dara junction where another line 29 km. in length

branches off to Sawankaloke. Bangkok is 2 m. and Utaradit 66 m. above M.S.L. It will be seen, therefore, that the line is practically on the level, the grade being slightly up towards the north. No difficulty was encountered in this section during construction. From Utaradit to Den Java 155 m. above M.S.L. and 49 km. distant the grade begins to go up more steeply. Two tunnels had to be cut in the rocks before Den Jaya was reached; one 109 m. long at 422.800 km. and the other 362 m. long at 425.500 km. In this section difficulty in the shape of malaria fever was encountered and progress was very slow at the beginning. The line ran through a thick virgin forest and the engineers and coolies all suffered badly through attacks of fever. However with patience and endurance the work of clearing the forest was got through and the fever trouble overcome. From here the line runs amongst the hilly district of the north and there is a gradual climb up to maximum height of 405 m. above M.S.L. at 526 km. Hence the line slopes gradually down towards the Lampang plain to Lampang 550 km. and 232 m. above M.S.L. From Lampang the gradient is again up towards the north. Up to 594 km. no further difficulties were encountered during construction. The most important work of the whole of the northern lines was reached here, viz., the Khun Tal tunnel 1,354 m. long. This tunnel was completed in the year 1918. Black water and malaria fever raged over the district and at one time the death rate was fairly high. The governing gradient on this line is 25 per cent. and the minimum radius for curve is 180 m. All the curves in this district are compensated. From the northern end of Khun Tal to Ban Ta Champoo a distance of 9 km. the longest and steepest grade on the line exists. Here the line slopes down at 25 per cent. right down to 603 km. At this point the river Meh Tah is crossed by the only reinforced concrete railway bridge in Siam. It is of two spans of 40-in. each. The bridge is of the arch type with suspended floors having expansion joints in the centre of each span, and the line runs over it on an ordinary ballasted track. The bridge was completed at the end of 1921 just in time for the opening of the northern line through to Chiengmai and is one of the outstanding features of this line. This hilly portion, though difficult to construct now, becomes a treat for the traveling public on account of the unsurpassed grandeur of the scenery passed through.



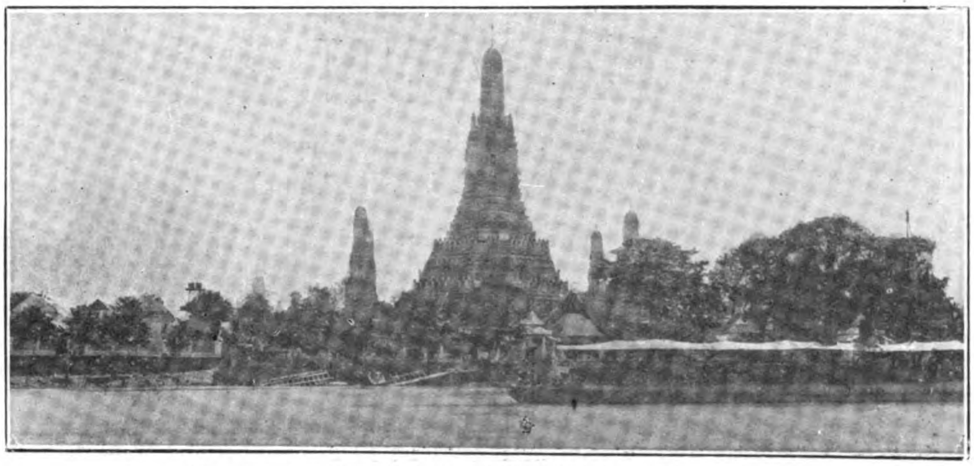
A Building Near the Chapel Royal, Bangkok, with Model of Angkor Wat in the Foreground

*Southern Line.*—Bangkok Noi-Sungei Golok.—At first this line was known as the Petchaburi Line and was of the metre gauge. It runs from Bangkok Noi on the right bank of the river Chao Phya due west passing the famous rice-producing plain of Nakon Chaisri to Ban Pong thence this line turns southwards and terminated at the town of Petchaburi (150 km.) well known for its sugar produce and its canes. The line is practically level the whole way through. The continuation of this line was begun in 1908. From Petchaburi the line is

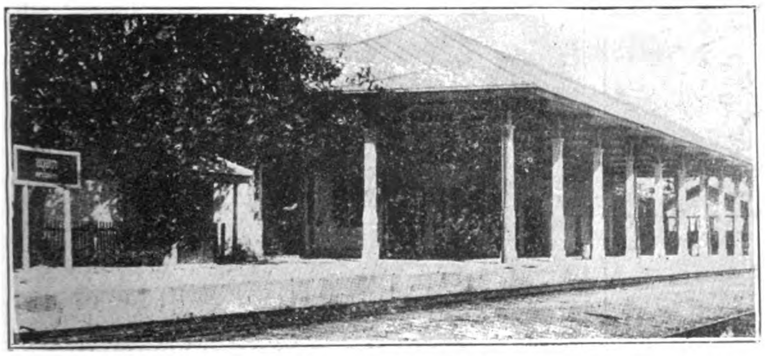


Nakorn Pathom, on the Southern Line of the Siam State Railways

again practically level. It passes Hua Hin the well-known sea-side resort 213 kms. from Bangkok. Twelve kilometres further the line takes a sudden up grade of 9 per cent. to climb a hill and comes down 5 kilometres further at 10 per cent. to its former level and enters Wang Pong, an engine station 233 kilometres from Bangkok. From Wang Pong to Bang Sapan Noi 393 kilometre the line is practically on the level. Between Bang Sapan Noi and Chumphon the end of the day's journey there are a few up and down grades not exceeding 10 per cent.; the highest point reached being about 88 m. above M.S.L. Between Chumphon and Kao Plu 652 kilometres from Bangkok there are no special features to mention and the line is again practically on the level. Between here and Tung Song (757 km.), however, the line passes over undulating country but the gradient never exceeds 10 per cent. At Tung Song there is a branch line 93 kms. long going through a pass of the Tennasserim ranges to Kan Tang, a port on the Bay of Bengal. Shortly after leaving Tung Song the line begins a long climb of 5 kilometres at 7.5 per cent. up the Chong Kao Pass. Immediately after reaching the summit at an elevation of 99 m. above M.S.L. the only tunnel on the southern line is passed. At Kao Chum Tong 781 km. there is another branch line to Nakon Sritamaraj some 36 kilometres away. The main line continues over fairly low-lying lands through to Patalung Haad Yai junction (928 km.). From here two lines branch off. One to Singora and another to the frontier town of Padang Besar where it joins the Federated Malay States Railways to Alor Star and Prai, the station for Penang. This latter line runs through 46 km. of jungles and rubber estates. A rail motor tram service has been organized between Haad Yai and Singorat town. From Haad Yai the main line runs southeastwards through Tanjong Mas to the frontier station of Sungei Golok (1,144 km.) which is a joint station with the F.M.S. Railways which will eventually run through Kuala Lipis to Singapore. The interesting engineering feature to be noticed on the whole of this southern line is the amount of openings provided. A glance at the map will show how the Tennasserim ranges run along the axis of the Malay peninsula and acts as a backbone to the watershed on either side of the peninsula. All the rain water on the east side of the range drain into the Gulf of Siam and there are floods every year. Washouts are not uncomonm on one part or another of this line and more openings are being added year after year The construction of the extension of the line from Petchaburi south, in all 1,195 kms. long, has been carried out with great speed in spite of the unavoidable delays in connection with malarial fever in several districts, especially Bang Sapan, Tung Song and Klong Rum and the through service to Kedah was started in 1918.



Wate Arun a Beautiful Bunddhist Shrine on the Menam



Chiengmai Station

## Underwear and Hosiery Industry in China

According to a recent report the manufacture of underwear and hosiery is one of the industries which is making great progress in China. The majority of the factories are located in the large towns such as Canton, Shanghai, Hankow, Swatow, Chungking, Peking, Tientsin and Tainan. In many cases hand-made machines are still in use, while there are many small works which are only poorly equipped with machinery. In fact it is stated that out of about 100 weaving and knitting firms only a score or so have kept abreast of the times by using modern machinery. The bulk of the latter formerly came from Great Britain, but in recent years Canadian, American and even Japanese machinery has been installed in many places.

*LABUAN: continued from page 426*

in the island which possess excellent steam raising qualities. The coal was worked with varying success from 1847 to 1879 when the company working the field went bankrupt through a bank's failure at home. After several fresh attempts the Labuan Coalfields Co., Ltd. went into liquidation in 1911 and since that time the mines have been idle. Subsequently the Labuan Exploration Co., Ltd. secured the lease and their geologists made a thorough examination of the island in 1919 and 1920. There are three workable seams of coal, their thicknesses being 4-ft. 6-in., 3-ft. and 8-ft. to 11-ft. respectively, and it is estimated that the main seam contains some 12,300,000 tons down to a vertical depth of 2,000-ft. The deepest workings opened up were only 600-ft. below the surface and the geologists thought that acid water did not exist below these workings. When the mines stopped working the output was about 10,000 tons per month, the cost approximating 14/- per ton f.o.b. The mines and the wharf, about nine miles away, were connected by a narrow gauge railway (now removed).

The Eastern Extension Australasia & China Telegraph Co. have a station at Labuan with a staff of five Europeans. The Brunei government has a wireless station and communication is now possible with Brunei and Sarawak by this means.

The adult European population at present is 19 and both children and adults enjoy good health as a rule. There is a resident medical officer in the island with a well equipped hospital. In 1921 the rainfall was 3415.9 millimetres and in 1922 it was 2971.1 millimetres. The mean temperature in 1922 was 81.5.

As regards education facilities there is a government English school a vernacular and a flourishing Chinese school in the town.

Three of the Straits Steamship Co.'s boats maintain a mail service between Singapore-Labuan—Borneo at intervals of about ten days. There is a good launch service between Labuan and Brunei, and various coasting vessels run between Labuan and Borneo and Sarawak.

Labuan is very much a place of "departed glory" at present; in the old days it had its governor and colonial secretary and a European colony of some size living in the vicinity of the mines. The island, it is to be hoped, will once again rise to a position of some importance, offering as it does an excellent harbor and good communications with the neighboring areas.

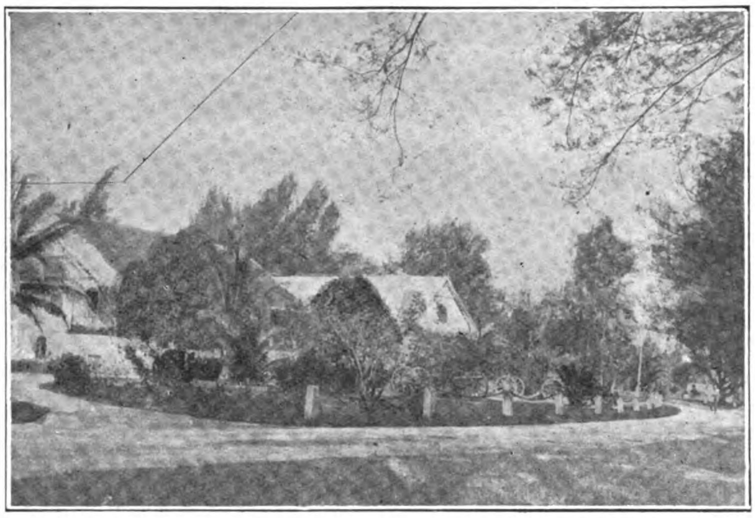
# LABAUN

## "A Place of Departed Glory"

*By H. J. Eley (Acting Resident)*

THE island of Labuan, with an area of 30 square miles, lies off the north-west coast of Borneo. It was first occupied in 1847, from 1890 to 1905 was administered by the British North Borneo Company, and in 1907 was taken over by the Straits Settlements, afterwards being constituted a separate settlement. This state of affairs exists at the present time.

In the main the island is flat, swampy in parts, with a range of hills running more or less parallel to the west coast. The central part of the island is a low lying plain. The population in 1922 was 5,922, there being about 1,000 Chinese and the remainder Malays, with a few Indians, etc. The native is the Kedayan, a peaceable and moderately industrious person, who cultivates padi, both swamp and hill varieties, and grows cocoanuts, fruits, etc. The central plain mentioned above is entirely given over to padi cultivation. The Kedayans also turn out carrying baskets of all descriptions, made from rotan, and mats. These articles met with a ready sale at the Malaya-Borneo exhibition at Singapore last year, and the baskets are still being sold at Raffles Museum, Singapore. Samples of these wares are to be sent to the British empire exhibition, but only as souvenirs, it being impossible of course to compete in the market with the European-made article. The Chinese form practically the whole of the bazaar traders and are also found in a little colony growing vegetables and fruits. The majority of the Chinese are Hokien, with some Cantonese and Hakkas.



Government Offices at Labuan

The soil of the island is not very good, but, in addition to padi and cocoanuts, pineapples, bananas, sago palm and tapioca all do very well. In the days of Sir Hugh Low a great variety of fruits was grown and found a ready market in Labuan and Borneo. Apparently cocoa and coffee were experimented with and one old resident can remember eating grapes grown on the island. Rubber is also grown by many natives having small estates, but in practically all cases it is surrendered to Chinese to work.

There are at present only some 5¾ miles of metalled road in Labuan but some grass roads exist capable of carrying vehicular traffic for some distance. The Kedayan is an excellent carrier and brings all his produce to town in the native-made baskets. The Chinese gardeners up country employ the same method.

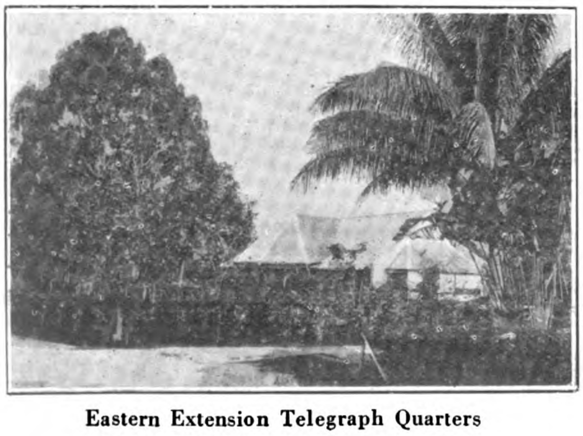
Labuan possesses an excellent harbor, well buoyed and lighted and capable of accommodating vessels of a large size. H.M.S. *Renown* on her visit anchored within a few hundred yards of the shore. The Sarawak government has two wharves, one with a length of 232 feet and a depth of water 11-ft., and Messrs. Vanscolina & Co. have one, length 220 feet with a depth of 13-ft.

In 1922 imports from Sarawak, Borneo and Brunei totalled $819,798 and exports to these countries $718,530. The figures for 1921 were $654,557 and $792,165. The only European firm in Labuan is that of Messrs. Vanscolina & Co. The business was started early in 1911 by Mr. Vanscolina who at that time was connected with the Labuan Coalfields Co., Ltd. He now has in partnership Mr. J. S. Montgomery formerly of the Langkat-Shanghai Oil Company. The firm has its own wharf, and the offices and godowns stand in a commanding position of the sea front. It represents practically all the companies operating in Brunei and the neighborhood, and the present lessees of the Labuan mining lease have entrusted to Messrs. Vanscolina & Co. the disposal of the rights to work coal and minerals on the island. Among the chief agencies are the following:—Surveyor of Ships: Lloyds' Agent; Straits Steam Ship Co., Ltd.; Blue Funnel Line; Anglo-Saxon Petroleum Co., Ltd.; Union Insurance Society of Canton, Ltd.; China Fire Insurance Co., Ltd. Selling agencies comprise Asiatic Petroleum Co., Ltd.; Nestlé & Anglo-Swiss Condensed Milk Co.; Orr's Zinc White Ltd.; Gloria Light Co.; Rubber Estates—Brunei Rubber Estates, Ltd.; Brunei (Borneo) Rubber and Land Co., Ltd.; Brunei United Plantations, Ltd.; Lawas Planting Co., Ltd.; Liverpool (Brunei) Para Rubber Estates, Ltd.; Linkungan-Borneo Rubber Maatschappij; Sundry Commercial—Sarawaka Oilfields, Ltd.; Vamco Timber Co., Ltd.; Island Trading Co., Ltd. (Brunei) and the Labuan Exploration Co., Ltd.

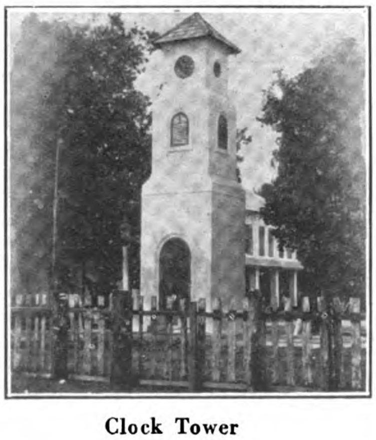
The history of the working of coal in Labuan makes interesting if depressing reading. There are rich deposits of bituminous coal

(*Continued on page 425*)

## LABUAN VIEWS



Eastern Extension Telegraph Quarters



Clock Tower

Beach Street

# The Musashino Electric Railway

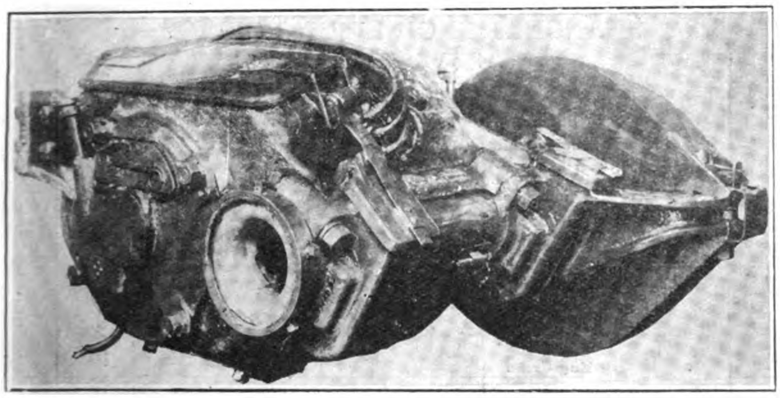
THIS is a single track road running from Ikebukuro, on the Yamate division, to Han-no, a total distance of about twenty-seven and one-half miles. It is one of the many privately owned feeders to the Imperial Government Railway system, and at present is electrified for 15 miles or as far as Tokorozawa where the government aviation field is located. This section was electrified and started operation during the Spring of 1922. The present equipment consists of four—25-ton motor cars, equipped with four Westinghouse 546-J type motors, of 65 h.p., designed especially for narrow gauge railways to operate with two in series on a maximum of 1,500 volts.

These cars are also equipped with Westinghouse type HL (hand line) remote control arranged for operation with two or more cars in a train. The air-brake equipment is Westinghouse type SME, and the air supply furnished by the Westinghouse 25-ft. 1,200 compressor.

The trolley voltage is 1,200 at the substation, with an average line voltage of about 1,100. The trolley system is double catenary, with an auxilliary messenger acting as a feeder. The prevailing grade of the road is from Ikebukuro up to Han-no, with an average for this distance of about .33 per cent. The maximum grade is 1.14 per cent. for a distance of about 1.11 miles. The roadbed is maintained in excellent condition and there are very few curves.

The success of the original electrification has been so pronounced as to lead the railway to plan immediately for the extension of the electrification over the entire 27½ miles. The passenger and freight traffic is increasing from day to day. At present the freight traffic is handled by steam locomotives, pending completion of the electrification.

An order has just been placed by this company for additional rolling stock, consisting of three—33-ton electric locomotives, two motor car equipments, duplicates of the previous equipments, and two trail car equipments, which will be equipped with control details, pantagraph, and lights, to permit these cars to be operated in train with the present and new motor cars. The trail cars will be equipped with master controller so that these trains may be operated in either direction from the front end of the train.



Westinghouse Type 546 J6 Railway Motors supplied to the Musashino Railway

The control is of the master simplified variety of remote type of control used for motor cars and makes use of the standard HL control manufactured by the Westinghouse Company, and consisting of electro-pneumatically operated switches, controlled from a small platform master controller, with connections provided between cars for train operation and with a special narrow gauge type of pantagraph for current collection. This pantagraph is specially designed by the Westinghouse Company for use on narrow gauge railway lines and the primary reason for its design was the demand for such a piece of apparatus from Japanese companies. (See Fig. 1).

All of the present freight traffic is being handled by steam locomotives in trains of from 10 to 15 cars. The sidings and passing tracks now accommodate a maximum train of 15 cars. These passing tracks will later be lengthened to accommodate 20 cars. The electric locomotives are designed to handle a maximum train of 20 cars weighing 17 tons each, over the entire line at a schedule speed of about 12 miles per hour. This includes the average number of stops and delays to be encountered on this railway system.

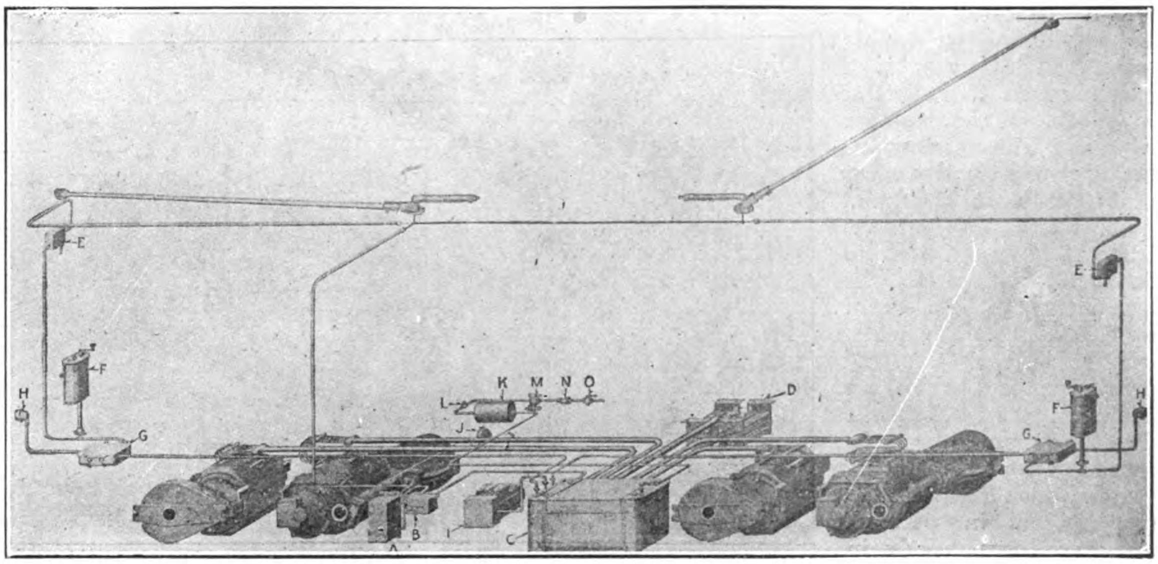



**Fig. 1. Arrangement of Electrical Equipment on Motor Cars: Typical Westinghouse HL Control Parts**

| | | |
|---|---|---|
| A—Main Switch | F—Master Controller | K—Control Reservoir |
| B—Main Fuse Box | G—Control Junction Box | L—Check Valve |
| C—Control Box | H—Tran Line Receptacle | M—Reducing Valve (when used) |
| D—Main Grid Resistors | I—Control Resistor | N—O. B. Strainer |
| E—Control and Reset Switch | J—Lightning Arrester | O—Cut-out Cock |

Each locomotive weighs 33 tons, will have four axles and four motors geared directly to the axles. The motors are Westinghouse type 576-J5 railway motor and each motor has a rating of 100 h.p. at the one-hour rating, with a normal voltage of 600 per motor. They are installed for operation on 1,200 or 1,500 volt trolleys, operating two in series. The motors are field control; in other words will each have a tapped connection on the field which will be cut out for maximum speed operation. This type of motor represents the most efficient development in railway motors. It is built especially for narrow gauge service.

The locomotives as well as motor cars will be equipped with Helical type gears, which is one of the most recent developments in the design of gears for railway service. The locomtives are geared for moderate speed operation to obtain the maximum drawbar pull, which is a characteristic essential for freight locomotives. The control for these locomotives is Westinghouse type HLF (hand line field) locomotive control, which embodies the same features as to electro-pneumatic train operation and remote control features as on the motor cars.

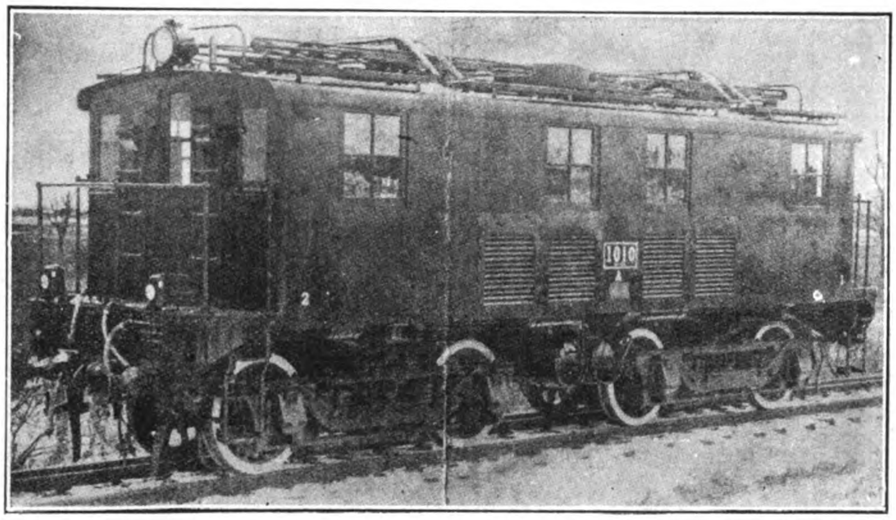
The success of the former electrical equipment was a deciding factor in the decision reach by this railway in purchasing duplicate equipments from the same manufacturer.

The current collection for these locomotives will be the same as for the motor cars. In fact, every effort will be made to make the equipment for locomotives and motor cars interchangeable. This will also hold true for the air brake equipment, especially in regard to the compressors, which will be identical for motor cars and locomotives. The locomotives will be equipped with the Continental type couplers, but provision will be made for the substitution of type MCB coupling at a later date.

# Electric Locomotives for Japanese Government

ON their way to Japan are two locomotives ordered some time ago for the Imperial Government Railways of Japan from the General Electric Company and built at the G. E. Erie Works. These will be tried out on the Tokyo-Yokohama line, which was electrified in 1915 at 1,200 volts direct current. The government plans in future installations, however, to use 1,500 volts.

The locomotive is of the box-cab type, equipped with four GE-274 750/1,500-volt motors, geared for a maximum speed af 40 m.p.h. Its total weight is 132,000-lb., all on driving axles, and it is capable of exerting a tractive effort of 17,000-lb. on the one-hour rating. The continuous rating gives a tractive effort of 17,400-lb. at 22 m.p.h., with 1,500 volts on the trolley. In addition to the 1,500-volt rating the locomotive can be operated at 1,200 volts at a somewhat reduced capacity, and provision is made for operation at 600 volts direct current by the throwing of a commutating switch which connects all four motors in parallel. They are permanently in series for 1,500-volt operation. Protective devices are supplied to prevent damage due to accidental contact with the 1,500-volt trolley when the commutating switch is thrown to the 600-volt connection. The leading dimensions of the locomotive are as follows:



1,500-volt, 1,040-H.P. Locomotive for Trial Use of Japanese Government Railways

| | |
|---|---|
| Length over all .. .. .. .. .. .. .. | 37-ft. 2-in. |
| Length of wheelbase .. .. .. .. .. .. | 26-ft. 0-in. |
| Rigid wheelbase .. .. .. .. .. .. .. | 8-ft. 6-in. |
| Height over pantograph (locked down) .. .. | 12-ft. 10-in. |
| Diameter of wheels .. .. .. .. .. .. | 42-in. |
| Gauge of track .. .. .. .. .. .. .. | 42-in. |

The GE-274 motors were designed especially for this locomotive and are the largest so far constructed for a 42-in. gauge track. Each motor rates 260 hp. on 750 volts, and is insulated for operating two in series on 1,500 volts. The motors are arranged for ventilation by means of external blowers.

One of the most interesting features of the equipment is the new electro-pneumatic type of control known as Type PCL. Two master controllers, one in each operating cab, energize the magnet valves of the pneumatically operated contactors, which open and close the main motor circuits. These contactors are closed by air pressure and opened by a heavy spring acting against the pistons. Ten control steps are provided with four motors in series and eight steps with the motors in series-parallel.

Another important feature of this equipment is the high-speed circuit breaker, which is connected between the trolley and the main part of the locomotive equipment. Under normal operating conditions this circuit breaker is closed automatically on the first point of the master controller; it then remains closed unless tripped by an overload or short circuit or by momentary loss of the control circuit voltage. After being tripped for any reason, the breaker is again reset upon the first point of the master controller. Under normal operation, however, the high-speed circuit breaker does not open with the return of the controller to the off position. This circuit breaker has no mechanical latches or triggers, but is tripped electro-magnetically. This construction makes for durability and permanence of calibration.

To protect the locomotive motors against damage due to overload, an overload relay is provided, which is so connected that in case the motor current exceeds a certain predetermined value the relay contacts open the holding circuit of the high-speed circuit breaker, which then opens and thus relieves the overload.

For collecting the 1,500-volt current, two slider pantograph trolleys (one a spare) are provided having a range of 7-ft. from minimum to maximum height. These pantographs are raised by admitting air to a set of cylinders and are held against the wire by springs, which are in turn held under tension by the compressed air in the cylinders. The contact elements consist of easily renewable copper wearing strips. A hand pump supplies compressed air for raising the trolleys for initial operation when there is no air pressure on the locomotive.

The control current is provided by a dynamotor arranged to supply 750 volts for the low-voltage control circuits and lights. In conjunction with this dynamotor there are two air compressors designed for 750-volt operation, but doubly insulated. The middle point of the air compressor circuit is connected to the mid-voltage point of the dynamotor to insure equal division of the load between the two compressors. The two blower motors for ventilating the traction motors are also designed for 750 volts each and are doubly insulated.

In the engineer's cab the master controller is located on the left side of the cab to conform to the practice in Japan of running to the left instead of the right.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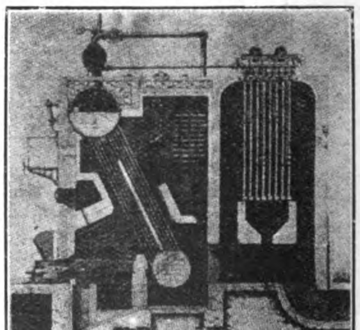

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Repairing the Yellow River Break

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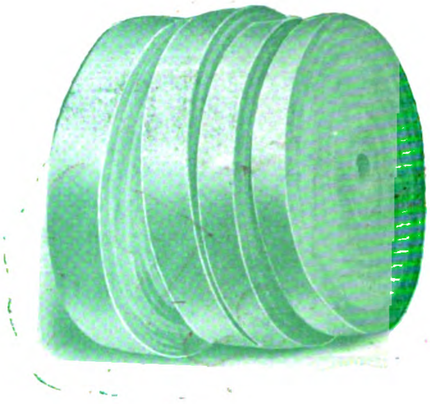

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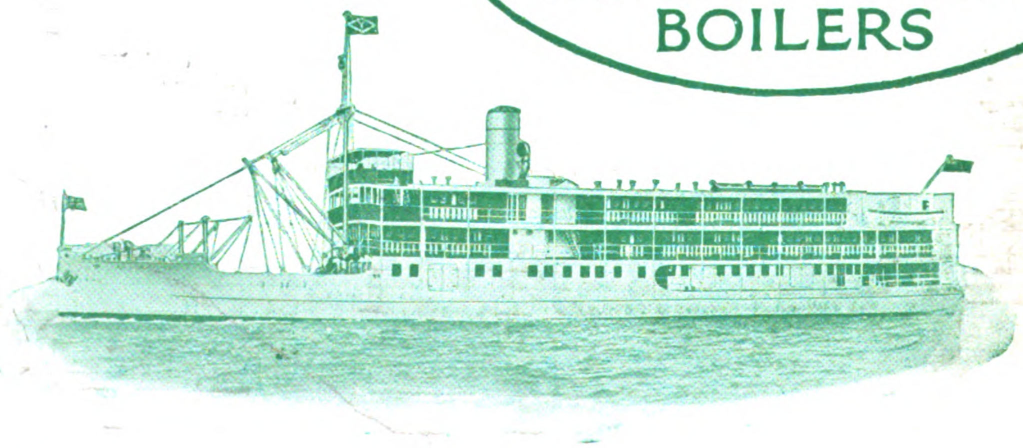

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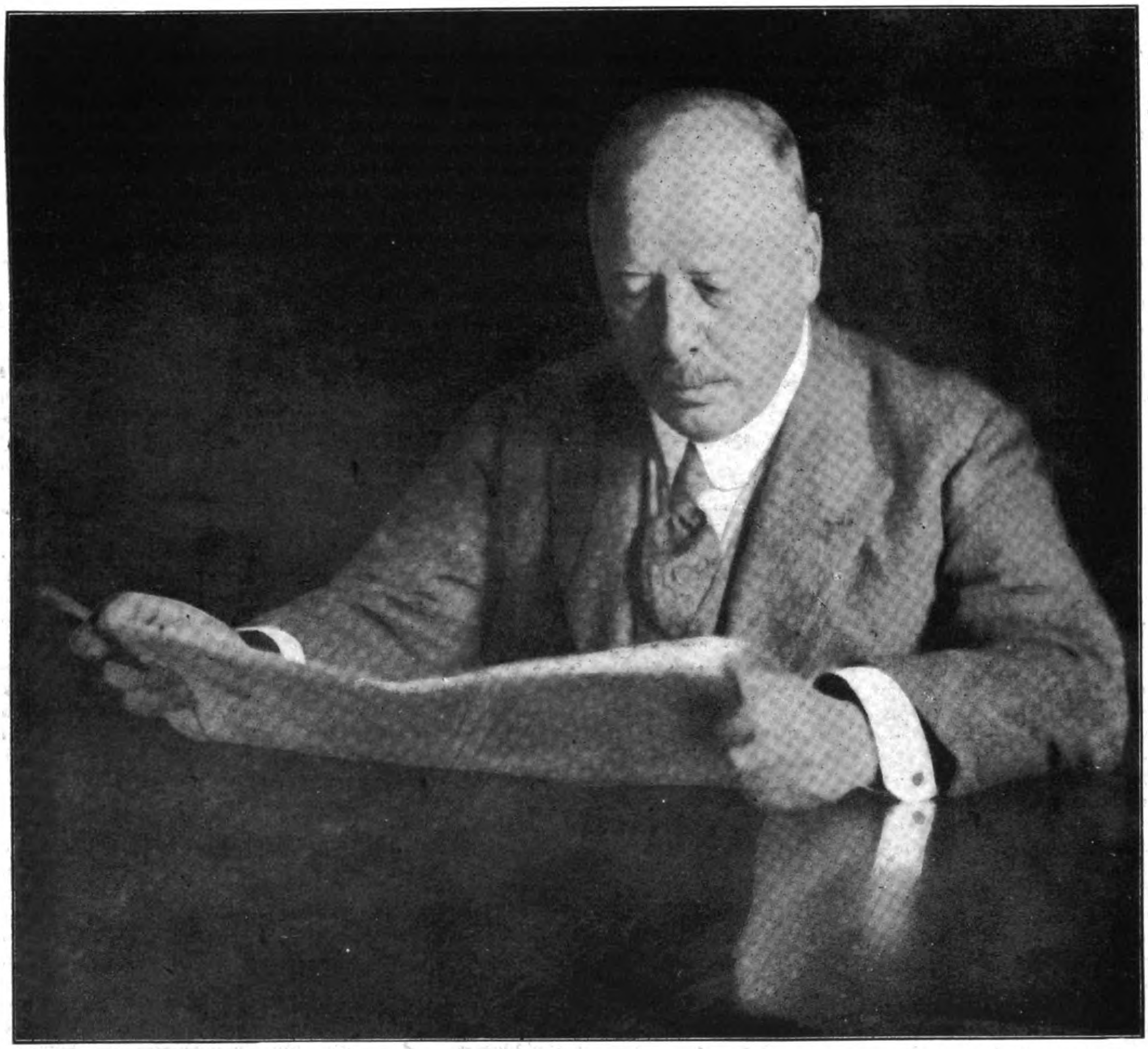

*(Photograph by Maurice Beck, Shanghai)*

HON. MR. A. G. STEPHEN,

*Chief Manager of the Hongkong and Shanghai Banking Corporation*

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, JULY, 1923 No. 7

# Back To Portsmouth?

WILL the Chinese boycott and agitation against Japan end in overturning the nine-power treaty and changing the map of Eastern Asia? China and her western friends have overlooked the important fact that Japan retains in her hand the joker that will win the last trick. In their madness, the Chinese are seeking further humiliations by re-opening the question of the Kwantung peninsula settled in 1915 as far as Japan was concerned by a treaty which extended their lease-hold to 99 years. The Chinese insist that the treaty was extracted under duress, hence invalid, and Japan must get out. Japan says that *all* impairments of China's sovereign rights were inflicted under similar conditions. She stands squarely upon the sanctity of the 1915 treaty.

**China's Confession at Washington that she was the Ally of Russia and Responsible for the Russo-Japanese War May Impel Japan to Call for a Re-opening of the Portsmouth Negotiations and Demand the Payment of a Cash Indemnity or the Cession of Manchuria.**

"Very well," answers China, "we won't discuss the matter further. We will drive you out. You have the bayonets but we have the boycott. You cannot bayonet a boycott. We will kill your trade, make it impossible for your people to reside in and do business in our country, force you into bankruptcy and bring about your downfall from within." Accordingly, China has severed relations with Japan and precipitated a situation equivalent to an open declaration of war. She hugs the delusion that it is impossible to bayonet a boycott, overlooking that it is equally difficult to boycott a bayonet.

The Chinese government side-steps responsibility for the boycott but instructs its provincial authorities "not to interfere with the will of the people." It is a new method of fighting. Officially, there is no war. The pretence of friendly relations is maintained but underneath, all the machinery of the Chinese government is operating to incite the masses to cripple the enemy in his most vulnerable point. Deprived of the Chinese market as an outlet for their manufactured products, the mills of Japan must perforce close down, throwing thousands out of employment, breeding discontent and fomenting disorders that may lead to serious internal revolts and smooth the way for the triumph of Bolschevism. The Chinese hope that these internal troubles will influence the Japanese government to evacuate Kwantung; that the Japanese people faced with economic disaster, will rise and compel compliance with China's demands. Like the Germans, the Chinese are poor judges of human nature. Instead of falling in with the Chinese ideas the Japanese masses, as distinct from their government, may insist upon employing the bayonet as an unanswerable argument to the boycott. As the Chinese government is impotent to oppose the will of the people, so the Japanese government may bow to the will of the masses in order to avert an internal catastrophe through the breakdown of its industrial system.

The Japanese government is making every honorable effort to live down the mistakes of past military cabinets; it has sacrificed every advantage gained during the past ten years in order to promote international goodwill and preserve the peace of Asia. But there is a limit. That limit has been reached. The cabinet that would discuss the return of Kwantung to China would be swept out of power on a typhoon of popular indignation; the nation would rally around the militarists and once more the legions of Nippon would march banzaiing across the Yalu on the way to Peking. This is no exaggeration. The Japanese have long memories. They remember their 200,000 dead butchered in the shambles of Port Arthur, the graves scattered along the banks of the Yalu and the Sha-ho, at Mukden, Liao-yang and elsewhere in Manchuria; they recall the crushing burdens imposed upon them by this struggle for independence, and the further load in order to be prepared for the war of revenge that Russia was plotting to launch by 1912. They are now learning for the first time that their real enemy was China who invited Russia into Manchuria and handed over her territories in order that Japan might be crushed and her independence taken away. They are learning at this late date that China was the secret partner of their open enemy, directly responsible for their supreme sacrifice. When this truth strikes home at a time when China is once more conspiring to imperil their existence through a commercial war, the will of the people of Japan will assert itself in no uncertain manner. If China in her madness insists upon forcing the Kwantung issue, Japan, in self-defense, may place her full case before the world, go behind the twenty-one demands, repudiate the Portsmouth negotiations and in the light of China's confession at Washington, demand the indemnity in cash or in territory she was buncoed out of by the operation of secret diplomacy.

Owing to the profound secrecy surrounding her partnership with Russia, China escaped the penalty which all nations have paid for defeat in war. China even had her full sovereignty restored over the three eastern provinces which Russia had determined to annex, or as Kuropatkin tersely put it: "We will turn Manchuria into another Bokhara," that is to say, closed to foreign trade and residence, a walled-in Russian preserve. China, however, emerged from the conflict a victor, while the real victor, bled white in the struggle, was forced to remain content with a short time lease to a worthless piece of property and the ownership of a busted, broken down railway. Seventeen years later, China frankly confesses and files a summary of her secret alliance with Russia, providing the evidence that she had lived up to her end of the bargain by ceding territories that enabled Russia to get into a position where she could more readily annihilate Japan.

After silently chuckling over the fact that no one paid any attention to her confession of guilt and relying on American sentiment to support and protect her, she now says to Japan," get out of Kwantung; restore to me full sovereignty over the territory you stole from me in 1915 or I will proclaim a boycott against your goods and starve you out." China honestly believes that she has the world buffaloed, and can frighten Japan into cancelling the Manchurian treaty. She overlooks the fact that if one treaty can be so lightly repudiated, other treaties can be similarly vitiated, so in resorting to these tactics, she simply invites Japan to follow her

# THE JOKER IN JAPAN'S HAND

## China's Confession of Guilt

**A Forgotten Document that May Overturn the Washington Treaties, Re-open the Portsmouth Negotiations and Change the Map of Eastern Asia.**

## Official Text of the Secret Treaty of Alliance between China and Russia, Signed in May, 1896.

*Summary Filed by the Chinese Delegation at the Washington Conference.*

**"Article 1.—The high contracting parties engage to support each other reciprocally by all their land and sea forces in case of any aggression directed by Japan against Russian territory in Eastern Asia, China and Korea.**

**"Article 2.—No treaty of peace with an adverse party can be concluded by either of them without the consent of the other.**

**"Article 3.—During military operations all Chinese ports shall be open to Russian vessels.**

**"Article 4.—The Chinese government consents to the construction of a railway across the province of Amur and Kirin in the direction of Vladivostock. The construction and exploitation of this railway shall be accorded to the Russo-Chinese Bank. The contract shall be concluded between the Chinese minister at St. Petersburg and the Russo-Chinese Bank.**

**"Article 5.—In time of war Russia shall have free use of the railway for the transport and provisioning of her troops. In time of peace Russia shall have the same right for the transit of her troops and provisions.**

**"Article 6.—The present treaty shall come into force from the day on which the contract stipulated in Article 4 shall have been confirmed. It shall have force for fif'een years."**

**Has Japan the Right to Demand an Indemnity from the Secret Ally and Enemy who Concealed her Responsibility for the Russo-Japanese War and Emerged as the Innocent Victim? In 1905, at Portsmouth, Japan was Buncoed out of a Cash Indemnity: In the Light of China's Confession of Guilt Can She now Demand Reparation in Full?**

lead and reopen the Portsmouth negotiations and demand full reparations for her losses in the war of 1904. There are no statutes of limitations in such matters.

Germany was called upon to pay reparations to the full extent of the allied losses, and when it became apparent that she had no intention of complying with her pledges, France simply exercised her liberty of individual action, occupied the Ruhr and started to collect her share of the indemnity. Despite the fact that France was only one of several allies who signed the Versailles treaty, her independent action has as yet called forth no official protest from her partners. While they may not approve, they understand, and at heart sympathize with her motives.

If, in the light of China's tardy confession at Washington, and her attempt to break the 1915 treaty, Japan now decides to re-open the Portsmouth negotiations and calls upon China to pay the full costs of the Russo-Japanese war, and China refuses, will Japan be justified in occupying the whole of Manchuria until her claims are settled, or, if there is no prospect of recouping her losses from the revenues of these provinces, is she entitled to annex them as a prize of war, in the same way that Germany, Austria and Turkey were dismembered to satisfy the demands of the allies at Paris? It would seem difficult to apply one principle in one part of the world and deny its application in another part.

G. B. R.

# The Consortium

## A Statement of Policy

A MEETING of the council of the China consortium was held in Paris on May 28, at which were present Sir Charles Addis, R. Th. de la Chaume, Thomas W. Lamont and Kanji Yano, representing the British, French, American and Japanese groups respectively.

A discussion ensued on the proposed consolidation of China's unsecured obligations and instructions were issued to the groups' representatives at Peking to examine, in consultation with the four ministers of their respective governments, the existing floating debt of China, including all loans which are unsecured or of which the security seems likely to prove inadequate in the near future with a view to formulating in due course a comprehensive scheme of debt consolidation.

The council also had under consideration the general policy of the consortium in China, and it was decided to publish this in the form of a separate report. This timely document comes to refute the stories calculated to destroy the confidence of the Chinese in the good faith of the consortium and give strength to independent financiers in floating loans to bolster up the Peking government. It also dispels the idea prevalent amongst Chinese and certain foreign elements that the consortium can be used as the instrument to carry out any intervention in the affairs of China that might in the most remote way be construed as an impairment of her administrative independence. It bears out what we have said in another article, that foreign intervention in the affairs of China through the consortium, is only possible if the Chinese authorities request this assistance in re-establishing economic and financial equilibrium. The statement is an assurance to the Chinese that the fou. powers speaking through their official financial representatives are not in sympathy with the opinion and resolutions of their nationals in China who clamor for immediate intervention. Since this statement was issued, President Harding has expressed himself of the opinion that the only salvation of China lies in the operation of the consortium, but it is evident that this is not intended to mean that further loans to the present Peking government is advisable. It means exactly what THE FAR EASTERN REVIEW has been saying for the past year, that once a representative government is established by the Chinese themselves, a government which will be representative of all factions and into which all factions will pay their just revenues, then and only then, can the four powers step in and lend a helping hand to China by strengthening that government through the consortium. Until China is unified and there is some guarantee that the security for further loans will not be diverted into the pockets of the war-lords or independent provincial treasuries, and that they will be remitted to Peking for the service of legitimate obligations, the consortium cannot function. It is futile for the Chinese or their apologists to expect foreigners to advance millions for further administrative expenses which find their way by devious channels into maintaining huge armies.

The statement of the consortium follows :

The council of the China consortium having under review recent telegram from their representatives in Peking as well as press message and comments bearing upon the present economical and political situation in China considers that a general statement of the policy of consortium may be at this time of interest to the public.

The policy of the consortium, namely the substitution of international co-operation for international competition in the economic and financial affairs of China, has been definitely affirmed and endorsed in a large sense by China and the powers in the treaty signed at Washington on February 6, 1922.

The treaty is in effect an undertaking by the powers to respect the sovereign rights of China, to preserve her territorial integrity and to provide her with a free and unembarrassed opportunity to develop her economic resources and maintain for herself an effective and stable government.

The consortium is an appropriate instrument for giving effect to this policy. It is not designed as a permanent organization, but rather as a temporary bridge by which China may be assisted to pass in comparative safety through the difficult period of transition from an unsettled to a settled state of government.

What has already been accomplished appears to justify the belief that the consortium has been constructed on sound lines, and may reasonably be expected to fulfil the purpose for which it was designed with due regard to the natural susceptibilities of the Chinese on the one hand and the security of the foreign investor on the other.

It is popularly supposed, and occasionally asserted, that the main object of the financial groups composing the consortium is to harvest undue profits reaped from loans forced upon China under the protection of their respective governments. This is not the case. On the contrary it has been by their consistently refraining from lending that their principal success has been achieved in encouraging the utilization of native savings before recourse is had to foreign capital, and in arresting the profligate expenditure which was heading the country straight for bankruptcy. It is not too much to say that the consortium has helped to stimulate and foster a sane and independent public opinion in China, and, by putting a stop to the menace of financial penetration arising from indiscriminate and unproductive foreign borrowings, is helping to conserve the integrity of the country.

Much still remains to be done, and until their work has been accomplished the several groups of the consortium are convinced that they would not be justified in having regard merely to their own convenience by resuming their freedom of independent action. They are reinforced in this conviction by the consideration that the consortium appears to form the chief barrier between China and the policy of spheres of interest which prevailed during the last decade of the XIXth century. It will be remembered that it was during that period, known as the "Battle of the Concessions," that definite claims to exercis preferential rights over specific geographical areas of China were advanced by different powers. If these claims had been maintained the disintegration of China must have followed. Any backward step towards the resumption of a similar policy might be expected to produce similar results.

The pressure upon modern nations to discover and develop outlets for their trade is increasing, and China presents to-day by far the largest undeveloped field for commercial expansion. If the restraint at present exercised by the co-operative action of the consortium is removed, the resort to the pressure of individual agents in competition with each other would appear to be inevitable. From that it might well be but a step to the intervention of foreign governments in order to protect the vested interests acquired by their nationals in different parts of China, and spheres of interest, with consequences disastrous to China, would once more be established.

It is more in the interests of China for the powers to deal with her as a whole rather than separately, in co-operation rather than in competition with one another. It is the aim of the consortium to assist China in the building up of her credit until some day like other nations she can borrow for her requirements on the strength of her national credit, without the necessity of recourse to specific security or supervision of expenditure. When that day comes it will be time enough to talk of disbanding the consortium. Until then the consortium must remain intact and, with the approval and support of the governments, continue to perform with patience the functions assigned to it.

It is the settled policy of the consortium to refrain from interference in the internal political affairs of China. The present political upheaval in that country precludes the immediate hope of giving practical effect to any consortium proposals for an administrative loan. Conditions, however, change so rapidly that the groups must always stand prepared for action in anticipation of the time when China shall have again attained to such degree of political peace and security as to afford a reasonable prospect of a stable government.

Industrial Loans, in which railway loans are included, are in a different category. Provided adequate security can be obtained there seems to be no reason why the further development of railway communication in China, in itself a potent means of political unification, should wait upon the solution of her administrative problem.

It is recognized that an essential part of any scheme for the financial reorganization of China is the consolidation of the floating debt and a scheme for such consolidation is at present under consideration by group representatives in Peking.

A certain portion of the Chinese public appears to be under the delusion that in some way or other the object of the consortium is to obtain control of China's finances and railways. If such a delusion really exists, it can only be due to a mistaken reading of every public announcement whch has been made on the part of the groups.

It has repeatedly been stated that interference with the domestic politics of China has no part in the program of the consortium, that the reorganization of China's finances must come from China herself, and that the rôle of the consortium is limited to an endeavor to assist the Chinese authorities, if requested to do so, in re-establishing economic and financial equilibrium.

It would be futile to ask the foreign investor, to whom the consortium stands in the relation of quasi-trustee, to subscribe to a Chinese loan until he is satisfied that its proceeds will be properly expended and his capital duly returned to him at maturity. It is indisputable that this necessitates some measure of supervision, but no more control than the minimum actually required to provide the adequate degree of security without which it would be impossible to issue a foreign loan.

It is the policy of the consortium to assist in building up the general credit of China on such secure foundations that all outside intervention may be gradually eliminated and the entire control of loan service and expenditure may finally pass into the hands of China herself.

There appears to be some misunderstanding in China with regard to the suggestion that the land tax might at some future date be utilized as a source of security for a supplementary administrative loan should the other revenues of the country prove insufficient for that purpose, or be already fully pledged. That the collection of land tax should be remodelled on the lines of that of the maritime customs, *i.e.*, placed under foreign supervision, formed no part of the suggestion, and was not even discussed. Neither the application of foreign control to the collection of land tax, nor specific hypothecation of that security, came within the scope of the conclusions reached at the consortium conference at New York in October, 1920. The project of a loan secured on the land tax was not then and is not now under consideration by the consortium.

# No Loans to China

## American Financiers Advocate a Square Deal for Japan

FOLLOWING on the heels of the consortium statement, the advisory committee of the Far Eastern division of the U. S. department of commerce appointed to report on how the Chinese government could be helped financially at this time submitted its recommendations at a luncheon meeting held at the lawyer's club in New York on June 8. It will be recalled that this business-men's committee was appointed some months ago to investigate and co-ordinate the debts owed by the Chinese government to American concerns and co-operate with the government in Chinese trade matters. The members of the committee are E. Stanley Glines (Chairman), of Lam, Glines & Co., Chas. M. Muchnic, vice president of the American Locomotive Sales Corporation, M. A. Oudin, vice-president of the International General Electric Company, A. I. Eisberg, of the San Francisco chamber of commerce, and Frank Waterhouse of Seattle. The meeting was attended by representatives of the most important American concerns interested in China.

In answer to the request of the Far Eastern division, Mr. Glines indicated that the best way out, both for China and her creditors, seemed to lie in an extension of the $180,000,000 obligations on which China was in default. His recommendations, as well as those of the consortium, undoubtedly influenced President Harding to declare in favor of the consortium as the best instrument for saving China, and comes as a distinct rebuke to the group of little-Americans who have consistently criticized and condemned the sane policy of Mr. F. W. Stevens (representative of the American group in Peking), in declining to be rushed into lending large sums to China without adequate security or supervision over their expenditures. To those creditors seeking to shift their load to the pockets of the bondholders such action was most distasteful. This group insists that our financial representative at Peking be a man with imagination and power to act "a man of the Hoover type with large experience in international finance and industrial achievement."

Mr. Glines, speaking for his committee of hard-boiled business men, starts right out with a positive statement, a knockout for the quick action positivists in China. He says :

" It is my opinion that the Chinese government has no acceptable security which could be offered for a new loan at this time.

" Those of us who have large interests in China, or who might be attracted to this field in a large way, are confronted with two lines of thought. First, do we desire to see our government become more deeply involved in China as a government in the protection of such interests as we now have or might have ? This might be in co-operation with other governments or independently ; and is this a support upon which we could rely ? Or, would we like to see less foreign interference, leaving tle Chinese to themselves to work out their own salvation ?

" Should the foreign holders of the overdue obligations of the Chinese government railways exercise their rights and take over these lines, our government would be inevitably involved and tremendous pressure would be brought to bear to protect American interests. This would virtually result in the Americans and Japanese taking over the Pekin Suiyan ; the British the Tientsin-Pukow and Pekin-Mukden ; the Chinese bankers, in co-operation with the Japanese, the Pekin-Hankow, etc.

" In the event of the French ratifying the ' Nine Power Chinese Customs Treaty ' I would recommend that this be funded for the purpose of taking up overdue foreign obligations, including those of the ministry of communications. No new money would be involved ; securities could be issued in exchange for outstanding obligations. This would relieve the government of foreign pressure, their governmental income would then depend upon their efficiency in operating their utilities, and since the internal native loans would have to look to this entirely, there would be considerable pressure brought to bear by the Chinese for a government that could function as a government, which might lead to the Chinese creditors taking over the roads and operating them in effect as private utilities.

" In the event of the funding of this 2½ per cent. customs increase becoming a reality, another source of income to the government and native creditors would be to follow a plan put forward by Mr. Eldridge, chief of the Far Eastern division of the department of commerce, and that is the organization of the wine and tobacco tax functioning like the salt gabelle with foreign supervision at the scource, if desirable, and the imposition of internal revenue taxes, under foreign control if desirable, at the place of manufacture and entry.

" Of the total amount owed abroad by the Chinese government, 40 per cent. represents overdue obligations to Japanese business interests and about 5 per cent. represents obligations owed to American business interests.

" At the recent disarmament conference held in Washington it was suggested that the Chinese government be permitted to increase its customs duties 2½ per cent. This would yield annually about $20,000,000, which would take care of the interest on the overdue obligations and provide for the creation of a sinking fund. This was known as 'The Nine Powers Customs Treaty,' and all the nations party to it have ratified the agreement with the exception of France. It was provided that three months after the nine nations had signed the treaty a conference would be held in Peking.

" It is to be remembered, however, that China is in political chaos, and that the lives and property of all foreigners are in danger. We all want to see a stable and prosperous China run by the Chinese ; the question is how to bring this about, whether by steps that might lead to wholesale foreign intervention or by leaving the Chinese measurably to themselves to work out their own solution. Unfortunately, a middle ground at this time seems very difficult.

" All business interests are in agreement that a first-class business man like Eliot Wadsworth or W. D. Gibson of the treasury department, Cameron Forbes or Frederick W. Stevens should be appointed as one of the American members of the special conference on increase in Chinese customs duties to meet in Peking within three months after ratification by the French of the ' Nine Powers Customs Treaty.' We are all very much afraid that it will be a political appointment, which would be disastrous to American business interests in China."

It will be seen from this report that the American advisory committee working in conjunction with the department of commerce had the vision to include in its list of loans to be repaid, $72,000,000 gold (Y.144,000,000) owed by China to Japan, and which covers the more reputable of the so-called Nishihara loans. As some of the American loans are in the same unsecured category and advanced for no specific purpose, it was natural that any consolidation scheme must include these much criticized transactions. Later telegrams from Washington would seem to indicate that the state department working in close harmony with the consortium failed to approve the plan for the proposed consolidation loan of $180,000,000 gold recommended by the advisory committee and the department of commerce. Secretary Hughes stands firmly upon the consortium platform that because of the chaos in China the time

is not opportune to lend any money to her and expressed the opinion that the American government should confine its fiscal relations with China to the protection of American investments in this country. This disposes for the time being of the constant agitation to induce Americans to open their purse strings and bolster up a government which does not exist.

# More Loans to China

## Independent British Attitude Freezes out Japan

QUITE different from the American position and unqualified endorsement of the consortium policy is the attitude of those independent British investors who subscribed to the unsecured " Vickers " and " Marconi " loans to the Chinese government, now in default. The position of this group is similar to that of the group which desires immediate action of any kind in order to satisfy its claims on Peking. The prospects of the British independent investors under the leadership of Mr. Birch Crisp are decidedly unpleasant owing to the opposition of the consortium to any allocation of the surplus salt revenues for the service of the above loans. As these two loans were issued prior to the organization of the new consortium at a time when the old combination had practically ceased to function and received the approval of the British government, there is an increasing tendency to question the right of the new consortium to take over the assets and rights of the old combination which negotiated the reorganization loan of 1913 secured on the salt revenues.

It will be recalled that President Wilson withdrew support to the American group because of the terms of this loan which seemed to impair the administrative independence of the Chinese government. This resulted in the withdrawal of the American group from the old six-power consortium, which then proceeded to issue the loan for £25,000,000 secured on the salt revenues and gave the issuing the banks an exclusive lien on these revenues for the security of future loans. When the new consortium was founded in 1920 under the leadership of the American group at the invitation of the American government, the Americans became an equal partner with the others in their assets, thus participating in the very deal which President Wilson refused to sanction in 1913. Naturally, if at this time, the independents can challenge the validity of the claim of the new consortium to be the successor to the old pre-war combination, it places the Americans outside the group which controls the salt revenues as security for further loans ; a most delicate position.

As most of the opposition to any loan to Peking pending unification arises from the American group, the independent operators who issued the " Vickers " and Marconi " loans can be expected to use every argument which may assist in forcing the consortium to surrender its exclusive option on the only available surplus in sight.

The feeling in England on this matter is running very high and may be summed up in the following extract from " Time and Tide " :

"When unfortunate investors subscribed for these Chinese notes and bills the old consortium was dead and the new one had not seen the light of day, and apparently the new one is not greatly interested in what has happened in the intervening time. . . . In some parts of the city there is a tendency to suggest that the holders of these investments subscribed to them with their eyes wide open and the high rate of interest, namely 8 per cent., was sufficient warning that the securities were highly speculative. The reply to this is direct and simple. They were : (a) A direct obligation of the Chinese government ; and (b) the India office in 1921 were offering 7 per cent. for an Indian government loan. If we have come to such a pass in international affairs that the simple promise of the nation to pay cannot be relied upon and specific security must be pledged before loans can be made, then we are paving the road to suspicion and chaos."

At a meeting of holders of the defaulted Chinese government eight per cent. sterling treasury bills and notes held in London on May 29, Mr. C. Birch Crisp explained the situation surrounding the new loan negotiations. Mr. Crisp said that the British bank for foreign trade acting in conjunction with his firm, negotiated the sale in October, 1918, of £600,000 of Chinese government eight per cent. ten-year sterling bills. Vickers notes amounted to £1,803,-200, and were issued in October; 1919. The default on the Marconi notes was on the August coupon in 1921, and on the Vickers notes in October, 1922. In America there had been issued notes to the value of about $10,000,000, so that there were in default securities similar in character of the nominal value of about £5,000,000. His connection with a loan issue for the Chinese government in 1912 had no bearing on the position in which they now found themselves; because these treasury notes, issued in 1918, came into existence in connection with the erection of wireless stations in China which the British government desired to be erected, and when the Marconi Company took payment from the Chinese in these treasury notes the British government facilitated the whole of the negotiations and approved of the issue of the notes upon the market. The same thing applied to the Vickers notes.

In February, 1921, the British bank for foreign trade was asked by the Chinese to advance the amount of the coupon then due for payment. The bank did advance that amount, and then asked the Chinese to secure the bank for that payment and to secure the noteholders their future payments. The Chinese, let it be said to their credit, were very desirous of keeping faith with the investor, and pointed out that there was a surplus of revenue arising out of the salt gabelle, and they were willing to inscribe an amount upon that revenue which would have prevented default. When the Chinese notified their readiness to inscribe the notes upon the salt gabelle they asked the British government to facilitate the process, and that they appeared ready to do, but the 1920 consortium, composed of some bankers and finance houses of Japan, France, the United States and Great Britain, lodged a protest with the Peking legation and claimed that to inscribe those notes on the surplus salt gabelle revenue would be an infringement of their rights. Personally, he failed to see how they could substantiate such a claim.

Proceeding, he said said that in March of last year he went to New York to examine the situation there.

One result of his visit was an intention on the part of certain parties there and here to re-open negotiations with the Chinese government, and at this moment they contemplated a transaction which would have the effect of securing these notes upon the surplus customs revenues. The discussions between Peking and London had gone on now for well over six months, and his group had notified the Chinese government that, if a contract be made, that contract must first be sanctioned by the Chinese parliament. The consortium was vigorously opposing the completion of the contract with them.

He did not for one moment suggest that the English bankers forming part of the consortium would do anything to prevent their getting security for the notes. It was on record that they did protest against the salt gabelle being utilized for the purpose, and he thought it behoved them all to discover what would be the attitude of the consortium supposing they made a contract with the Chinese government for a new loan—if they were prepared, as he had been, to say to the Chinese. "No new loan can be issued until the default upon these notes has been rectified."

Commenting on this meeting, *The Financial News* says " apparently the 1920 consortium is a dead sort of thing, for it has not yet functioned. It is not working with the Chinese government, and yet blocks the way to a settlement of the ' Marconi ' and ' Vickers ' claims and to the raising of a further loan. Deferring payment is not necessarily default ; it all depends upon tenure of life. If the Chinese government would only throw off its lethargy and assert its authority there should be no difficulty in solving loan problems. At the same time, while the Chinese profess their willingness to pay their debts, we imagine they are not crying to do so."

In summing up the British position it would seem that the group led by Mr. Birch Crisp is simply seeking to supplant the consortium and take over the only tangible security for a new consolidation loan to the amount of £20,000,000, in order to protect noteholders in America and Great Britain, with no reference to

the defaulted Japanese obligations of the Chinese government. The independent operators censure the consortium because it does nothing to help China or the holders of defaulted securities and challenges its right to take over the assets of the defunct organization. Mr. Crisp now offers to negotiate a new loan on condition that noteholders in England and in America are protected. In order to effect these two operations it is proposed to create new bonds to a nominal value of £10 millions, bearing 8 per cent. interest and redeemable over the 30 years beginning 1928. The notes would be exchanged at par for these bonds on conditions that the holders underwrote an equal nominal value of the bonds, which would be issued to the public at 97½ per cent. This scheme met with the approval of the noteholders at the May 29 meeting, the more so that the payment of arrears of interest is provided for. The Peking government, it is understood, has also agreed to the terms, but the consortium has control of the funds necessary to secure the services of the new loan. There the matter rests for the moment, or until the new committee secures, if possible, the co-operation of the consortium in permitting the salt surplus to be diverted for this purpose. As pointed out, there is apparently no provision made in this independent British scheme to protect the unsecured Japanese investors, and it is hardly likely that the consortium will at this late date consent to any impairment of the security that the Japanese group has an equal right to enjoy for the liquidation of its defaulted notes. The recommendation of the American advisory committee which included these Japanese loans in its consolidation scheme, is in somewhat striking contrast to the Crisp proposition.

# A Resolution and Brass Tacks

**The American chamber of commerce of Shanghai and the American association of China on June 13 sent to the secretary of state of the United States a cablegram containing the following recommendations:—**

**1—Suspension of all benefits accruing to China under the Washington conference.**
**2—Disarmament and return to their homes of China's 1,200,000 surplus troops.**
**3—Chinese government finances should be placed under foreign supervision.**
**4—Foreign guards should be placed upon all lines of communication both land and water.**
**5—Foreign garrisons should be placed at strategic points throughout China.**
**6—All further remission of the Boxer indemnity should be stopped.**
**7—Full co-operation with Great Britain in providing remedies for present conditions in China.**

THE above resolutions reflect the opinion of an important section of American and British interests in China. They do not represent the opinion of all commercial interests nor do they represent the most mature thought of foreigners in China on the question of intervention. They are, however, important as the immediate reaction of foreigners to the Lincheng outrage and to the accumulation of outrages in China since the Paris conference.

They are still more important as showing how far the opinion of the Shanghai American chamber of commerce has changed towards China since 1919, when its secretary was sending circular letters to firms at home urging them to bring pressure to bear on their congressmen and senators to demand from the state department all the confidential reports about Japan's activities in China and to read them into the congressional record. The Tientsin American chamber of commerce also sent similar circular letters to firms at home in order to arouse them against the continued Japanese occupation of Shantung, declaring that armed force alone could drive them out, in effect, an appeal for American military intervention.

In less than four short years, we find the same American chamber of commerce, led by the same group, advocating a complete reversal of policy, even to the suspension of all benefits accruing to China under the Washington conference. The literal application of this resolution would carry with it the restoration of Tsingtao, the Shantung railway and mines to Japan, the return of Japanese troops for policing Shantung, and recognition of such of the twenty-one demands as were surrendered at Washington by Japan. If the benefits accruing to China as a result of the Washington conference are suspended, it means *all* of the benefits, not some of them. The other signatories to the pacts could not very well suspend their share of the benefits and insist that Japan alone be penalized, so the resolution means that the American chamber of commerce now advocates Japan's retention of her special advantages. This must be most gratifying to President Harding, Secretary Hughes, Elihu Root, Senator Lodge and other highly placed Americans who accepted at their face value the recommendations of Americans in China as to the policy they should pursue.

Taken in connection with the other six resolutions, we find the American chamber declaring that the Chinese government is now unworthy of American sympathy, that America should adopt a policy which would be more drastic and far-reaching in its effects than that which Japan advocated and which these same gentlemen condemned at the time of the twenty-one demands and were even willing to fight Japan over. Japan never advocated foreign garrisons throughout the interior. Japan never advocated seizing control of China's finances, despite the fact that China owes more money to Japan and has defaulted on more Japanese loans than she owes to other nations. Japan never advocated enormous navies on the great waterways of China. Japan never proposed to destroy completely the right of the Chinese people to find a way out of their troubled, not even in the irritating Group V. These things and more are being advocated by the same gentlemen who knowingly, or otherwise, worked hand in glove with the clique who labored to plunge America into war with Japan to save China from the application of the twenty-one demands. These things are being advocated by the same gentlemen who attacked this magazine and its editor because he could not agree to the destruction of American trade and prestige in China by the silly, coddling attitude of these same Americans during the period from 1918 to date.

Such drastic resolutions must convey to the heads of the nation at Washington how unwise it is to formulate national policies on the snap judgement of any one group and must vividly remind President Harding and Secretary Hughes that they have "lost face" because of having listened to the advice of the identical group which now calls so loudly for a reversal of policy. Experience therefore teaches them to carefully scrutinize all political resolutions and recommendations passed by Americans in China in order to determine just how far they really represent national opinion. In this case, where an appeal is made in the name of the American community as a whole for the reversal of a policy strongly advocated up to a very few months ago, and urges Anglo-American co-operation in armed intervention in China, it is of vital importance to the American government to know exactly what lies behind such a move. It goes without saying that had the American community organized itself for such an expression of opinion and the above resolutions put to a vote before a committee of the whole, they would have been voted down and others more carefully worded passed. Such a general meeting would have disclosed that the American community as a whole is opposed to intervention of any type in spite of conditions in China and in spite of the views of a small minority.

American initiative in passing such resolutions is to be condemned. Whoever drafted, passed and paid for their transmission took upon themselves responsibility for a move which singles out American interests for retaliation in the shape of commercial boycotts and other practices dear to the heart of the Celestial.

One of the greatest obstacles confronting united action on the part of the powers in bringing pressure to bear upon China is the unwillingness of any diplomat to take the initiative that invites the certain commercial retaliation of the Chinese on his own nation.

It is very unwise for a commercial association in China to ignore its consul-general and minister in communicating with its home government. It is sheer impertinence when such communications attempt to instruct their governments, and it is to be expected that all such communications will be referred back immediately to the consul-general and legation for investigation and comment. These fundamental rules of etiquette and procedure have long since been relegated to the scrap heap by American associations in China who, at the slightest provocation, attempt to dictate to Washington what to do and how to do it. For some years these peculiar duties of the diplomatic and consular service have been usurped by the group which directs the moulding of American policies in China and which transmits its recommendations for war with Japan or intervention in China as the case may be, direct to the secretary of state and the American press. It makes good copy for the newspapers and brings considerable publicity to the policy-makers. At the same time, it relieves the legation and consulates of much responsibility permiting them to attend to ordinary routine matters. Under, these conditions, the American government will soon be able to further reduce its overhead by eliminating its diplomatic representation in China and confiding its delicate negotiations to a student interpreter or fourth rate civil service clerk.

It is safe to say that the various foreign powers are kept fully and accurately informed by daily telegraphic reports from the legations of every development in China, in addition to those of the military, naval and commercial attaches. They are also kept informed of every public meeting and the trend of opinion expressed through resolutions, editorial opinion or private comment. Part of the duties of the accredited diplomatic representatives of the various powers is to act in an advisory capacity, and there is no justification for ignoring their existence except when it becomes apparent that they are incompetent or willfully neglecting their duties. When American commercial organizations ignore the presence of their official representative and transmit instructions to Washington over his head, their official representative becomes an ornament, he loses face, and the responsibility for any loss of national prestige or trade falls squarely upon those who usurp his duties. Officious meddling with delicate international questions almost compromised the nation to a war with Japan. Heroic action alone on the part of the more sober-minded element at home averted this catastrophe. It may require equally heroic action to avert another catastrophe if these tactics are to be continued.

There was just one sensible way to handle the present situation. The entire foreign community, represented by all the foreign chambers of commerce, bar associations, clubs and other bodies, should have assembled and each body passed the resolution simultaneously. Leadership in such a delicate matter should never have been accepted by the nationals of any country. As it is, it compromises Americans to exclusive co-operation with the British and ignores other equally important interests. Anglo-American intervention without the participation of Japan is not only impractical but highly prejudicial to peace and good understanding. Unless Japan is requested from the first to co-operate on an equal footing with the others and share all responsibilities, the road is paved for independent Japanese intervention with demands for indemnities quite apart from what the other powers may consider equitable. It must not be overlooked that Japan has her own grievances against China and may be forced to take independent action unless China shows some disposition to mend her ways.

The Americans who drafted the above set of resolutions have shown themselves as ignorant of their own countrymen and the policies of their government as the group who labored so hard to have America challenge Japan to " save China." They do not know that the people of America have very set ideas against intervening in the internal affairs of another country. It would surprise them to learn that firm adherance to this doctrine saved their own country from European intervention during the civil war, when Lincoln, exasperated at repeated overtures the part of peace-makers, informed the British government that any further note to bring about peace, would be considered as an unfriendly act. We insisted upon our right to solve our problems in our own way, and so created a precedent in international law that has become the basis of our attitude towards other countries placed in a similar position.

It was this principle which guided our policy with Mexico at a time when over 700 American men and women were massacred and our soil violated by the raiders of Villa. It is hardly to be expected that our government will depart from this principle in order to intervene in China, especially when at least one-half of our nationals in this country are engaged in philanthrophic pursuits which would be ruined by the adoption of a firm policy. Under these conditions, it is folly to think that the people of the United States will ever consent to the dispatch of a large force to police China. Americans will never again go crusading over the seas to make the world safe for democracy or sacrifice themselves for any other old shibboleth. If Americans ever intervene in China it will come only when the lives of all foreigners are actually in danger and then in co-operation with other powers.

As to the British, they retain the spirit, but the day is past when they can continue single-handed to regulate the affairs of the world. Great Britain has reached the limit of her endurance. In any plan of international intervention in China she can be depended to assume her share of the burden by contributing a nominal contingent of troops for police duty with a squadron for their support. It is safe to say that her participation would not exceed five or six thousand men or about the same number as might be released by the Americans from garrison duty in the Philippines for the same service. These are the realities of the situation overlooked in drafting the above resolutions, and which should have been considered and discussed before a general assembly of Americans, or even a committee representative of the really important national interests operating in China. As it is, many important American firms oppose the resolutions for the reason that they are really not beneficial to China and in no way reflect their opinion. These interests, with wide ramifications throughout the interior, feel that the resolutions will result in inflaming the minds of the Chinese against Americans and injure their business, all of which might have been avoided had they been worded differently and brought before a committee of the whole for discussion.

The truth of the matter is that no meeting of the entire chamber was held to discuss a matter of such tremendous importance, although general meetings have been held in the past to discuss matters of much lesser importance. The resolutions were drafted and passed by a sub-committee of five members in which men of training and experience in these matters were conspicuous by their absence. These facts simply mean that the resolutions do not represent American opinion but the opinion of the individuals who wrote them. This systematic ignoring of other Americans in passing important resolutions by a committee without bringing the matter up for discussion at a general meeting is working considerable harm to American interests. It was only last month that we commented on a similar incident in the matter of the protests against the National City loan to the Oriental Development Company, passed without any opportunity for the representatives of the National City Bank to say a word in explanation, yet its subsidiary, the International Bank, is a member of the chamber, and the recognized financial instrument of our government.

As to the resolutions themselves, much can be said in their favor, but they went too far and compromised the American community to a line of action completely out of harmony with our traditional attitude towards China, and which if acted upon, would have resulted in a complete breakdown of our prestige. The efforts to provoke American intervention either independently or in co-operation with Great Britain, arises from the ungrounded fear that Japan, on her own initiative, may act to protect her own interests and gain an ascendency in the affairs of China that might prove inimical to other nations. This attitude is simply a reflex of the discredited program to bring about Anglo-American domination of China through Wu Pei-fu and his henchmen characterizing western diplomacy at Peking for the past three years. The sooner this idea is relegated to the ash-heap the better it will be for all.

There has been altogether too much intervention in the affairs of China by supporting one faction against another and encouraging the Chinese to oppose Japan by raising false hopes of foreign assistance in the event of a show-down. It is entirely possible that unless the Chinese set their house in order and refrain from further outrages and indignities upon foreign lives, and meet their just obligations, that some sort of intervention may be necessary. Intervention of any kind that meets with the open or passive resistance of the Chinese people will require far more troops to guard the railways and supervise the collection of the salt revenues

than either Great Britain or America would care to send for such purposes. Unless the Chinese of their own initiative ask the friendly assistance of the foreign powers to straighten out their finances and generally reorganize their government, any departure from the rules of international procedure by armed intervention may lead to an adventure that the western nations are in no condition to carry out to its logical end. It is easy enough to start something but extremely difficult to finish it, unless the Chinese themselves are plainly in favor of outside tutelage.

Intervention of any kind means the complete negation of the nine-power treaty, an impairment of China's sovereign and administrative rights that would stand as an everlasting monument to sentimental diplomacy. It is hardly conceivable that the present American administration will take any action that might be construed as evidence of its gullibility or that might be employed by political opponents as an argument against the efficacy of the Washington conference. The political parties in America are lining up for the next presidential campaign and it is safe to predict that the mahouts of the republican pachyderm will provide a front seat in the howdah for those who put through the Washington treaties. Americans in China may shout their heads off, but it won't stop the procession. Harding will fall back on the Wilsonian policy towards Mexico and watchfully await developments, praying and hoping that our sister republicans will see the error of their ways and come to their senses before next July.

It was a foregone conclusion that intelligent Chinese would view with disfavor any movement to deprive them of the benefits arising from the Washington conference and would come together as one man to oppose foreign intervention. When the American association and American chamber of commerce declared that the joint resolutions were endorsed by Chinese bankers and merchants, it was not surprising that the Chinese bankers' association and the Chinese chamber of commerce immediately protested the statement in the following terms :—

"We take the liberty to say that owing to the continuous fight for rights and privileges of those high officials in the central government without taking any care of the general welfare, our citizens might warn the government in such a way was to awake them in the sense stated, while foreigners might be misled to think that our citizens are of the same opinions with them. It should be understood that the Chinese banking groups here are functioning in no other matters than pecuniary ones and never attempting to make any senseless suggestions to communities whatsoever. In case insistance is laid on the recommendations which will no doubt effect our rights and privileges given by the Washington conference, we, Chinese citizens, will certainly protest against the violence and seek a way for protection."

Following this plain statement, the various guilds joined in a letter to the Chinese chamber stating that none of them had been consulted before the passage of the resolutions, while prominent political leaders frankly declared that they would meet with serious opposition on the part of educated Chinese. This united Chinese stand taken in connection with the general unfavorable American comment, is ample evidence of how much harm may be done American interests and prestige by failure to discuss such important measures at a general meeting where wiser and older heads could have lent a stabilizing influence to the proceedings.

Within ten days after the publication of the American resolutions the Chinese chamber of commerce in Shanghai unanimously repudiated the authority of the Peking government. This step and the protest against the American resolutions indicate that although the Chinese are indulging in a good, old-fashioned family scrap, it is not a free for all affair. This declaration of independence may or may not have any meaning further than a warning to outsiders that the Chinese prefer to settle their problems in their own way, and if the American resolutions contributed to spurring the mercantile element to do something to stave off foreign intervention, perhaps it was all for the best.

The only road to stability in China is the organization of a representative government with which the powers can deal. Such government must be truly representative of the whole nation, a compromise effected by concessions on all sides. It must not be a government dominated by one military overlord whose authority has been consolidated by the force of arms. To hold that authority the victorious *tuchun* must occupy the provinces with his own trusted troops, a reversal to the Manchu system of preserving their power. It means the maintenance of such a huge army that no scheme of reconstruction based on disbandment could be carried out; no financial program a success.

When the Chinese have compromised their differences and settled on a representative government which all the provinces will acknowledge and support with legitimate revenues, it will not be difficult to find a way for the consortium to function and assist the Chinese to develop their many resources, and pay their debts. The real problem is to find some way to bring about this unification. If the various Chinese factions were fighting for some ideal, principle of government or provincial rights, no outside influences would be warranted in meddling in their affairs.

As the struggle is simply one for power, the time may well come when foreign governments will be justified in serving notice upon China to settle her internal differences forthwith and comply with her treaty obligations, or be haled before the league of nations for such punishment as this body may mete out.

G. B. R.

# The Pacific Rat Trap

## Forcing Japan Into a Corner: America's Duty in the Philippines

WAS the Washington conference worth while ? When we read of the plans for the establishment of a huge naval base at Singapore to defend the British dominions in Asia against the ally whose fleet for the past twenty years guaranteed them from attack by a third power, and realize that the price Americans must pay for the cancellation of this purely Asiatic alliance is an Anglo-American *entente* for the defence of mutual interests in this part of the world, it begins to look as though we had exchanged one pact in order to assure peace in the Pacific for an understanding which may land us with both feet into the very thing we hoped to side-step. There exist excellent strategical reasons why Singapore should be converted into another Gibraltar, but we cannot but deplore the lack of vision which sooner or later must convince Japan that her right to exist is being challenged.

In permitting ourselves to be hypnotized into demanding the cancellation of the Anglo-Japanese pact, Americans have been jockeyed into the position of taking Japan's place as a guarantor of British supremacy in Asia. For, after all is said in favor of the formidable Singapore base, it is admittedly aimed against a possible rupture with Japan, and when the statements of responsible British writers are taken into consideration, it implies that with the aid of America she is to be isolated, hemmed in and slowly strangled to death. This is not an exaggerated statement but the logical deduction to any impartial study of the present trend of Asiatic politics. It is difficult perhaps for writers in England and America to visualize the ramifications of the present situation or understand all the difficulties confronting Japan in working out her destiny along peaceful lines. Could they but view these problems from the standpoint of a people blocked on all sides in their struggle for existence, a little more sympathy might be shown in discussing and proposing remedies that will hasten a peaceful solution.

The Singapore base is designed for the legitimate purpose of guarding the eastern gateway to India. There is much to be said in favor of this move. It is also intended to act as a barrier to Japan's expansion southwards and when we read the statements of Mr. Herbert Sidebottom in *The Sunday Times* and of Commander Bellairs in the House of Commons to the effect that the base will be of benefit to America in case of a war with Japan in defence of China or for the protection of the Philippines, we come to the conclusion that the great lesson of the world war has been forgotten. Japan's crying need for an outlet for her surplus population and guarantees for a free access to raw materials and food products, in addition to her peculiar strategic problem in Manchuria, constitutes the greatest problem the world is now called upon to solve in a peaceful manner. Unless the western powers discard the blundering diplomacy which erected a wall around Germany, the world

is headed straight for another catastrophe in Asia. Barred from America, Canada, Australia, New Zealand and British South Africa by the exclusion laws of the white man ; deprived in China of the right to settle and own property by the closed door policy which prohibits foreigners from residing outside the limits of the treaty ports ; persecuted by irrational boycotts ; hounded out of Siberia by the Russians ; denied the right of acquiring properties in the Philippines ; villified and misrepresented by Chinese propagandists; harried by American protests and opposition to her development of Manchuria and faced with the necessity of keeping her children at home and providing for their existence through industrial growth, Japan already feels the tightening of the noose.

When Great Britain at this juncture establishes a formidable naval base designed to defend her Asiatic possessions against a possible attack from her old ally, and we are given to understand that her legitimate aspirations in China may precipitate a war with America in which Britain will be our ally ; remembering always that Russia is slowly but surely edging her way into Mongolia in order to be in a better position to oust her from Manchuria ; that China is a puppet in the hands of her enemies; it is difficult to convince the Japanese that they are not being driven into a corner where they must turn and fight for their lives.

In establishing the new base at Singapore, the British are motivated by precautionary technical considerations arising from our own vacillating policy towards the future of the Philippines. THE FAR EASTERN REVIEW has steadily maintained that the Philippine problem can be approached only from its strategic angle, and in the April 1921 issue of this magazine, laid down the following fundamental principles surrounding the international status of the islands, based on the inability of a Filipino republic to guarantee its neutrality in any future Pacific conflict or clash of races :

**" The present centre of world empire lies in India, the corner-stone of British prestige, the bulwark of Australia, the half-way house to New Zealand, Singapore and Hongkong, the base of the mighty structure of British trade and influence in Asia and the Pacific. Before the great war, the menace to the security of this empire came from the west. Gibraltar was the key, the first powerful fortress along the all-red-route to Bombay and Brisbane. With the collapse of Germany and the elimination of all danger from this quarter for another generation, the next possible menace arises from the East. Singapore supersedes Gibraltar as the strategic key to the British empire. From a position of negligible political importance, the Philippines have become the buffer between two great empires, the barrier to the expansion of the Mongolian races to the south and southwest, the guarantee to Singapore's position and the assurance to Australia and New Zealand that they will be permitted to work out their destinies without fear of Asiatic domination. On the other hand, the islands stand as a bulwark guaranteeing to Japan that her existence will never again be menaced from that direction. The neutrality of the Philippines is therefore a matter of grave importance to Britain, Japan and Australia. Like the Swiss, the Filipino must be prepared to fly to arms at a moment's notice to defend a neutrality upon which rests his precious independence."**

The subsequent Wood-Forbes report on the islands emphasized the same situation.

Since the above was written, the rubber restriction act has brought home to the British authorities the fact that their Malayan possessions (supplying three-fourths of the world's rubber output) are a most valuable asset to the empire. Aside from any consideration of its strategical importance as the " Gateway to India," Malaya demands adequate protection because of its immense intrinsic wealth. Two years ago, the Anglo Japanese alliance guaranteed these possessions against attack by any third power, relieving the British from maintaining a large Pacific fleet and naval base. With the disappearance of that guarantee at the Washington conference, Britain is now compelled to prepare against the day when her late ally may become a possible enemy. As long as the Philippines remain under American rule they provide an effective shield against any possible danger to Malaya from the north. Take away this guarantee and they become a tempting bait to any naval power seeking secret bases for submarine warfare. If Japan should acquire control of even a portion of the archipelago, British Far Eastern shipping lines and even the base and fleet at Singapore would be endangered. Should Britain get there first, the menace to Japan's existence would be even greater. If the new British undersea leviathans using steam for surface cruising be attached to the Singapore base, Japan will have sacrificed her power of defense by accepting the limitations of the Washington treaties.

These possibilities tell us that the failure of the United States to take a reasonable and definite stand on the political status of the Philippines not only stands as an obstruction to their development through outside capital, but compels neighboring nations to take every precaution for the defense of their respective colonies. The Dutch are extending their fortifications throughout the Netherlands East Indies ; Britain is creating another Gibraltar at Singapore for the protection of Malaya and India, forcing Japan to strengthen her southern naval bases in Formosa. France must follow by establishing air or submarine bases in Indo-China. It may well be that the expenditure of the huge sum for strengthening Singapore is a necessary measure of military preparedness against any unfortunate difference between Japan and Great Britain : it may also be a wise move to have a near-by impregnable British base in case the United States is ever called upon to defend the Philippines. No self-respecting American, however, will applaud the sentiments expressed by Commander Bellairs and Mr. Sidebottom. We cannot conceive of a situation in which Great Britain and America acting together, or one in which America acting alone will operate against Japan in defense of China, unless Anglo-American policies and activities in this country ultimately convince Japan thas she is to be singled out for racial discrimination in other parts of the world and economically isolated in Asia. Under such conditions it is conceivable that the Japanese cornered like rats in a trap, will stand and make their last fight. All this talk about America fighting Japan in defense of China savors too much of the propaganda emanating from Peking to precipitate a show-down between the two nations. Americans do not like to feel dependent upon Great Britain for the security of the Philippines nor do we relish the idea that we may be called upon to defend China against Japan and be the catspaw for Russia or other European powers in Asia. The insinuation that America might have cause to welcome a base and ally at Singapore will be most gratifying to those Chinafied-Americans hypnotized into the delusion that it is our bounden duty to play the rôle of crusaders and defend China against Japan. It is not very flattering to American self-esteem to be again reminded even indirectly, that we are still expected to assume the burden of fighting Japan after we have compounded our differences and look forward to a long era of peace in the Pacific. The day may conceivable arise when the Philippines will have to be defended against Japan, but we are certain that it will not come while the islands remain under American rule. We incline to the belief that the far-sighted British strategists have not overlooked the possibility that within the next decade the islands may be granted their independence, in which case the British will be just as much if not more concerned over the future of the infant republic, as Japan. We prefer to believe that this is the real danger which has influenced the British to be prepared against all possibilities, and to camaflouge their motives behind the explanation that the Singapore base will be a welcome assistance to the United States in the event of a war with Japan. It stands to reason, that if America concedes independence to the Philippines, they must either defend their own neutrality and provide guarantees that none of their many islands will be alienated under lease or otherwise, or, a large American military and naval force must remain in occupation to provide these essential safeguards for the security of neighboring powers.

It is difficult to believe that the American people will consent to carry a burden, obligating them to act as the outpost of the British empire in Asia and stand the strain of the first violent clash in any unfortunate break in Anglo-Japanese relations. The British evidently entertain no illusions about our position and are preparing against the day when we will sever our connection with the Philippines.

If Great Britain proceeds with the construction of the Singapore naval base as a precautionary measure against some unfortunate misunderstanding with Japan, it is obvious that Japan will not remain inactive. We may now expect a further extension of the Japanese base at the Pescadores or some other southern Formosan port, with France taking similar measures to defend Indo-China against a possible break with Britain. These wholly unnecessary and provocative expenditures must have their influence on the American position in the Philippines. There is just as much possibility of an unfortunate break in American and Japanese relations as there is in a misunderstanding between Britain and

Japan, not to mention complications in which France may become involved in the Far East through her activities in Europe. The French labor under no illusions about the new move. They realize that as long as the present *entente* exists, Indo-China has nothing to fear. Should the slightest cloud arise, however, they forsee the loss of one of their most valuable colonies, and elimination as a political factor in China—unless they also prepare.

The cancellation of the Anglo-Japanese alliance with nothing to take its place is certainly having results, which might be avoided by a frank declaration on the part of the United States of its intention to remain in the Philippines for a fixed period of at least fifty years. The creation of a strong buffer state whose neutrality could only be violated by bringing the United States into the war, would seem so be the one move that would obviate the necessity of these huge expenditures, or, a return to an Anglo-Japanese alliance designed for the mutual protection of their Asiatic possessions against an attack by a third party.

It is folly for Americans to accept the partial British explanation that the move is simply a precaution against some unfortunate rupture with Japan. The rupture might come over rubber or oil with the United States. The establishment of the Singapore base may be the first shot in the rubber war looming ahead. France may precipitate a situation in Europe that might strain the *entente* to the breaking point. or Russia precipitate a crisis through her moves in Central Asia. Bereft of the advantages of the Anglo-Japanese alliance, Britain would then require some strong guarantee that the eastern gateway to India could not be forced. There are many possibilities that come within the purview of the strategists once they start to manufacture reasons for the expenditure of funds for national protection. As long as the present tendency towards an exclusive Anglo-American working partnership exists, with Japan on the outside, there will be no lack of reasons for squandering public moneys on useless fortifications. It would seem much simpler for America and Britain to take Japan in a tripartite partnership that would do away with all these senseless preparations for future wars. At the same time, America should definitely settle for the next fifty years the status of the Philippines. Otherwise, the Washington conference goes for naught, and we can prepare for another era of fortress building that will undo the benefits arising from the limitation of naval armaments.

If the senseless provocation to Japan in the construction of the Singapore base is carried into execution and Japan becomes convinced that Anglo-American sentiment has crystallized into a tacit understanding that she is to be hemmed in on all sides, her people discriminated against and denied the right of entrance into the white man's countries; her legitimate aspirations in China thwarted by boycotts and propaganda and her existence placed in jeopardy, we must not be astonished if she takes the necessary precautions against being caught like a rat in a trap and condemned to a slow death through starvation or worse. There exists a large and influential party in Japan favoring an immediate understanding with Russia. Militaristic moves on the part of other powers based on the possibility of a break in Anglo-Japanese relations, after Japan willingly abandoned her former security and accepted in good-faith their policies for the preservation of Pacific peace, must sooner or later cause the downfall of liberalism in Japan, repudiation of the present cabinet and return of the militarists to power. In self-defense, this element will seek an understanding with the Soviet and then, the "fat will be in the fire." There is a way out of the trap set for Japan.

America is faced with a terrible responsibility. In order to assure our own safety in the Philippines, bring peace to the Pacific and guarantee the integrity of China, we destroyed the one effective safeguard for peace in Asia. It would appear that we have since aligned ourselves with Britain in a tacit understanding to oppose and block Japan's legitimate aspirations in Manchuria and other parts of China, while viewing with complacency the moves of the Soviet in Mongolia. As the coil tightens around the neck of Japan and far-sighted British strategists prepare against the day when the high-spirited Samurai will make their last fight for life, America stands by helpless, unable to move or correct its errors of diplomacy because of a sentimental and misplaced regard for the feelings of the Chinese and a wholly altruistic program for the uplift of the Filipino. In trying to avert war in the Pacific, we have created conditions, which, in the end, will precipitate hostilities in Asia.

It is time Americans awoke to a full realization of the facts. It may be true that the Singapore base is legitimately designed for the defense of Malaya in the event of an unfortunate misunderstanding with Japan: it may also be that it is only the first gun in a rubber war directed against the United States or a hint to France that her program in Europe is viewed with suspicion, but whatever is behind the move, there is one important fact that Americans dare not ignore.

Japan views with misgiving an action that infringes on the spirit of the Washington treaties. In her eyes the establishment of the Singapore base is almost a crime after she accepted in good faith a program which left her at a disadvantage of six to ten against either Great Britain or the United States. She accepted the four-power pact loyally and whole-heartedly and has faithfully complied with all the requirements of the agreement for the limitation of armaments. Japan views the Singapore base in the same manner as Americans would view the establishment of a similar stronghold in the British West Indies, at Trinidad, Barbadoes or elsewhere, which under given conditions would cut off our supply of rubber and tropical products from South America, nullify our Monroe doctrine and menace the Panama Canal. There is just as much a possibility of America attacking Guiana, Trinidad or British Honduras in order to acquire rubber lands as there is of Japan attacking Malaya, and if the Singapore base is a strategical necessity, a similar naval stronghold at Trinidad is just as essential.

Unless the British government abandons its project for the construction of the Singapore base, Japan must feel that she was duped at Washington. With Americans protesting against her development of Manchuria, accusing her of imperialistic designs after she has signed the Washington treaties; with other misguided foreigners encouraging the Chinese to apply and enforce a boycott for her refusal to surrender Kwantung; others insinuating that she is arming the bandits and inciting internal disorders in this country; still others clamoring for exclusive American intervention in the affairs of China; and with the knowledge that much of the present chaos is traceable to Anglo-American support to the anti-Japanese cabinets at Peking, it is no wonder that Japan is deeply moved by the trend of affairs, or that British writers insist that the day is not far distant when America must defend China against Japan and excuse their own preparations for defense by an appeal to our weakness. Can we blame the Japanese if they now feel that they have made concessions for peace under cover of which they are to be forced into a corner and compelled to fight for their existence?

The United States government has a duty to perform. There is little hope that Britain will abandon her plans for the Singapore base, so the only honorable amende we can make to Japan is to announce a definite Philippine policy that will guarantee their neutrality for at least fifty years. To do this, we may have to break some of our promises to the Filipinos. It is one thing or the other. If we live up to our program in the islands and concede their independence we must be prepared at all times to guard their neutrality by force of arms or witness their gradual absorption into British or Japanese spheres of influence preparatory to their partition and annexation by the strongest power. In any event, if the islands are to be developed and made self-supporting and strong enough to defend their own independence our entire Philippine policy must undergo a radical transformation. These are stern facts from whose logic there is no escape.

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There are other angles to the Singapore naval base which have a special interest for Americans and although some of them can be treated lightly, others compel attention. It is well to bear in mind that the present day descendents of the Malay ocean rovers who once held sway over the isles and waters of the southern seas have their own peculiar traditions and aspirations. The Filipinos, in anticipation of their independence, claim sovereignty over British North Borneo, partly held under lease from the Sultan of Sulu. After having prevailed upon the Americans to set them adrift, they will repeat the same publicity campaign to induce the British government to pack up and get out of Borneo, in which case, if the nice, benevolent parties sitting in London decline to be moved by sentimental appeals, the Japanese menace to Singapore will be overshadowed by the still graver peril of an outraged Malaya seeking the restoration of its Borneo Alsace-Lorraine. This grave possibility must cause the British strategists considerable concern and will justify expenditures for the establishment of sub-naval bases at Labuan, Jesselton, Sandakan and other points, in order

to be thoroughly prepared against the Pan-Malay movement. When seeking excuses for the establishment of the Singapore base, the British strategists might as well include this : it is just as convincing as the arguments already given publicity.

However, it is safer for Americans interested in the development of the Philippines to stick to the rubber viewpoint. The fight for oil is not over by a long shot and in the meantime Great Britain has scored the initial victory in the rubber war. American manufacturers must willy-nilly pay tribute for several years to British foresight and to an amount that may well balance that which they are indebted to us for war advances. This is an intolerable situation after we had looked forward to post-bellum world supremacy in the control of raw products for our manufacturers. However, the cold, hard facts of the situation are before us, with our government desperately trying to remedy it by appropriating the sum of $500,000 for the purpose of investigating rubber possibilities in the Philippines and South America. In any event, we cannot escape being mulcted or discriminated against for several years, or the time necessary for new rubber plantations to obtain their full growth for tapping. It will probably be another two or three years before anything definite comes of the rubber investigation or before legislation is enacted that will enable American manufacturers to free themselves from the British monopoly.

It would seem at first glance that the Philippines would appeal strongly to Americans as a rubber producing centre, but this means throwing overboard old policies and the enactment of new legislation that must revolutionize prevailing ideas about the future status of the islands. There appear to be two absolutely essential conditions to the success of a profitable rubber industry in the Philippines. First, the bars must be let down to Chinese contract labor. The Filipino may be an excellent workman, but the consensus of opinion is that he is not suitable for the heavy jungle work of clearing and planting. Second, the land laws must be repealed and modified in order to permit rubber plantation companies to hold at least 20,000 hectare tracts for twenty years with privilege of extending their grant for another twenty years.

As a corollary to the enactment of these laws, Congress must pronounce a definite policy and fix the political status of the islands for at least fifty years. Otherwise, the laws will not be worth the paper they are printed on. And, following the precautionary precedent of Great Britain, if we are to remain secure in the possession of this source of great wealth, a huge American naval base should be established at Manila, Zamboanga or Davao. If the British are justified in defending their rubber empire against possible attack from an imaginary enemy, then some way will have to found to circumvent the Washington treaties to protect our own equally valuable rubber world. Of course, the Washington treaties effectively cover the islands but we might paraphrase the British pretext and see some unfortunate future misunderstanding with Great Britain over rubber or oil, in which case the Singapore naval base would loom very prominent on our insular horizon and we would find ourselves caught in the Philippines a long, long way from home with no covering but a gee-string.

Anglo-American friendship will undoubtedly stand the strain of the oil and rubber war and eventually find a compromise to these petty struggles for trade supremacy, nevertheless, it is exactly these commercial jealousies which lead to friction and bad-feeling.

Despite the fact that we are a long way from home in the Philippines, we believe that our wisest move is to cut adrift from past policies and remodel our entire Philippine program by the enactment of new labor and land laws reinforced by a definite pronouncement of their future political status. Such a solution is best for the Filipinos, best for ourselves and the only safe guarantee to Japan, Britain and France that the islands will remain as a buffer of empire, a neutral state that will make superfluous the vast expenditures that are bound to follow the establishment of the British base at Singapore.

* * *

# Machinery Trade of China*

*W. H. Rastall, Chief Industrial Machinery Division*

THE Chinese market for industrial machinery is developing rapidly and American products occupy an important position in the trade. China imported over $41,000,000 worth of industrial machinery in 1921, of which the United States furnished an important share.

An analysis of the Chinese maritime customs, as applied to the machinery trade, provides information that is interesting as illustrating the position of the several countries in this trade. The situation is unique in that the country has long been considered as being unchanging. On the contrary, however, the situation reveals the fact that in 1921 China absorbed over $41,000,000 worth of industrial machinery. While this total is not large compared with the quantity absorbed by the important occidental countries, it is obvious that very substantial progress has been made.

The total imports of machinery into China, and the extent to which the United States and Canada participated therein are shown in the following table :—

*Total Machinery Imports into China and the Participation of United States and Canada.*

| Year | | Total | United States and Canada. | Per cent. Supplied by United States and Canada. | Total. | United States and Canada. |
|---|---|---|---|---|---|---|
| | | *Haikwan Taels* | *Haikwan Taels* | | | |
| 1902 | .. | 1,008,295 | 122,462 | 12.1 | $635,226 | $77,151 |
| 1903 | .. | 2,145,026 | 291,141 | 13.6 | 1,372,817 | 186,330 |
| 1904 | .. | 2,708,648 | 221,898 | 8.2 | 1,787,708 | 146,453 |
| 1905 | .. | 5,383,363 | 410,505 | 7.6 | 3,929,855 | 299,669 |
| 1906 | .. | 6,041,944 | 579,667 | 9.6 | 4,833,555 | 463,734 |
| 1907 | .. | 6,199,174 | 1,255,061 | 20.2 | 4,897,347 | 991,498 |
| 1908 | .. | 6,786,656 | 810,756 | 11.9 | 4,411,326 | 026,991 |
| 1909 | .. | 6,010,212 | 342,298 | 5.7 | 3,786,434 | 215,648 |
| 1910 | .. | 7,103,137 | 576,321 | 8.1 | 4,688,070 | 380i372 |
| 1911 | .. | 6,561,020 | 382,054 | 5.8 | 4,264,663 | 248,335 |
| 1912 | .. | 4,704,485 | 179,803 | 3.8 | 3,481,319 | 133,054 |
| 1913 | .. | 7,137,048 | 673,227 | 9.4 | 5,210,045 | 491,456 |
| 1914 | .. | 8,157,270 | 681,170 | 8.3 | 5,465,371 | 406,384 |
| 1915 | .. | 4,485,867 | 659,722 | 14.7 | 2,781,238 | 409,028 |
| 1916 | .. | 6,131,258 | 1,078,530 | 17.6 | 4,843,694 | 852,038 |
| 1917 | .. | 5,982,715 | 1,411,141 | 23.6 | 6,062,196 | 1,453,475 |
| 1918 | .. | 7,860,290 | 2,390,332 | 30 4 | 9,903,965 | 3,011,818 |
| 1919 | .. | 14,328,249 | 6,407,727 | 45 0 | 19,916,266 | 8,906,741 |
| 1020 | .. | 22,536,254 | 12,181,382 | 54.1 | 27,944,955 | 15,104,914 |
| 1921 | .. | 54,898,590 | 21,199,400 | 38.6 | 41,722,928 | 16,111544, |

## China an Important Market for American Machinery

It will be noted that the United States and Canada furnished $16,111,544, or 38.6 per cent. of the machinery imported into China during 1921. This, compared with a total of $18,184,978, as reported in the export returns of the United States customs (a very satisfactory check, if allowances be made for the difference in classification and the period covered), indicates that China ranked fifth in importance among the foreign markets for American machinery. Such a showing is satisfactory when it is remembered that this country ranked only twenty-eighth in 1913 and fifteenth in 1910. American machinery exports to China in 1921 were 30 times as great as in 1900.

From the Chinese point of view the information conveyed by the above chart is deceptive because the currency of China is on a silver basis. The original returns, from which these curves were prepared, were in Haikwan taels, the value of which has varied from $0.63 to $1.39 in the period indicated (1902 to 1921).

## Imports from Great Britain, Japan and Other Countries

Corresponding information regarding the participation of other countries is shown in the table, which follows. The hold which British manufacturers had on this trade prior to the war and the extent to which British interests suffered subsequently is illustrated by the figures. Marked recovery has more recently been observed, and 1921 figures show that the British total slightly exceeded that of the United States.

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*This article is intended to bring to date a report entitled "Asiatic Markets for Industrial Machinery," published by the Bureau of Foreign and Domestic Commerce, in so far as it refers to conditions in China. This report can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 60 cents. It is a book of 332 pages and provides a great amount of information regarding the machinery trade for entire Orient.

The Japanese figures are interesting as showing to what extent the manufacturers in that country supplied equipment to China during the war period, although this record has not been maintained since the armistice. It should be remembered, however, that the total volume of this Japanese machinery trade has expanded to such an extent that, even with this reduced participation, the yearly totals show consistent increase, as is indicated more clearly in the following table, which shows the value of machinery imports into China, with the exceptions of agricultural, embroidering, knitting, and sewing machinery :—

*Value of Machinery Imports into China.*

| Year. | United States and Canada. | United Kingdom | Japan. | Total from all sources. |
|---|---|---|---|---|
| | *Haikwan Taels.* | *Haikwan Taels.* | *Haikwan Taels.* | *Haikwan Taels.* |
| 1911 .. .. .. | 382,054 | 2,330,209 | 465,122 | 6,561,020 |
| 1912 .. .. .. | 179,803 | 1,762,916 | 388,475 | 4,704,485 |
| 1913 .. .. .. | 673,227 | 3,241,590 | 548,522 | 7,137,048 |
| 1914 .. .. .. | 681,170 | 3,749,149 | 852,934 | 8,157,270 |
| 1915 .. .. .. | 659,722 | 1,994,518 | 851,185 | 4,485,867 |
| 1916 .. .. .. | 1,078,530 | 2,350,903 | 1,991,031 | 6,131,258 |
| 1917 .. .. .. | 1,411,141 | 1,648,869 | 2,419,813 | 5,982,715 |
| 1918 .. .. .. | 2,390,332 | 1,313,604 | 3,569,909 | 7,860,290 |
| 1919 .. .. .. | 6,407,727 | 2,073,968 | 3,604,905 | 14,328,249 |
| 1920 .. .. .. | 12,181,382 | 5,229,026 | 3,727,604 | 22,536,254 |
| 1921 .. .. .. | 21,199,400 | 21,267,694 | 7,142,163 | 54,898,590 |

Up to the end of 1921 German participation in the machinery trade of China had not recovered, and the general conclusion is that the United Kingdom and the United States will be the most important factors in the machinery trade of China from now on. These figures also suggests that American machinery deserves more active representation in the markets of China:—

## Volume of Trade in General Types of Machinery

As further illustrating the situation in the machinery market of China, the following table shows the volume of the trade in each of the several general types of machinery enumerated in the returns of the Chinese customs :—

*Imports of Industrial Machinery into China, 1921.*

| | Total. | Japan. Value. | Japan. Per cent. of total. | United Kingdom. Value. | United Kingdom. Per cent. of total. |
|---|---|---|---|---|---|
| | *Haikwan Taels.* | *Haikwan Taels.* | | *Haikwan Taels.* | |
| Machine tools .. | 940,337 | 292,772 | 31.1 | 295,877 | 31.5 |
| Propelling machinery | 5,163,781 | 255,433 | 49.5 | 3,350,784 | 64.9 |
| Textile machinery .. | 26,792,072 | 3,622,553 | 13.5 | 11,160,313 | 41.7 |
| Brewing machinery | 634,973 | 575,626 | 90.1 | 1,311 | .002 |
| Other machinery .. | 21,367,427 | 2,395,779 | 11.2 | 6,459,409 | 30.2 |
| | *54,898,590 | 7,142,163 | 13.0 | 21,267,694 | 38.8 |

| | United States and Canada. Value. | United States and Canada. Per cent. of total. | Germany Value. | Germany Per cent. of total. |
|---|---|---|---|---|
| | *Haikwan Taels.* | | *Haikwan Taels.* | |
| Machine toola .. .. .. | 277,827 | 29.5 | 34,078 | 3.6 |
| Propelling machinery .. .. | 1,051,333 | 20.3 | 115,137 | 2.2 |
| Textile machinery .. .. | 11,768,212 | 43.9 | 131,492 | .49 |
| Brewing machinery .. .. | 58,036 | 9.1 | — | — |
| Other machinery .. .. | 8,043,992 | 37.7 | 681,435 | 3.2 |
| | 21,199,400 | 38.6 | 962,142 | 1.75 |

It should be explained that in this report the returns from the United States and Canada have been combined, because large quantities of machinery manufactured south of the border are shipped through Vancouver, and therefore important quantities of American-made machinery are credited to Canada in the returns of the Chinese maritime customs. It is true that a certain amount of error probably creeps into the figures as they are published, because some machinery manufactured in Canada and shipped to China may be credited with that from the United States.

* This value is equivalent to $41,722,928 at the average rate af exchange for the year, which was $0 76.

## The Different Markets of China

It should also be remembered that China approximates the size of the United States, and in this area there are several markets that are more or less distinct. In order that the comparative importance of these different markets may be estimated, as applying to the different classes of machinery indicated above, the data in the following table are also included:—

*Comparative Markets for Machinery.*

| Markets. | Machine tools. | Propelling machinery. | Textile machinery. | Brewing machinery. | Other machinery. |
|---|---|---|---|---|---|
| | *Haikwan Taels.* | *Haikwan Taels.* | *Haikwan Taels.* | *Haikwan Taels.* | *Haikwan Taels.* |
| Shanghai .. | 485,426 | 2,959,233 | 18,751,225 | 1,596 | 8,356,584 |
| Tientsin .. | 20,672 | 1,007,169 | 3,668,594 | — | 4,850,795 |
| Dairen .. | 286,254 | 444,750 | 671,213 | 3,621 | 1,871,501 |
| Hankow .. | 42,780 | 117,880 | 1,080,739 | — | 1,691,115 |
| Kiaochow .. | 42,470 | 161,232 | 1,944,776 | 629,913 | 407,937 |

The market for industrial machinery in China is developing rapidly and American manufacturers occupy an important, if not a leading, position in that trade, and the volume of business available there is such as to justify careful sales effort in order that the market may be developed up to its possibilities. While some of the particulars published above indicate that there is a certain amount of European competition, it should also be remembered that, for many classes of equipment, the difference between the European and American designs is such as to place these classes of equipment in quite a different grade. Therefore, the sales problem consists in educating the oriental buyers to the supeiior qualities of the American product.

* * *

# The Textile Industry in China

*By George E. Sokolsky*

THE industrial revolution in China is making itself most potently felt in the textile industry. Cotton mills, spinning, weaving and knitting mills are springing up in many provinces of the country. The following list gives the Chinese textile mills by provinces :

| | | | |
|---|---|---|---|
| Kiangsu.. .. .. | 49 | Anhui .. .. .. | 1 |
| Chihli .. .. .. | 9 | Hunan .. .. .. | 1 |
| Hupeh .. .. .. | 5 | Kiangsi .. .. .. | 1 |
| Honan .. .. .. | 4 | Shansi .. .. .. | 1 |
| Chekiang .. .. | 3 | Fengtien .. .. .. | 1 |
| Shantung .. .. | 2 | | |

Of the 48 mills owned by Chinese in Kiangsu, 24 are in Shanghai and its immediate environs. Shanghai has thus become not only the centre of the textile industry in China, but of all industry, for textile mills outnumber all other industries in the country. The large number of mills in this particular field, however, have not yet been able to displace foreign commodities nor have they displaced the ancient handicraft system of spinning and weaving. In 1922, cotton goods was imported into China to the amount of Taels 151,567,436 or 16.04 per cent. of the total import. Cotton yarn was imported to the amount of Taels 66,955,734 or 7.08 per cent. of the total imports. Together they amounted to 23.12 per cent. of the total as compared with 5.23 per cent. for machinery imported. Raw cotton was imported to the amount of Taels 41,956 187 or 4.44 per cent. of the total import. Cotton products exceeded all classified imports and amounted to more than a quarter of the total import trade of China during the bad year of 1922.

This industry which has reached such enormous proportions and for which there are such splendid prospects, is now on the verge of bankruptcy. Three steps have been proposed to meet this situation. The Chinese Cotton Millowners' Association tried to raise a loan of $30,000,000 which was to have been guaranteed by the government in Peking. The government being to busily occupied making civil war in various parts of China or compromising with bandits, was unable to do anything at all for the cotton mills. The second step is assistance from textile machinery manufacturers in the United States and negotiations on this scheme are now under way, it is reported. The third method is usual in China : the mill owners are trying to mortgage their mills to Japanese banks and

to Japanese cotton mill proprietois. It is understood that some progress has been made in this direction.

The Chinese owned cotton mills in Shanghai (23 reported) represent a capital investment of Tls. 22,535,000 and $31,200,000. Behind this stands a reported reserve of Tls. 1,028,000. It might be accepted that mills not reporting reserves have none. It is this lack of reserve which is the principal weakness of the textile mills. Instead of piling up reserves the directors of mills have been paying enormous and in many respects ridiculous dividends. The effect has been that the Chinese mills have never had sufficient liquid capital to purchase raw cotton before the crop was harvested or early in the season. Their purchasing activities have generally been limited to the tail end of the season when prices were leaping skyward. Domestic raw cotton sold at better prices to Japanese and British mills which were financially in a position to handle the early drop. As for Egyptian, Indian and American cotton, the Chinese have seldom been able to finance large shipments and have been forced to deal through jobbers, which naturally increased the price to them. Likin is another factor in this situation, as it is in every commercial and industrial enterprise in China the cost of bringing cotton down from the interior to Shanghai is often prohibitive, making it advantageous to import Indian raw cotton or Japanese yarn. China at present grown only short staple cotton and therefore is dependent upon other countries for that commodity.

The position of the foreign mill owners is as follows : British, 5 mills ; Japanese, 32 mills. There are no American owned cotton mills in China. The figure 32 for Japanese mills does not however represent the entire Japanese interest in this industry, since Japanese holdings in Chinese mills is considerable although invisible. The Japanese find it more economic to build mills in China for the China trade than to export yarn and cloth from Japan. This has been particularly true during the past few years, since the Japanese labor market has become disrupted by labor difficulties. With regard to spindles, the ownership might by stated be percentage.

| | |
|---|---|
| Chinese | 44% |
| Japanese | 40% |
| British | 14% |
| Load in fractions | 2% |
| | 100% |

The British are hopeful of regaining their influence in the industry by utilizing a portion of the returned boxer indemnity funds for the erection and management of a textile school in Shanghai. The scheme provides for all the textile trade, including spinning, weaving, dyeing, bleaching, etc. The college is to contain the most modern British appliances and accessories and the classes are to be taught by expert Britishers who are to be able to teach in both the English and vernacular languages. The underlying idea of the plan is that the Chinese mill managers of the future, having been British trained and having become accustomed to the use of British machinery, appliances and accessories, will forever after utilize British goods in this industry. The Germans are to a certain respect forstalling the British plan by establishing a machinery company in Shanghai which produces spindles and other accessories, manufactured in China where there are no patent laws. This company, it is hoped by the Sino-German promoters, will eventually manufacture cotton mill machinery and all that is necessary for the industry. The British plan nevertheless is the most consturctive thus far advocate for the utilization of boxer funds, benefitting both sides.

The labor situation in the textile industry is an important factor, for with Chinese companies poorly capitalized, they are unable to withstand labor's demands, since strikes of long duration required a financial reserve for the capitalist as well as the laborer. In China, when laborers become dissatisfied with conditions in the factories they can always return to the villages from which they came. This is one of the explanations for the tremendous turn over in labor which all industries report. According to the report of the Chinese Cotton Millowners' Association, 67,707 laborers are employed in this industry in Kiangsu province. Approximately 50,000 are employed in Shanghai. Off-hand this appears to be an underestimation, although it is difficult to ascertain the truth in any purely statistical pioblem in China. Most of these laborers come from Shanghai, Ningpo, Pootung and northern Kiangsu. Most of them are women and children and hail from impoverished peasant families. Most of them are of the class known as occasional laborers in the west, although a certain element become industrialized and settle down in Shanghai as urbanized laborers. According to estimates of the *Chinese government bureau of economic information*, the wages for men range from $1.00 to $0.05 and for women from 0.25 to 0.15 per day. The average is about $0.40 per day for a twelve hour day. Children of all ages are employed except in a few mills. Only in a few mills are any educational facilities provided for the children. Some mills have made medical and sanitary provisions. The most progressive mills in Shanghai are those owned by the Naigai Wata Kaisha and managed by Mr. Okata. Chinese mills under the supervision of Mr. C. C. Nieh and Mr. H. Y. Moh have made some progress in providing more suitable working conditions. The Ewo mills will hereafter restrict child labor.

Several devises for restricting child labor have been put into operation, almost all of which have failed because the Chinese laborers themselves favor child labor as a source of further earnings for the family. Mr. Okata attempts to restrict child labor by requiring that all workers measure at least four feet. The defects of this method are obvious, particularly since so many of the poorer Chinese are dwarfed. The other alternative is to guess the age from the face. Visits the writer made to many cotton mills convinced him that both these methods are doomed to failure and that there can be no adequate solution of this problem until the Chinese government has taken the matter in hand along Western lines, that is, by compulsory schooling and heavy penalization for the employment of children. In its present condition, China is unable to enforce any laws and therefore nothing will be done, such employers as are paternalistic will sacrifice profits by assisting their workers ; while, other will continue to exploit labor in the most brutal fashion.

The theory that labor is cheap in the Chinese cotton mill is altogether fallacious. Labor is abundant but not cheap, for the Chinese worker is physically weak, undernourished, careless and weary. He lacks in efficiency and in interest. The desire to do a job well is foreign to the Chinese worker, who expects at best to save a small sum to return to the country for an old age of idleness old age meaning from forty onwards.

With a labor problem so serious, with under-capitalization and practically no reserves, the position of the Chinese cotton mills is exceedingly difficult. But added to these, is the psychological and traditional unwillingness of the management of these mills to employ either foreigners or foreign-trained Chinese to manage the mills at adequate salaries. In most of the Chinese-owned mills the rule of thumb still holds in spite of all the developments which have taken place during the past decade in the industry. Many young Chinese study textile engineering at Ameiicon universities only to find that it is either impossible to find employment in China, or that they can find employment only at ridiculous salaries. The Chinese system of paying small salaries and the worker depending on a large bonus at the end of the year is altogether unsatisfactory. The worker gambles against the financial acumen of his employer. The textile engineer might do everything possible to make the mill modern and properous and he may fail through the supine incompetence of his board of directors. The younger, foreign-trained Chinese are unwilling to take this chance. They insist upon living wages at the outset. The old-fashioned Chinese directing cotton mills are horrified at the suggestion that they pay a mill manager a large salary. They want men to work at Mex. $150 a month, which is inadequate, with the result that they are unable to get the right type of man and they are unable to have their mills properly managed.

The lack of skilled and trained management in the mills is having the effect of demoralizing the industry. Machinery runs down, little progress is made in dyeing and bleaching, etc. The mill's progress is only in the direction of more spindles and more looms, a good half of which are idle most of the time. The emphasis on size is characteristic of the industrial development of China. Shares in companies can only be sold if the proposition is large in appearance even if not in fact Chinese investor have had several unfortunate expeiiences in this direction, for all the paid in capital has gone into building and equipment and nothing remained for operation.

# Municipal Government in China

*By Laurence Impey, A.M.I.M. and C.E.*

IN the sense in which municipal government is understood in other countries it may truly be said that in China it is still in its infancy.

The largest cities, such as Canton, Hankow, Shanghai, Tientsin, all have their own foreign concessions where such municipal undertakings as roads, lighting, water supply, drainage, etc., are carried out by the foreign committee or municipal council concerned, or by some company operating more or less under their control.

In none of these cities, with the possible exception of Canton, does there appear to be any spirit of public enterprise on the part of the Chinese, who apparently prefer to let things 'gang their ain gait,' as was well instanced by the expression used by a Chinese who had studied in both France and America, when he explained to the writer that his 'idea of a democracy was a country where he could use his own doorstep for any purpose he might desire.'

This critical comment on the uses of modern drainage will seem a trifle severe to those who are used to their own definitions of democracy and civilization, but nevertheless it is interesting as an example of how little an education abroad may influence a trend of thought moulded by ancient and accepted customs.

Peking, which is the capital of the country, is the first city in China which ought to endeavor to carry out some semblance of real municipal work, and it is well worth while to compare the form of organization which prevails abroad with that which is growing up here in the Far East.

The ministry of the interior is theoretically responsible for all the municipal governments in China, but in actual practice the work in Peking devolves upon the municipal council and the police board.

The minister of the interior holds the office of president of the municipality also, but in view of the frequent changes of government the work really devolves upon the vice-president, who is nominated by the president of the republic on the personal recommendation of the minister of the interior, and with the concurrent approval of the Peking chamber of commerce.

This vice-president is assisted by a second vice-president, under whom are four heads of departments and four assistant heads of departments, while these officers have the power to appoint the minor officials, namely, forty-two secretaries, four engineers, six architects, eight investigators, and various clerks and petty employees.

**The Peking Water-carrier**
**He supplies nine-tenths of Peking's population with water just as he did a thousand years ago**

These officials appear to correspond more or less with the mayor and corporation of and American or British town, with their salaried staff of town clerk, borough engineer, medical officer of health, and their office assistants, though it is true that the work that they undertake in China is not nearly so specialized, and the technical part of it is largely handled by the Peking police department.

As far as can be ascertained and tabulated the work of the various departments in the Peking municipality is subdivided as follows :—

### Department One

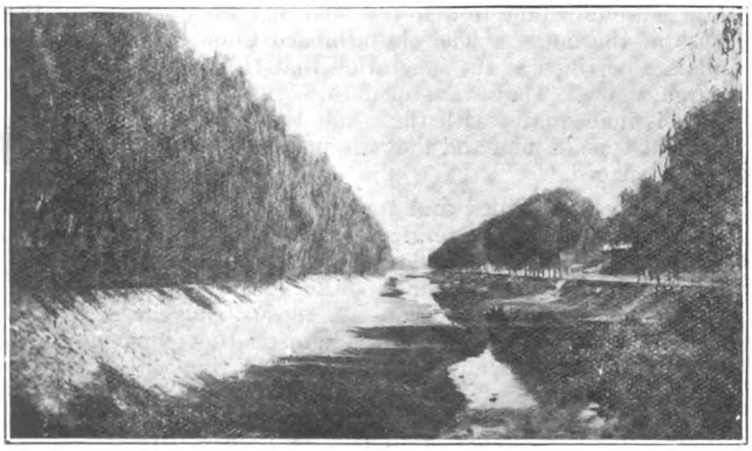
1. Correspondence Division.
   Handles all mail, notices and proclamations, superintends filing.
2. Accounting Division.
   Auditing accounts, responsible for receipt and payment of money.
3. Editing Division.
   Prepares minutes of meetings, reports, has charge of maps and books.
4. Miscellaneous Division.
   Responsible for purchase of materials, also supervision of minor employees.

### Department Two

1. Political Division.
   Handles public health affairs, industry, relief, and city business.
2. Property Division.
   Care of city property, revision of regulations.
3. Investigation Division.
   Laying out streets, issuing building permits, buying and selling property.

### Department Three

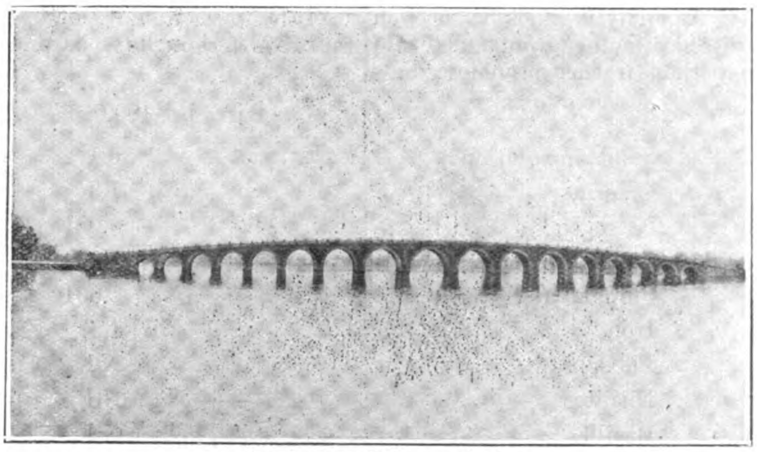
1. Construction Inspection Division.
   Preparation of estimates, inspection of construction work.
2. Surveying Division.
   Surveying of roads, bridges, sewers, preparing maps.
3. Engineering Division.
   Planning of engineering work, preparing designs and working drawings.



**The Canal South of Manchu City.**
**This serves to carry off the bulk of the surface water over a large area of Peking, and was formerly used as a moat for defensive purposes also**

Peking Roadway of the Past

**The road leading to the Palace. built in the fifteenth century, but quite unfitted for motor traffic**



An Ancient Chinese Bridge

**The graceful outline reveals the design of architectural artist of Peking**

## Department Four

1. Construction Division.
   In charge of work connected with roads, bridges, sewers, etc.
2. Estimating Division.
   Superintending contract work, preparing estimates.
3. Material and Supply Division.
   Purchase of materials, sale of materials, issuing of materials to jobs.

It will be noticed that these divisions overlap considerably from the point of view of one who is accustomed to corporation work, doubtless finding employment for numerous friends and relatives of the powers that be, but presumably rendering the satisfactory execution of work somewhat difficult owing to conflicting orders and opinions.

The money to carry out necessary work is obtained by the Council from various sources, amongst which may be mentioned taxes levied on stores, vehicles, prostitutes and their residences, theatres, the sale and mortgaging of property, and the rent of property owned by the city, all contributing their quota, totaling in all about $60,000 per month.

This sum, one would imagine, should be ample for good upkeep of the city, but in point of fact it appears to be used for various other purposes, some of them probably unconnected with municipal government, and it is stated that the minister of the interior has to meet an annual deficit, the causes of which would almost certainly vanish under the supervision of an expert accountant.

The police board appears to have the handling of considerable sums of money which are to be expended on corporation work, and it is likewise responsible for the collection of most of the taxes which comprise the revenue of the municipality.

The inside department of the police board is divided into seven sections, which control street lighting, issuance of building permits, roads, sewers, public conveniences, hospitals, and fire prevention.

**The drainage canal running south from the Forbidden City through the Legation Quarter, whence it passes through the water gate under the city walls and empties into the canal south of the city as shown above**

Peking Roadway of the Present

**Under construction, the barrow men are the ubiquitous servants of the Municipality, transporting with equal facility earth, sewage, rock, foodstuffs or passengers**

The outside department execute the above work, and superviso also the workhouse, the reform school, the city hospitals, the markets, and the city museums.

Practically all these various branches of public service come under the control of the city corporation in most other countries, being in the departments of the town clerk and the borough engineer for the most part.

The duties of the medical officer of health in other foreign municipalities are fulfilled by a board of health which functions under the police board, and which is said to control the cleaning of streets, supervision of sewers, the health of the city and prevention of infectious disease, inspection of food supplies, supervision of hospitals, doctors, midwives, and chemists and druggists.

Unfortunately the carrying out of these all-important functions is in the hands of officials who, however energetic and desirous of well-doing, have no technical training which will enable them to promote the work to the best advantage, and as a result the public have to suffer.

The city water supply is more or less independant of their control, as there is a water company, founded in 1908, which serves part of the Peking area, though the price of one cent per twenty gallons is regarded by the Chinese as so exorbitant that there are only about four thousand private customers from a city population of nearly one million people.

This water supply is taken from the Sun Ho, a river to the north-east of the city, passed through three reservoirs, clarified, and put under pressure by means of a 170-foot water tower.

There are over one hundred miles of pipe lines throughout the city, supplying the families aforesaid and also the hydrants, whence a great number of people carry their water in buckets, a man being stationed at each of the four hundred odd street hydrants to collect the water tickets issued by the company, and to supervise the distribution of the water.

An analysis which has been made of the water would seem to be quite satisfactory from a medical point of view, though the hardness is perhaps rather pronounced :—

| | Parts per 100,000 |
|---|---|
| Solids in solution | 26.4 |
| Chlorine | 1.3 |
| Nitrogen | .081 |
| Saline ammonia | .0004 |
| Sulphates | .001 |
| Iron | 1.5 |
| Phosphates | Nil |
| Nitrates | Nil |
| Bacilli | Nil |
| Hardness of water | 9.0 |

This water supply has sufficient pressure to be used for the fire hydrants, having a capacity of 300,000 gallons per hour, but unfortunately it does not cover the area of the small *hutungs* or side streets, which get their water by bucket from one of the numerous surface wells.

These surface wells vary in depth from thirty feet to one hundred feet, though various attempts have been made in sinking deep wells to three or four hundred feet without much success in striking a good flow.

The water coolie, with his wheelbarrow carrying two large tubs of water, is a very familiar sight in Peking's highways and byeways, for there are some two thousand of them in the city, united in a guild of watercarriers, an example of trade unity which is imitated by most of the coolies who are employed in industrial and other forms of labor.

Water from this source costs one cent per four buckets, and it seems that the supply is fairly satisfactory, for there is very seldom any epidemic which could be ascribed to this origin, and the demand is sufficient to enable the vendors to compete successfully with the Peking Water Company.

There is a surface water drainage system covering the city which was built some eight hundred years ago, but it cannot now be said to be very efficacious, as the hundred and fifty odd miles of sewers are built of stone blocks, which have shifted with the passing years, until much of the water percolates through the cracks, probably only half being eventually delivered to the canals which intersect the city and deal with the overflow in bulk.

The volume of water in the rainy season is such that the existing system is totally inadequate to handle it, and oftentimes the flood stands eighteen inches deep on the main streets after a storm.

In practice it appears that most of the houses use a soak-away pit for their waste water, though a good many of them have a pipe delivering into the street, in spite of the fact that the police profess not to permit this.

There is no sewerage system proper, the night soil being carried away in wheelbarrows and used as fertiliser, as is the custom in most countries in the East ; and apparently there are no bad results from it beyond the inconvenience of such a practice, and it must be admitted that in such a low-lying city as Peking, with its practically uniform levels and water-bearing soil, it would be somewhat expensive to instal the necessary sewers and pumping stations.

Under the pressure of circumstance, to wit, the number of Peking politicians who own motor cars, the roads of the city have recently been much improved, and the six steam rollers owned by the municipality are in constant use for construction or repair work.

The stone supply comes from the quarries in the western hills, and if the light railway system was used more effectively for its transportation, there is no reason why the whole of Peking should not possess metalled roads within the next decade.

The tramway system which is under preparation at the moment will doubtless affect this considerably, but in the writer's opinion it will be an unnecessary adjunct to the city, for the Chinee ares seldom in such a hurry as to need rapid transportation, foreigners are grouped in such a small area as not to require the service, the picturesqueness of the city will suffer greatly, while if the trams are a success there will be great hardship inflicted on the numberless ricksha coolies, who are already living on the verge of destitution, and whose transportation rate of ten cents per hour cannot compete with the rapid service and cheap fares on the tramways.

The upkeep of the roads devolves upon the police board also, and one must admit that they do fairly well at it, though their system of dust prevention through sprinkling water from a tub by means of a willow basket on a handle is as primitive as can well be imagined.

The annual budget for cleaning and sprinkling the main roads amounts to $144,000, while the cost of maintaining the *hutungs*, or side streets, is charged to the householders, which, in view to the fact that there is no tax on property or dwellings in Peking, is only reasonable.

The lighting of the highways is also done at public expense, electric current from the Peking Electricity Company being used in part, some incandescent gas burners in other places, while the majority of the streets are lighted by oil lamps of an inferior type.

Private houses are also supplied with electricity, but owing to the fact that the power station is badly run or that the generating power of the plant is insufficient, the lights in most of the houses are almost useless from 6 p.m. till 11 p.m. when so many people have gone to bed that the current supply improves considerably.

It must be recognized when considering the municipal organization of Peking that most of the improvements outlined above lie in the tartar or north city, which was first laid out in wide streets as being the residential quarter of the Manchu or ruling race, and this same area is now maintained by the republican government of China for much the same reason.

With the income which is available from various sources there is no reason why Peking should not have a municipal organization and government of a first-class nature, and if the open space and parks were utilized to the best advantage, the roads suitably maintained, an adequate drainage system installed, and sanitation and public health properly attended to by qualified officials, there need be no cleaner, healthier, or more attractive city throughout the Far East.

But in order that this object may be attained it is necessary that the authorities responsible for municipal government in China should have an efficient staff, properly trained and equipped with the most modern and scientific appliances and ideas.

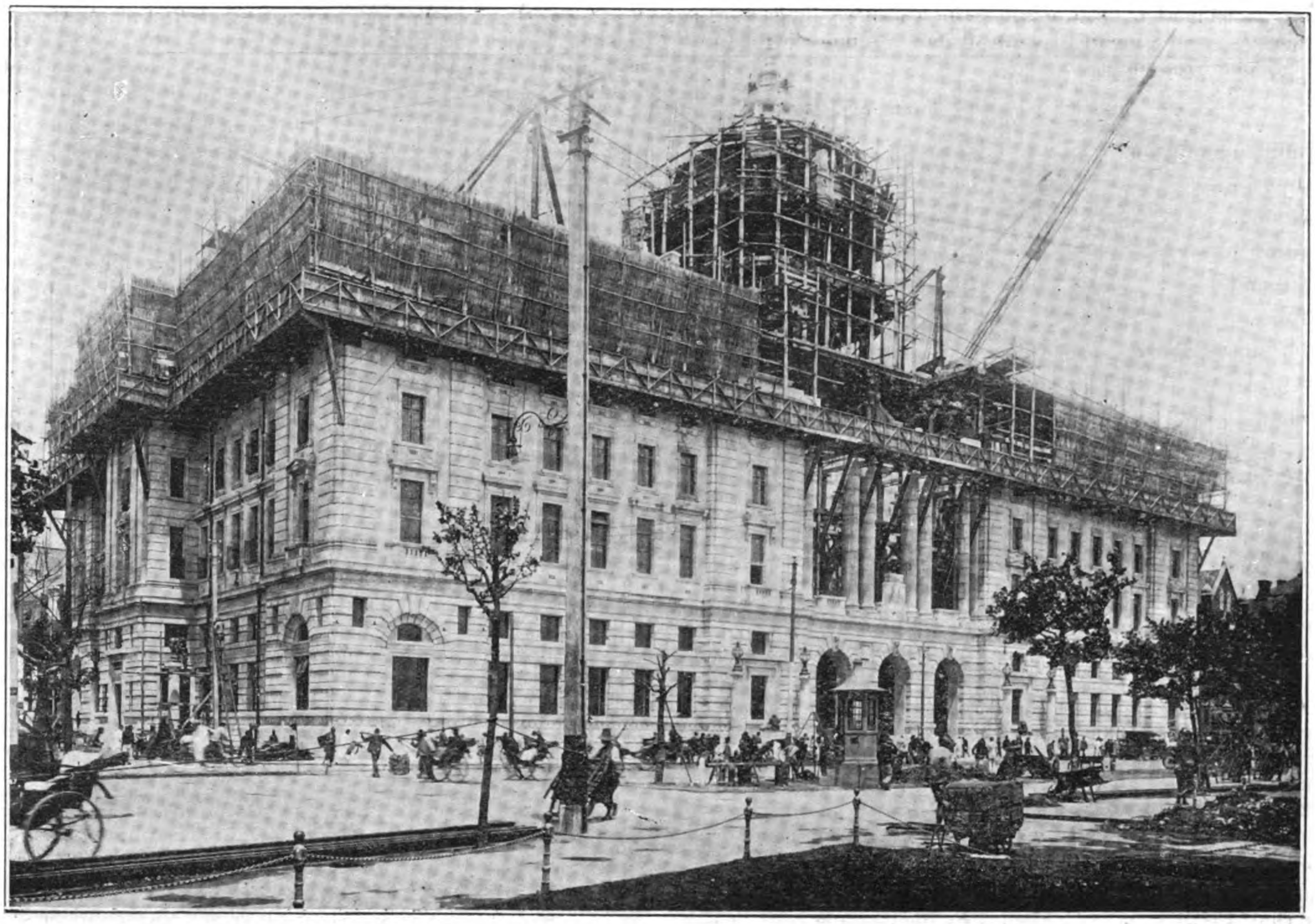
In saying this no reflection is cast upon the police force, who have achieved marvels in a province which is really outside their scope, but it must be recognized that they have not the knowledge required to advance their municipal duties with the times, and that this unavoidably results in over-staffing and incompetency, with that consequent waste of public funds which it is the duty of a municipality to avoid.

It is an interesting point to notice in conclusion, that China has arrived at her engineering achievements from a totally different direction to that taken by other countries, for whilst in Europe and America the initial steps in promulgating works for the welfare of the public have usually been taken by the municipalities and cities, who have constructed their own drainage systems, roads, and bridges, in China and also in Japan the state has been the chief motive power.

Three thousand years ago the paternal government of China- recognizing its duty to its subjects, was constructing such engineer, ing works as the grand canal, state highways which ran the length and breadth of the land, and vast national granaries in which could be stored agricultural produce against a time of famine and need.

The procedure now seems to be reversed, for while other nations are tending to place engineering construction of public importance more and more under governmental control, the Chinese are gradually turning towards the development of a municipal system, as already instanced in Peking and Canton while the responsibility for the building of state high ways and bridges has devolved upon the various provincial governments.

If this nascent spirit of municipal enterprise can be fostered and encouraged it should prove to be the foundation of a vast field of engineering, which would provide scope for the use of large quantities of articles of both Chinese and foreign manufacture, and the employment of numerous skilled technicians, while the resultant benefits to the nation in health and efficiency would be almost incalculable.



Present Appearance of the New Hongkong and Shanghai Banking Corporation's Building at Shanghai

## "WAY-FOONG"

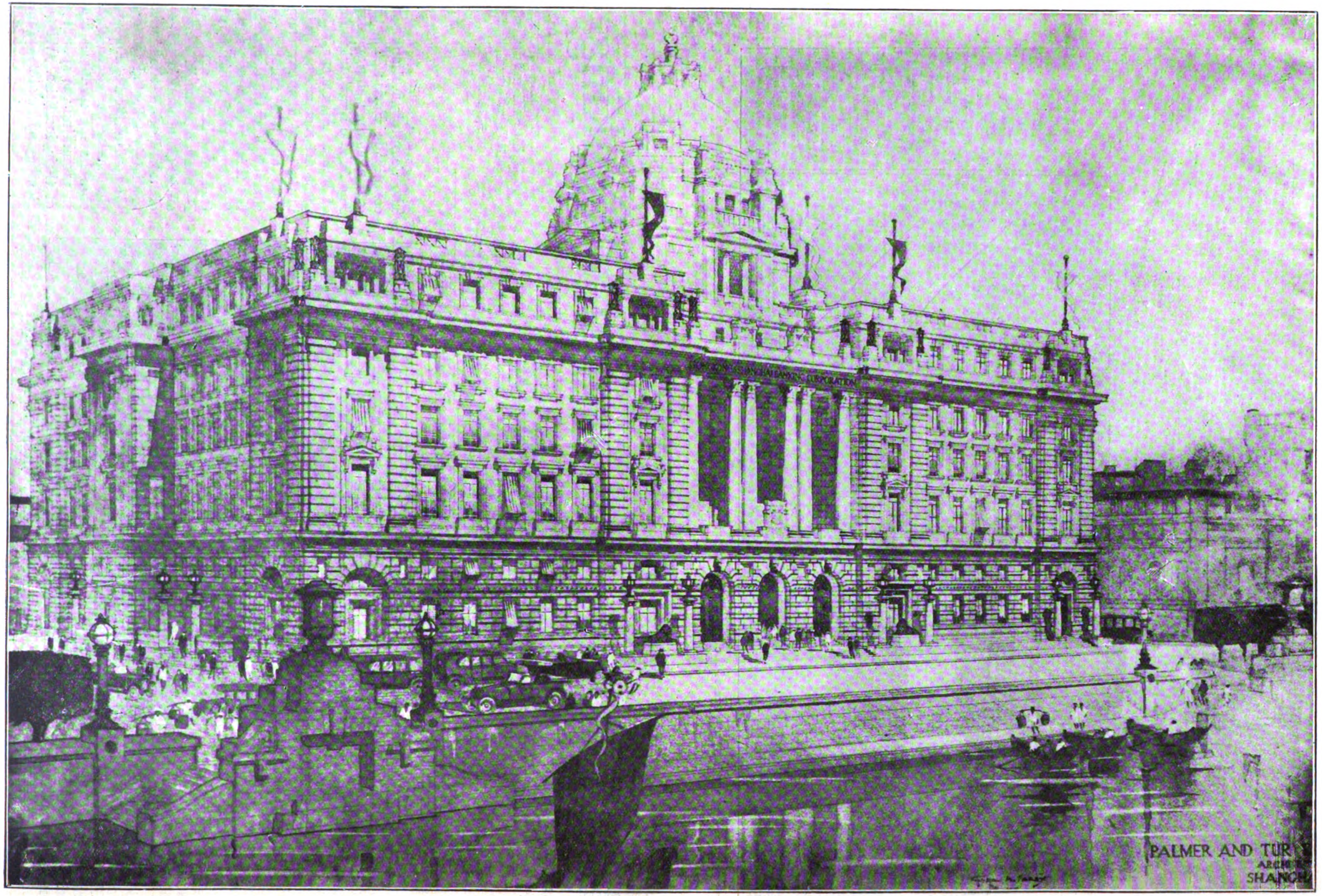
# The Hongkong and Shanghai Banking Corporation

### The Pioneers of International Co-operation in China
### Its Great Services to China and the British Empire

THE history of modern banking in China dates from April, 1845 (two years after the island of Hongkong was formally ceded to Great Britain in the Nanking Treaty), when the Oriental Banking Corporation opened a branch in the new possession. This institution was soon followed by others and in the next twenty years the following banks had established branches in Hongkong: The Agra and United Service Bank; The Central Bank of Western India The Chartered Bank of India, Australia and China; The Chartered Mercantile Bank of India, London and China; The Commercial Bank of India;

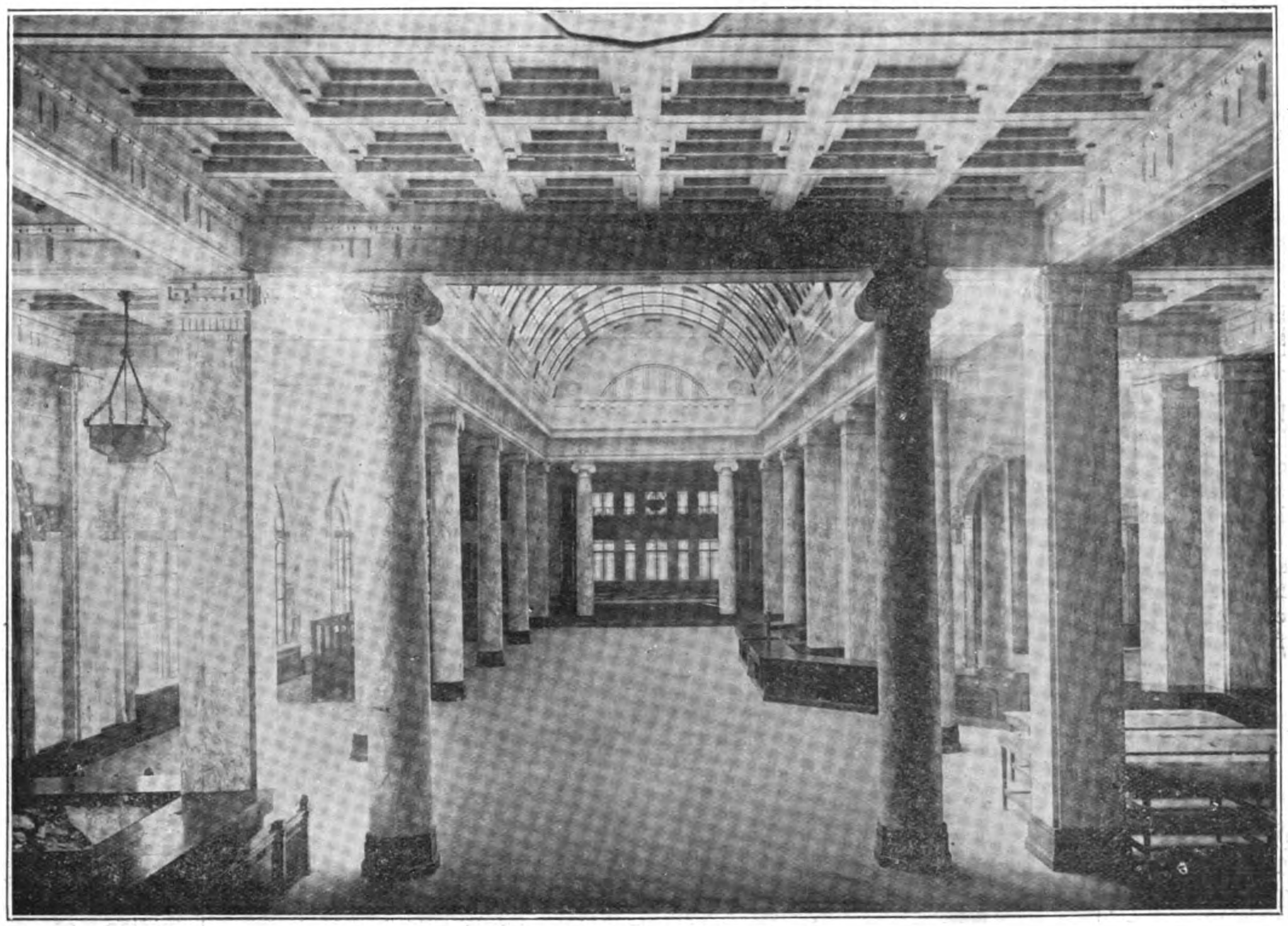
The Head Office of "Wayfoong" at Hongkong

The Comptoir Nationale d'Escompte de Paris; The Bank of Hindustan, China and Japan; The Asiatic Bank and the Bank of India. All except three of these are memories, wiped out in the great Bombay slump of 1866 and the failures which characterized the depression of the three following years. At that time the profitable opium trade was largely controlled by Bombay merchants. Any financial disturbance in this centre of India trade activity was immediately reflected throughout the ports of the Far East, where the banks were merely branches having no direct interest in promoting the special needs ot their localities. When the Bombay speculators promoted

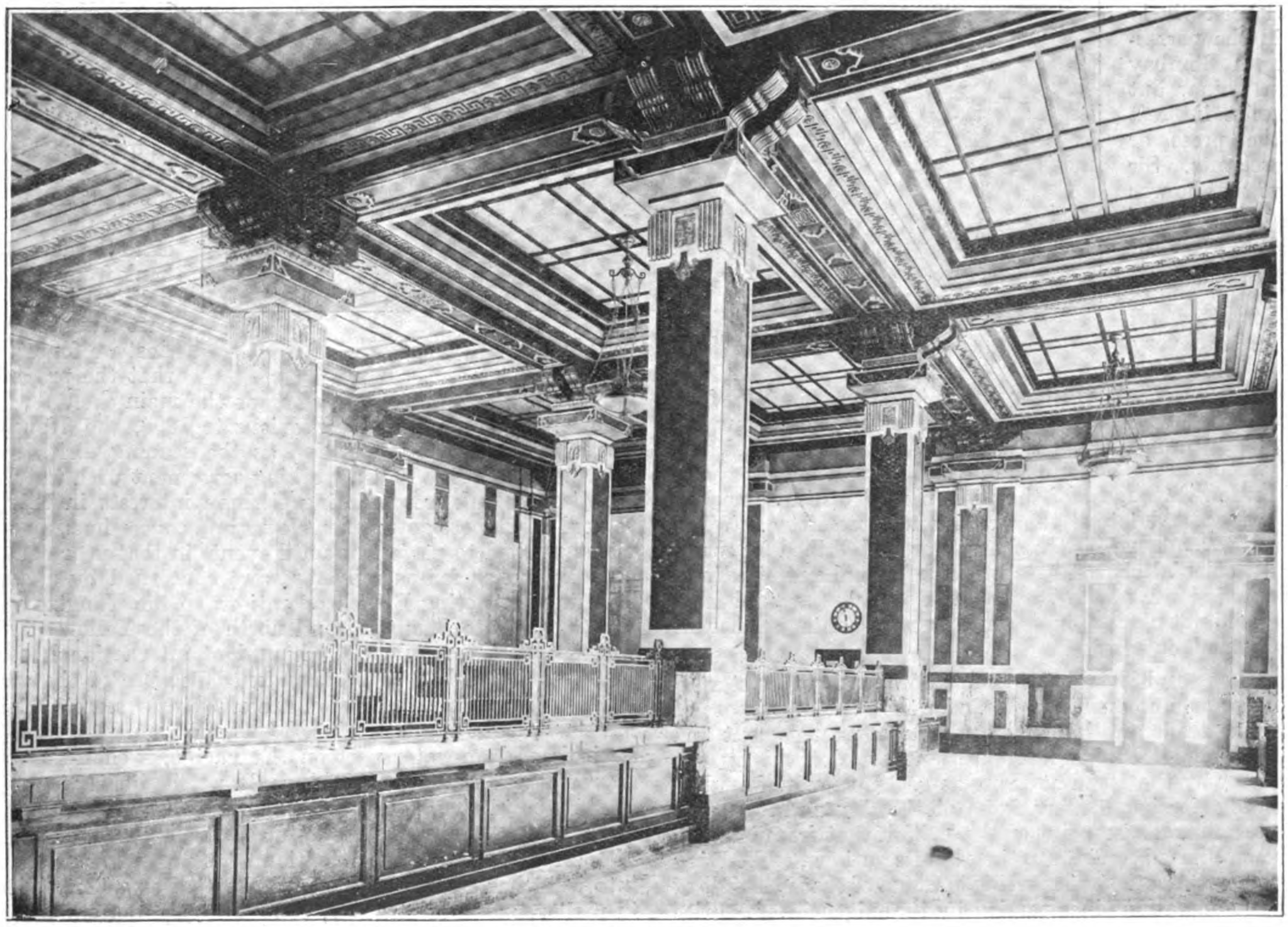



THE STATELY HOME OF THE HONGKONG AND SHANGHAI BANKING CORPORATION ON THE BUND AT SHANGHAI: AS IT WILL APPEAR WHEN COMPLETED

From a Drawing by Cyril A. Farey; Architects, Palmer and Turner; Contractors, Trollope and Colls (Far East) Ltd. The 3,700 tons of structural steel used in the construction of the building were supplied by Redpath, Brown & Co., Ltd., of London



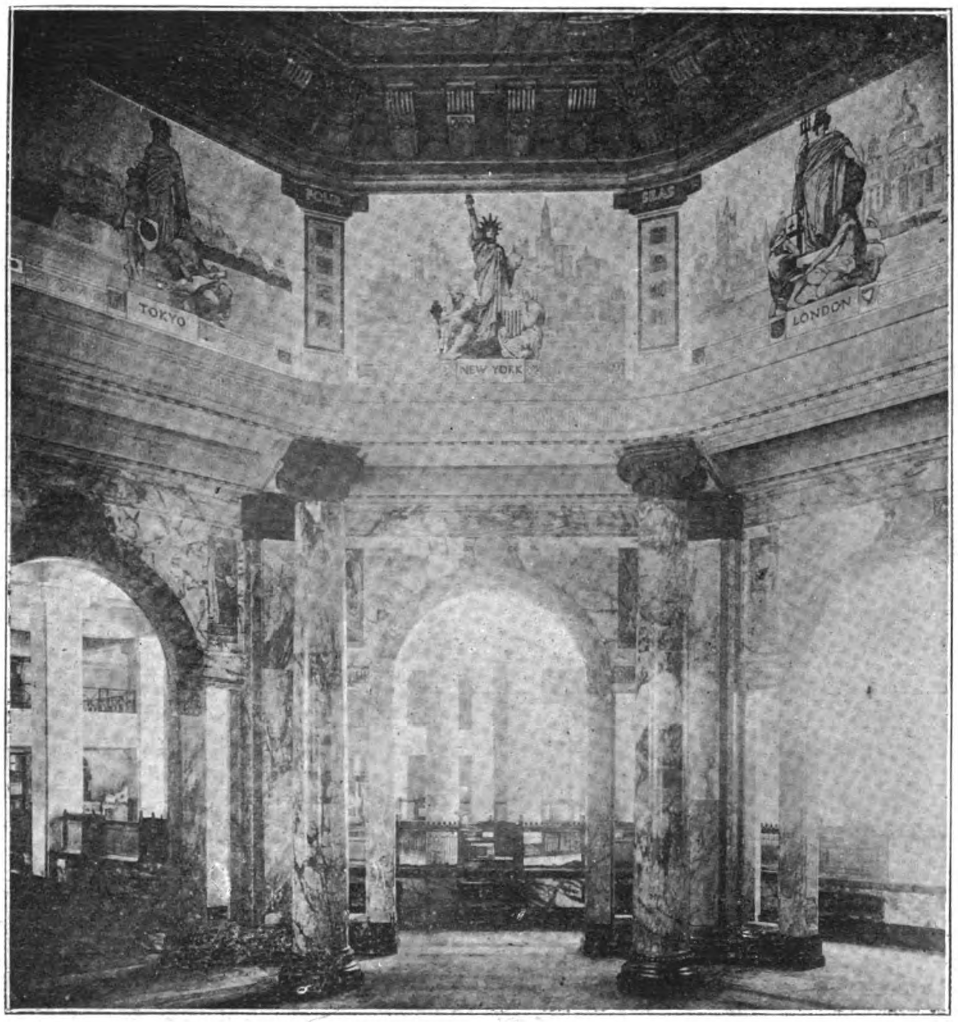
The Banking Hall: Looking North



The Chinese Banking Department

the Royal Bank of China holding the majority of the shares in their own hands, they made possible the movement which resulted in the creation of the Hongkong and Shanghai Banking Corporation for the furtherance of commerce and industry in China under a board of directors who actually lived in the country and staffed by men with an intimate knowledge of local exchange and methods of conducting business. The story of the inception of the Hongkong and Shanghai Banking Corporation has been told by Sir Thomas Sutherland, its original promotor. In 1867, he was superintendent at Hongkong for the P. & O. Company, boarding every mail steamer on arrival. On one occasion the steamer happened to be the *Ottawa* whose captain communicated to him that the wild speculators of Bombay had started a bank to be called the Royal Bank of China whose shares had all been taken up at a high premium, with the exception of a limited number set aside for subscription in China where the directors were to be found and the dividends earned. A representative of the Bombay shareholders was to arrive shortly in Hongkong for the purpose of forming the board, distributing the modest allotment of shares and superintending the inauguration of the business, and the captain urged Sir Thomas to get in on the ground floor of such a promising speculation.

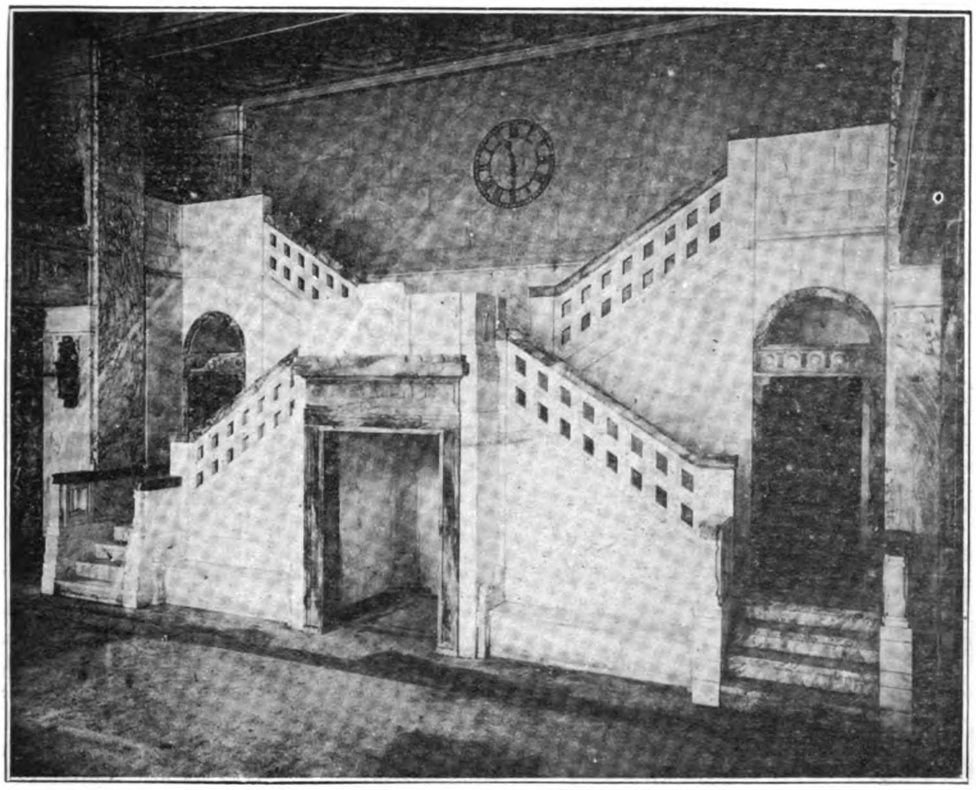
The news of this venture had been widely conveyed in the correspondence from Bombay to firms in China, but failed to excite interest either in the press or with the merchants. Sir Thomas says that he was disgusted at the idea of a great community like that of China being made the catspaw of a gang of Bombay speculators and set out to write a very modest prospectus of a local bank basing his views as to success on the same principle of co-operation as had been so successfully carried out in connection with the Hongkong insurance companies, then earning very handsome dividends. Securing the adherance of a legal friend in the promotion, within a few days most of the prominent firms in China had accepted the idea and joined the provisional committee. When the prospectus was advertised the shares were subscribed for many times over :. a colonial charter was applied for and promised and when the commissioner of the Royal Bank of China arrived from Bombay he could not place a single share or win a solitary adherant to his foredoomed enterprise.



The Octagonal Entrance Hall

The Hongkong and Shanghai Banking Corporation thus started out on its career as a co-operative bank for the express purpose of promoting China trade and industry under local management and direction in which all business propositions are decided by the local manager or by the Head at Hongkong. Among its founders were the leading foreign trading firms of the day and it speaks volumes for the liberal viewpoint of the British that from its very inception the bank has been international in its outlook, embodying in its plans the first practical adaptation in China of that principle of international co-operation since carried by the exigencies of politics to the creation of an official consortium in order to eliminate competition and spheres of special interest. The founders of the bank included the British firms of Jardine, Matheson & Company, the Sassoons, the Dents and others, the German firm of Siemssen, the American, Russell & Co., and some Parsee merchants. Its first manager, Mr. Victor Kresser, a Frenchman, was taken over from the local branch of the Comptoir Nationale d'Escompte de Paris. This sweeping aside of national trade jealousies to more better addance the general interests of the China commercial community characterized the policy of the bank until war conditions forced a severance of relations with the Germans and a more stringent adherance to purely national interests. At one time the Hongkong taipans of the German firms of Melchers, Siemssen, Carlowitz and Arnhold, Karberg & Co., all sat on the board of directors, with American interests partially represented by Shewan, Tomes & Company at a time when Mr. Tomes, the American partner, was active in the affairs of the colony. In fact, it may be said that although representative of British interests in China, the Hongkong and Shanghai Bank was built up on a solid basis of international goodwill for the advancement of foreign trade in China, the only road to real success in this highly competitive market.

This spirit of co-operation with its elimination of destructive competition has been the key-note of the bank's policy and had this spirit been accepted at the beginning in the same frank manner it was offered, the history of China since 1898 might have been written on a different and larger scale, as it is difficult to dissociate the activities of the bank from the really big political events of the past twenty-five years. Lest we forget, it is well that the present generation should be reminded of some of the main events which bear out the above statement. Previous to 1898, the Hongkong and Shanghai Banking Corporation as the leading British financial institution of China had a working agreement with the Deutsche-Asiatische Bank (representing German interests in this country) to pool all Chinese government loans and concessions, an agreement which worked to perfection until events in that year compelled its cancellation as far as railways were concerned by a new understanding restricting British operations to the Yangtze valley and the Germans to Shantung and north of the Yellow River. This was the first example of independent international co-operation in China which had to be abandoned because of the momentous political forces set in motion when China's secret alliance with Russia brought the latter into Manchuria and presented her with an icefree, deep-water port on the Pacific, a challenge to British supremacy at that time which could not be lightly ignored. Add to this the intrigues through which Russia hoped to gain an easy access to the northeast frontiers of India through the territory of China, compelled the adoption of a program parcelling China into what has erroneously been designated as spheres of influence, in reality, zones of strategy, concealing the determined moves of different nations to protect themselves against the onward march



Marble Staircase at South End of Bank

and monopolization of railway rights in the Yangtze Valley in order to eliminate disastrous competition, fair participation was offered to the Americans who refrained from acceptance. A British-French-Belgian company was called into existence for financing these Yangtze railways, creating another international combine for harmonizing conflicting interests. Had the Americans accepted the invitation held out by the Hongkong Bank's subsidiary, they would now be participating in the Chinese Central Railways, Ltd. with a share in the Tientsin-Pukow and Pukow-Sinyang lines, avoided the clash over the Hukwang and Siems-Carey upper-Yangtze contracts and forestalled the consortium as a means of eliminating international competition. The success attending international co-operation in the Hukwang loan is popularly accepted in the United States as the first application of the principle to China, a triumph for American diplomacy and finance which brought into existence the original four-power group subsequently expanded after a bitter publicity campaign into the six-power and later into the present consortium. The credit for these amalgamations to eliminate spheres of interest has been accepted by Americans as a matter of course, but a knowledge of the real facts will reveal that this spirit of co-operation was early recognized by the Hongkong Bank as the only sensible policy for the development of China's great resources. Every attempt, however, to induce Americans to reciprocate this spirit was met with a rebuff and not until the stage was set for a theatrical demonstration in the Hukwang imbroglio and later on in the Siems-Carey contracts, did Americans evince the slightest interest in co-operation and then forced themselves into the combines they had refused to join or had broken away from ; in both instances taking the credit for applying the open door doctrine.

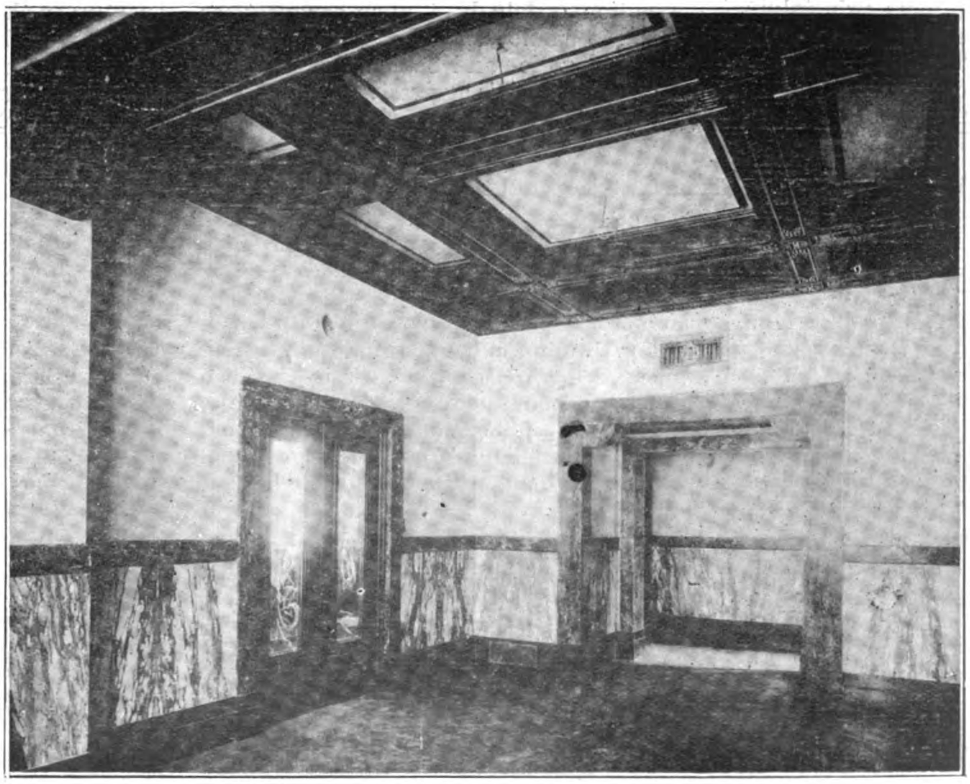
The story of the Hongkong Bank's participation in these politico-railway battles forms one of the most interesting pages of modern Chinese history. The bank has often been criticized by competitors and independent operators for its methods in advancing British interests, but when it is understood that every European railway concession extracted from Peking concealed some secret

of Russia under cover of her secret alliance with China.

Before this menace, it became necessary for the British to revise their ideas of international co-operation and protect their interests through the creation of a special instrument for the acquisition of and execution of concessions designed to counteract the plans of Russia and Germany. The Hongkong and Shanghai Banking Corporation and Jardine, Matheson & Company, the two strongest British institutions in China, stepped into the political ring by organizing the British and Chinese Corporation to carry out the policy of its government in the financing and construction of railways and other concessions for the safeguarding of national interests. Although this combination subsequently incurred bitter criticism and opposition from independent Britisih concerns, it must be said that they were fully entitled to the preference of their government, as they were on the ground, knew what was wanted, and took a chance. Notwithstanding the growls of those on the outside, it can be fairly said that the union of these two concerns has done more to advance British interests in China than all other influences put together. This combination still survives as the official instrument of its government, working at all times in the closest accord with the foreign office and legation.

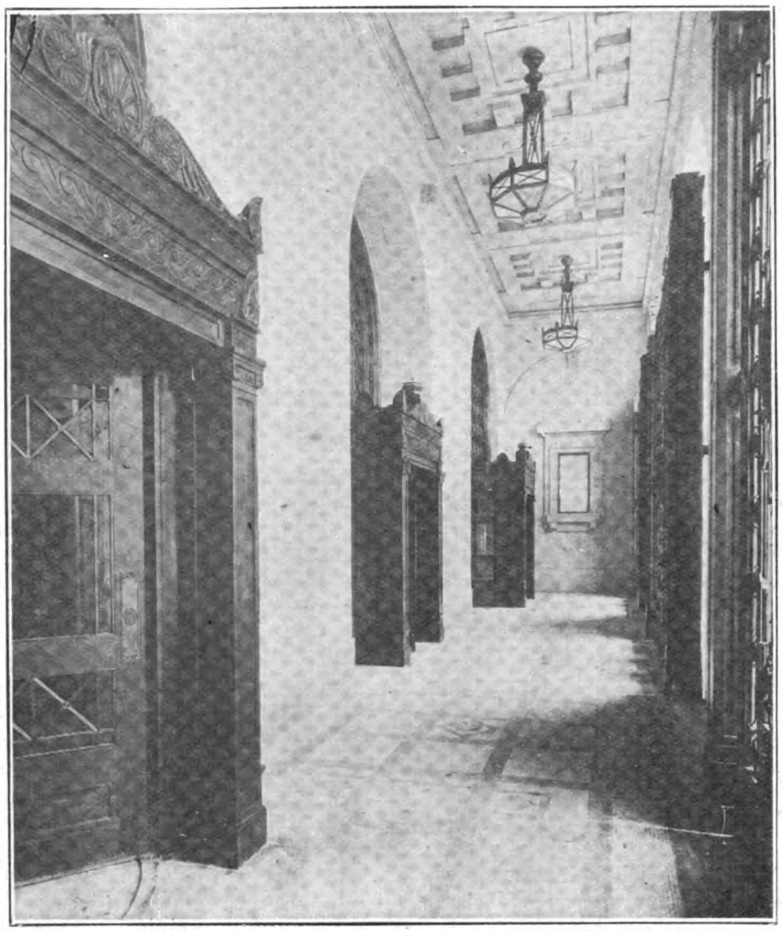
As the Hongkong and Shanghai Banking Corporation led the way towards international good-will by combining with the Germans, so it extended the glad hand of fellowship to the Americans, for in 1899, six months after the American-China Development Company obtained the concession for the Canton-Hankow Railway, the British and Chinese Corporation entered into an agreement with the Americans for the amalgamation of their mutual interests in the Canton-Hankow and Canton-Kowloon Railways and agreed to divide equally all future business obtained by either party in China. Had this early contract of co-operation been carried out, Americans would have been saved from the fiasco of the Canton-Hankow deal and acquired a half interest in the most important railways and concessions in the Yangtze Valley.

Again, when the British group led by the Hongkong and Shanghai Bank reorganized the Central Chinese Railways, Ltd., for the acquisition



Compradore's Office

political move on the part of the Russo-Franco-Belgo group to place the British at a disadvantage, it is not to be wondered at that the official instrument of the British government was compelled to be always on the job at Peking with both eyes open in order to counteract the moves of their opponents. Other independent British banks might easily have been selected by their government to act as its instrument in China or been permitted to participate in the monopoly, but it is safe to say that any such combination would have invited disaster to British diplomacy in China. Through being on the ground with full and accurate knowledge of every move made in Peking or throughout the provinces, the Hongkong Bank has at all times been able to correctly estimate the importance of political contracts made by other nations and act on the spur of the moment in matters which other foreign banks or an unwieldy British group would have had to submit to a board of directors sitting on the other side of the world.

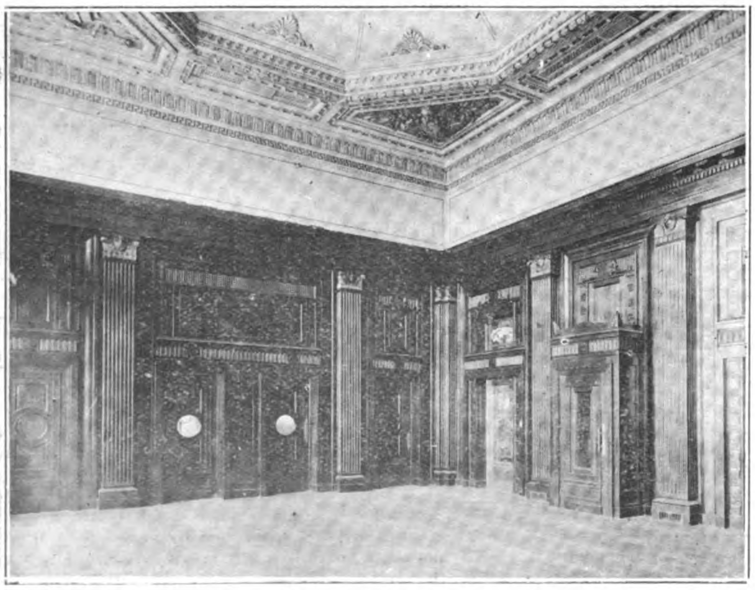


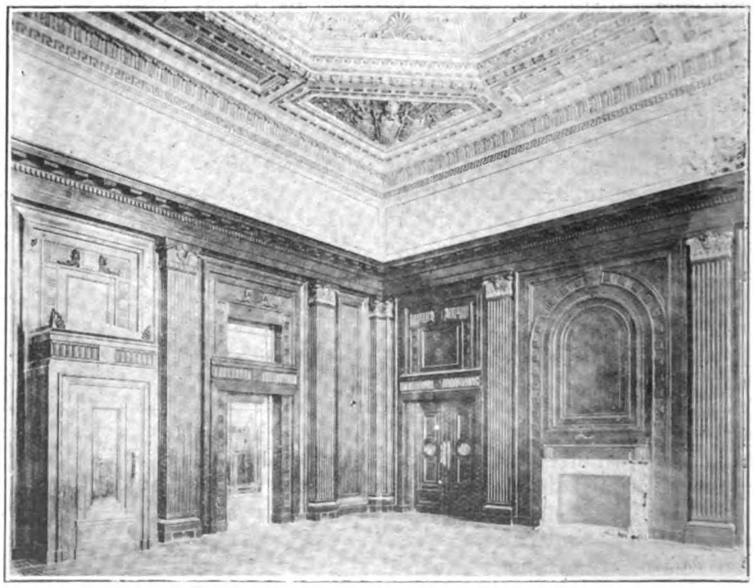
The Portico

The new international consortium and the Washington Treaties has saved China from partition and eliminated spheres of political and commercial interests, but it is well to recall that these safeguards to China's integrity are only the culmination of years of constant vigilance on the part of the British legation working at all times in close accord with its efficient financial ally, the Hongkong Bank, supported by the moral force of the open door doctrine. Every move made by Russia under cover of her secret alliance with China was at once checkmated in a practical manner by the ever watchful group at Peking. There was no time to discuss principles with a nation openly bent upon conquest, so diplomacy to be effective had to employ immediate and practical methods. This combination of legation and bank co-operating to checkmate China's duplicity and Russia's aggressiveness, resulted in wringing counter concessions from China for the protection of British interests.

It is well to recall briefly the high points of this desperate battle of concessions on which depended the life of nations and empires, and which, through ignorance of basic facts has been construed as a cold-blooded attempt to parcel China into spheres of commercial interests preparatory to her partition. At that time Russia was the menace to world peace, with her plans set for the subjugation of China and Japan and the ousting of the British from India. Thwarted in her attempt to reach India through Afghanistan and Tibet, Russia sought to reach the northeast frontiers of India through the territory of China, assisted at all times by her European ally and financial agent. When Russia secured her hold upon Manchuria as a result of her secret alliance with China of 1896, she openly extended her sphere of influence into North China, extracting promises from the Chinese government that all railways north and east out of Peking should be built by Russian capital. In order to save the Peking-Shanhaikwan Railway from falling under her control, it became necessary in 1898 for the British to act quickly and make a loan of £2,300,000 to the Chinese government secured on the physical property and earnings of this line and to tie it up under British direction for 45 years. The combination on the ground advanced the funds through its subsidiary, brought the railway under British influence, saved Peking from Russian domination and China from partition. Unless backed by the weight of military power, the open door doctrine would never have operated to save China under these conditions. It required prompt action of a definite character. The Hongkong Bank with its headquarters on the ground supplied the action.

It then became necessary to confine Russia's activities to territories north of the great wall in what is known as the Scott-Muravieff convention of 1898. Within a few months however, Russia was breaking her pledges by working with the Belgians to obtain the Peking-Hankow Railway concession which would





Manager's Office

bring her into the heart of the Yangtze Valley. Always alert, the British soon discovered the connection and protested to China against conceding this right to Russia. The British minister was solemnly assured by the Chinese government that Russia had no interest in the concession. Four days later, the concession was signed, disclosing that the Russo-Chinese Bank had been nominated as the fiscal agent of the loan in China. For this breach-of-faith China was compelled under an ultimatum to concede to Great Britain compensatory damages which took the form of five railway concessions which were at once transferred by the foreign office to the official group headed by the Hongkong Bank for execution. Again, the combination worked without a hitch to preserve China from the consequences of her own folly and incidentally erected certain essential barriers in the Yangtze region to any further Russian advance through Chinese territories towards her ultimate goal in India.

The British felt comparatively safe with Americans holding the southern section of the great north and south trunk railway and were willing to split fifty-fifty with them in all future concessions. The Americans dragged along their work and the shares of the American China Development Company offered for sale on the open market were bought up by the Belgians until they acquired the majority, when they insisted upon taking over control. The old connection with Russia still held, and once more British interests were menaced by the possible transfer of the American concession to a group working as the agent of their traditional enemy.

The British patiently awaited developments and when, under pressure of Chinese public opinion, the Americans consented to a cancellation of the concession and indemnification for work accomplished and loss of prospective profits, their chance came. In order to recover the concession, the Chinese had to pay the sum of $6,500,000 gold, and as usual, had no funds. The Hukwang Viceroy applied to the German Bank for a loan and while negotiations were being carried on in Peking, the British got busy and within a few days raised the money from the Hongkong government, handed it over to Viceroy Chang-Chih-tung in return for a promise that if at any time in the future foreign capital was necessary to build the line, the Chinese would first apply to the British. So when the Americans stepped out, the British stepped in, destroying any possibility that this important strategic and commercial artery might again fall into possession of her enemies and used as an instrument to undermine her position in Hongkong. Another instance of the close working of the combination whose success was due entirely to the fact that it included a bank which did not have to refer matters to a board or a group directorate sitting in London. Although the financing of this railway is now included in the four-power Hukwang loan, the important section between Canton and Hankow is to be built, equipped and managed by the British participants, a triumph for the Hongkong Bank.

That cordial spirit of co-operation which lies at the bottom of the Bank's present prosperity, together with its willingness at all times to assist any legitimate scheme for the development of China may be better elucidated by the following story. When Dr. Sun Yat-sen received the mandate to create a national railway corporation for the financing and construction of a national system of railways, he was ridiculed as a dreamer, because he had the vision to look far into the future to the time when China would need 100,000 miles of railways. The public did not know that this preliminary scheme for publicity purposes was afterwards trimmed down to an immediate working scheme of 10,000 miles of well designed and urgent lines. When the map and outline of the scheme together with Dr. Sun's and his representative's credentials were laid before Sir Charles Addis, the London manager of the Hongkong and Shanghai Banking Corporation, and he was asked his opinion, he did not laugh or jeer and call it a dream. The Hongkong Bank knew every foot of China, its needs and the possibility for development. It knew that a railway between any two capitals of China, under efficient management, would prove profitable. The dream of Dr. Sun Yat-sen is the vision the Hongkong Bank has always before it, the goal of its endeavors, and it took Sir Charles just ten minutes to make his decision. There was no hesitation, no long drawn out directors meetings, conferences with the foreign office or requests for preliminary surveys and assurances that the lines would pay: Sir Charles simply said "*we will take every mile of railway that Dr. Sun can give us.*"

Instead of remaining in London and concluding a preliminary agreement with the Hongkong Bank which would have settled the question of international co-operation and the elimination of the spheres of influence, the representative of Dr. Sun, at the invitation of the American group, proceeded to New York to give the latter the prestige of signing this epoch-making contract, arriving in time to have President Wilson withdraw support to the American group and destroy all hopes of an international deal. There were any number of American financiers willing to take over a Chinese railway contract after they had sent out a commission (to be paid for by the Chinese government) to report on the feasibility of the lines and their earning capacity. The difference between this attitude and the prompt decision of the Hongkong Bank is one of the reasons why the latter now dominates the financial world of China, the difference between an institution specializing in its own field and the working of banking groups who attempt to cover the world.

This same spirit of co-operation was again evidenced in the independent British contract signed by Pauling & Company for the financing and construction of the Shasi-Singyfu railway. Although it interfered with what was generally accepted at that time as a monopoly of the official group, the Hongkong Bank swung into line with Erlanger & Company (Pauling's bankers) jointly guaranteeing the issuance of the loan for £12,000,000. It meant the opening up of China, greater prospects for trade in general and increased profits for British manufacturers. In the following year when another international company was organized in Paris by the Chinese government for the financing and construction of a national system of railways, in which the French and German official financial groups guaranteed their respective constructors, the Hongkong Bank once more stood beside Erlanger and Pauling and guaranteed the British share of the financing, amounting to £25,000,000. At that precise moment, the American government did not believe in international co-operation and killed this scheme to eliminate the spheres of influence by refusing to support the American participant.

These typical incidents bear eloquent testimony to the broad policy of an institution whose first concern is the advancement of the general interests of the community it serves, bringing into prominence a truth that is sometimes lost sight of by other foreign traders in bemoaning their inability to compete with the larger British concerns whose success is due to the same basic principle that has carried the Bank to its enviable position in China. Like the Hongkong Bank, the premier British traders are China hongs first, last and always, indissolubly linked with the welfare of the country. They are not international traders with branches and ramifications covering the globe, but special firms having their headquarters in Hongkong, Shanghai, Tientsin or Hankow as the case may be, deciding all matters of business on the ground without reference to a board of directors at home or handicapped by market conditions and commitments in other parts of the world. Like "Way-foong," the names of "Ewo," "Taikoo," Soey Chee," (now changed) "Laou-kung-mow," the American "Sun-Chong," and many others, convey to the Chinese and old China-hands a significance that can never be attained by an international firm. They belong to China, and prosper or decline with the fortunes of the country. They are here to stay.

In an article in a recent number of *Trans-Pacific*, Mr. George Sokolsky invited attention to the same situation in the following words:

"A Bank is the same sort of an institution on main street that it is in New York and London. When it serves the interests of its neighbors and inspires confidences in itself, it succeeds. In China, the criticism of the foreign banks has been that many of them are sublimated exchange shops. They do not participate in the business of the community. They do not associate themselves with local development movements. They do not lend money for local industrial enterprises. Their business consists largely in forward bills, exchange transactions and current accounts. The fact that so many banks refuse to lend money on mortgages, and are unable to assist their nationals in new enterprises, hampers the growth of their national interests in China."

"If one studies the foreign settlements in China, one finds that in each one the local enterprises are largely British controlled. In Shanghai, the metropolis of the Orient, the tram system, the telephone company, the principal ice company, the gas company and the water works are British owned. The electricity department is Municipal property. Of nine Municipal Councillors in Shanghai, six are British, two Americans and one Japanese; the British predominate because they own or control the largest amount of property. During the student movement, when a wave of pro-Americanism manifested itself in Shanghai, a number of Chinese property owners offered to register their land in the American Consulate on condition that American financial institutions took up the mortgages with which British banks had accommodated them. No American banks offered to do this. They had no authority. They would have to consult an office in New York."

This tells the story of British success in China. They send out their best men, who look forward to a life-time of service in the country. They become a part of it, investing their savings in local enterprises and property. Their machinery for doing business is complete and when it comes to the larger matters affecting national prestige and interests they have the largest foreign bank in the world, whose directors are "Johnny-on-the-spot" to work in with their legation in a practical manner to solve delicate matters that would take months for a foreign board of directors to understand.

Apart from its activities in financing the various British built railways in China through its subsidiary, the Hongkong Bank has been the principal factor since 1874 in financing the Chinese government. At that early date and at a time when its fortunes were at a low ebb, it placed a loan of £600,000 with the Imperial Chinese government. Following this initial loan, various advances were made to China in the next fourteen years : 1877, £1,604,276 : Eight per cent. silver loan Shanghai Taels 1,949,500 : in 1881 also a silver loan of $4,384,000 : 1885, £1,505,000 : and another 6 per cent. loan of £750,000: 1886, 7 per cent. silver loan Shanghai Taels 767,200; 1894 Tls. 10,000,000 : 1895, £3,000,000. It was not however until after the Sino-Japanese war of 1895 that the opportunity came for the Bank to assume its natural leadership in financing the Chinese government. In the following year it was called upon in combination with the German bank to advance the first instalment for the war indemnity amounting to £16,000,000 at 5 per cent. to run for 36 years and in 1898 this was supplemented by a further loan of the same size at 4½ per cent. to run for 45 years, both loans being secured on the customs revenues. These loans gave the Hongkong Bank its great prestige in China, as since 1911, the customs revenues have been deposited each month in the branches of the bank to the credit of the Chinese government subject to withdrawal by the head of the customs. In 1898, when the Germans were intriguing to have one of their men succeed Sir Robert Hart as inspector-general of customs, in order to safeguard their interests in the huge loans secured on its revenues, the British exacted a promise from the Chinese government that as long as British trade predominates in China the inspector general of customs shall be a British subject. In thus protecting its clients who subscribed to the two loans of 1896-98 the Hongkong Bank working in close harmony with its legation scored the biggest victory that has come to foreign financiers in the history of China. Other banks entering the field later on and failing to reap the benefits arising from being designated as a depository for Chinese government revenues, have at times misunderstood the Bank's position and charged it with manipulating government funds for the advancement of its special and national interests. These charges were renewed last year through a mistaken idea of the conditions underlying the handling of these funds and were suitably answered by the *North-China Daily News* in the following editorial :—

"The funds of the two services (Customs and salt gabelle) mentioned are distributed among certain banks, British included, but they stand in the names of the heads of the customs and the gabelle and are dealt with entirely as they direct. The only authority which any British bank would recognize in refusing to pay out would be an order from the British Supreme Court, and it is practically impossible to imagine any conditions under which such an order would be given. It may be said that instances have actually occured in which pressure was put upon the British banks to hold up customs money, which attempts completely failed. It will be recognized, of course, that there are certain loans which are a first charge upon the customs and salt revenues by agreement with the Chinese government, and the heads of these services will see that the interest is duly paid—just as the Inspector-General of Customs recently incurred the Chinese government's wrath by declining to part with moneys earmarked for the service of certain internal Chinese bonds. But this is a very different matter from saying that the British banks simply help themselves as they please and hand over what is left to the depositor."

Following the two large loans secured on the customs, the Hongkong Bank in 1905 furnished the Chinese government with a five per cent. gold loan of £1,000,000 and in 1912 subscribed for its share of the £25,000,000 reorganization loan divided amongst the five powers and employed by Yuan Shih-kai for strengthening his position. The salt revenues given as security for this loan carried the provinsion that the revenues should be paid into the issuing banks in China to the order of the inspector-general of the salt gabelle. The benefits arising from the handling these large revenues once more testifies to the wisdom of the banks who advanced the loan to China on condition that collection of the revenues be placed under foreign supervision. Although the Chinese claimed that the salt revenues properly managed would bring only $40,000,000 into the treasury, the estimate of the banks was about $25,000,000. In ten years of efficient supervision the total salt revenue paid into the group banks designated as depositories in 1922 after deducting administrative expenses, was $85,633,000 while $31,668,000 was retained by local authorities.

In addition to its loans to China, the Hongkong Bank has also issued some loans for Japan and last year issued one for £2,000,000 to the Siamese government for railway construction, which at persent stands at 8 per cent. premium. When, several years ago, the Hongkong government decided to provide a savings bank for the masses, arrangements were made with the Hongkong Bank to open a savings department which has proved a great boon to the public. A similar department is attached to the Shanghai branch.

Simultaneously with the opening of the head office in Hongkong the branch at Shanghai commenced business and other branches were later opened in the following cities : Amoy, Bangkok, Batavia, Bombay, Calcutta, Canton, Chefoo, Colombo, Dairen, Foochow, Haiphong, Hamburg, Hankow, Harbin, Iloilo, Ipoh, Johore, Kobe, Kuala Lumpur, London, Lyons, Malacca, Manila, Nagasaki, New York, Peking, Penang, Rangoon, Saigon, San Francisco, Shanghai, Singapore, Sourabaya, Sungei Patani, Tientsin, Tsingtau, Vladivostok, Yokohama. Once opened, no branch has ever been closed.

The original capital of the bank was $2,500,000, increased to $5,000,000 in 1872. Further additions brought it up to $10,000,000 in 1891, and in 1907 it was raised to $15,000,000. At an extraordinary meeting of the shareholders, held May 28, 1921, the authorized capital was increased to $50,000,000, of which 160,000 shares of $125 are issued and paid up, a total of $20,000,000.

So successful were the operations of the bank up to the end of 1916 that the accumulated reserves aggregated $33,000,000, or more than double the capital at that time. By the end of December, 1922, the sterling reserve was £4,500,000 equivalent to $40,373,831 and a silver reserve of $24,500,000, with cash assets of over $84,-000,000, which included $24,700,000 in coin lodged with the Hongkong government against authorized note circulation. The bank had in circulation $41,883,655 in notes issued against securities and coin deposited with the Crown Agents for the Colonies, their trustees and the Hongkong government. These British government, Indian, Colonial and other securities held by the bank amounted to $103,013,844, which, with the cash deposited with the Hongkong government maintains the value of the note issues. On this date the bank had $366,620,124 in current accounts and $135,710,948 on fixed deposits.

The accounts of the bank are made up annually to December 31, and submitted at Hongkong in February. The shareholders in London register their dividends on advice by cable of the accounts having been passed. For each of the thirteen half years to December, 1913, the dividend was £2 per share, with a bonus of 5s. per share each time for the second halves of 1908, 1909, 1910, 1911, 1912 and 1913 ; for the first half of 1914, £2, 3s. per share ; and for the second half of 1914, £2 3s per share, with a bonus of 5s. per share. For 1915, 1916 and 1917, £4 6s. per share was paid each year ; for 1918 £4 8s.; and for 1919, £4 10s. with a bonus in addition of 5s. per share for 1915 10s. per share for 1916, £1 per share for 1917, £1 10s. per share for 1918 and £3 10s. for 1919.

On account of 1920, £3 per share was paid in August, and in January, 1921, a final dividend of £3 per share was announced, together with a bonus of £2 per share, making a total dividend for the year of £8 per share.

On August, 1922, an interim dividend of £3 per share was declared and a final dividend of £3 with a bonus of £2 per share, a total of £8 per share for the year, a total of $10,864,170 in dividends, or over 50 per cent. on the paid up capital of $20,000,000.

The bank has been fortunate during its long period of progress in the large number of far-sighted men who have guided its policy. The most prominent of its managers was Sir Thomas Jackson, Bart., who served from 1876 until his retirement in 1902 and is now honored in Hongkong by a fine bronze statute fronting the bank. On his death, the chairman of the court of directions paid the following tribute to his memory :

"Great and many as were the public services he rendered, his most enduring monument is the standard of commercial morality he set throughout the Far East. Nothing that was not generous, nothing mean or underhand, could abide his presence, and he leaves to those who follow a noble inspiring example of unselfish devotion to duty"

This stands at the foundation of the bank's policy, adhered to by his successors in office who have carried it to its proud position in the financial world of to-day. Mr. N. J. Stabb (now Sir Newton) was appointed chief manager of the bank in 1910 and was succeeded by the Hon. Mr. A. G. Stephen. Sir Ewen Cameron, K.C.M.G., was manager of the Shanghai branch from 1873 to 1889, and as the able lieutenant of Sir Thomas Jackson in Hongkong is entitled to rank as one of the founders of the bank. He later became manager of the London branch, was honored with K.C.M.G., for his advice to the British government on Chinese financial affairs, and retired on account of ill-health in 1905.

Sir Charles Addis, after a long career in the Far East, was appointed manager of the London branch in 1905, and continues to occupy that position. He was knighted in 1913 in recognition of his service as head of the British group in negotiating the Chinese reorganization loan and is now a director of the Bank of England. Mr. E. G. Hillier, C.M.G., was appointed Peking agent in 1891 and is the representative of the bank in its official relations with the Chinese government and the negotiation of loans.

In his speech at the opening of the bank, Sir Ronald Macleay, the British Minister to China paid the following well merited tribute to the work of Mr. Hillier.

"I cannot leave the subject of the consortium without mentioning another old and trusted servant of the Hongkong and Shanghai Bank, Mr. Guy Hillier who combines the post of agent of the branch in Peking with that of chief representative of the British Group in China. Mr. Hillier's skill in handling the intricate problems of the group's relations with the Chinese government, his remarkable proficiency in the language and knowledge of the Chinese make him an ideal adviser in such matters for H. M. representative in Peking; and his gentle nature and the wonderful serenity and fortitude with which he endures one of the saddest of nature's disabilities have won for him the affectionate esteem and admiration of a host of friends. He has a trusty second and a stalwart co-adjutor in Mr. R. C. Allen."

The same high words of praise should also be extended to Mr. Sydney Mayers, the Peking representative of the British and Chinese Corporation, upon whose shoulders has fallen the brunt of the delicate railway negotiations for the past ten years and keeping a watchful eye over the interests of the British bondholders in Chinese railways.

Mr. G. H. Stitt, the present manager of the Shanghai branch, also exemplifies the spirit which has made the bank that tower of financial strength which it is to-day.

To the Hon. Mr. A. G. Stephen, the present head manager, under whose spirited leadership and wise guidance the Shanghai branch was able to steer and even course through the storm years of the war and its aftermath of inflation and depression into the smooth waters of prosperity, much credit for the present position of the bank is due. The present structure in Shanghai was conceived under his administration, the plans made and the finances set aside which enabled this significant monument to be erected. The following extract from the speech of the chairman of the court of directors of the bank at its last annual meeting sums up his work and the esteem in which the shareholders hold its staff:

"I cannot conclude without a word of commendation to the staff. In the Hon. Mr. A. G. Stephen, our chief manager, we have a man whose knowledge of business and finance is unparalleled and whose services to the empire and its eastern connections is well-known to all of you. During the past two years, in a period of world depression, the bank has progressed under his able direction and its position to-day is stroner than ever. Amid the troubles and disasters throughout the world, the disorganization and uncertainties of exchanges, our men everywhere have risen to the occasion and have created a faith in the bank of the utmost value to trade and British prestige in the East. We are indeed fortunate in possessing a staff second to none in loyalty and devotion to the interests of their employers, and I am confident that as senior men retire their places will be taken by men of equal calibre and the bank will continue to be a tower of strength to Eastern trade and enterprise in the future as it has been in the past."

G. B. R.

## The New Building

The architects are Messrs. Palmer & Turner of Hongkong and Shanghai. In the official description, Mr. G. L. Wilson, one of the partners who designed the building, renders due credit to those responsible for its erection, in the following foreword:

"*The Hongkong and Shanghai Bank deserve the thanks of the whole community of Shanghai for they have generously spent a large sum of money in beautifying the New Building so as to give pleasure and inspiration to all who see it.*

"*A great modern building such as this, equipped with all the latest time and health saving appliances which make for efficiency, is a complicated structure, and it is impossible for one man to design it in all its details.*

"*The modern architect therefore gathers about him assistant architects, engineers, artists, sculptors and other specialists, carefully selecting those he knows will work in sympathy with his ideas and aspirations.*

"*His position is, therefore, analogous to that of the conductor of an orchestra playing one of his own, compositions, and all those who contribute are deserving of thanks if the result is a success, for one false note is sufficient to create discord instead of harmony.*

"*I therefore take this opportunity of thanking all those of our office staff who worked so loyally on the drawings, Mr. Geo. Murray of London, the artist, for all the time and trouble spent in the preparation of the cartoons for the mosaic work in the entrance hall, and Mr. Faber, the structural engineer responsible for the design of the foundations and the steel frame.*

"*It was due to Col. M. H. Logan's initiative that the celebrated London firm of contractors, Messrs. Trollope & Colls, Limited, came out to Shanghai to erect the building, and Mr. H. Richardson, the local manager, deserves special praise for the rapidity of construction due to his skilful co-ordination of all the crafts and trades and organization generally. When it is remembered that very nearly the whole of the varied materials used have been imported, and that arrangements had to be made for their arrival at the precise time they were required for fixing, it is not difficult to understand the importance of organization. But for the failure of the Chinese contractor in Hongkong to supply the granite within the specified time, the whole building would have been completed last month.*

"*Mr. John Morley, the general foreman in charge of the building, also deserves great praise; dealing with Chinese labour for the first time he patiently taught them modern methods and thus obtained a better finish and standard of work generally, than is usually possible in China.*

"*The architect in China has many difficulties to overcome not met with in England. The architect in England for example can watch the finer fittings being made and alter them should be find that the spirit of his design has not been caught, but the architect in China is separated by ten thousand miles from the craftsmen working from his drawings and it sometimes happens that when the article is delivered the result is disappointing. It is then too late to make alterations. I wish, therefore, to congratulate the sub-contractors who supplied the various metal fittings, the marble work and the suppliers of the fibrous plaster ceilings: they one and all caught the spirit of the designs and produced work of which they may well be proud.*

"*It is for the community to decide whether the architect has justified the confidence placed in him and produced a building worthy of the opportunity which, as regards the size, site and in other ways, was an exceptional one. It is sufficient for him to say that he has given of his best.*

*G. L. WILSON.*"

The building is of the type known as Neo-Grec, and to achieve the dignity with simplicity which that name implies the architects have eschewed the use of carving or sculpture almost entirely and relied upon proportion and line. They had an opportunity in the site and size of the building such as very rarely falls to the Architect's lot. The frontage of approximately three hundred feet to the Bund and two hundred feet to Foochow Road formed the ideal site for this memorial to the commerce and prosperity of the world. Rising one hundred feet to the long line of the roof and a further eighty feet to the final of the massive dome, the whole building stands out clear to the view of the merchant ships of all nations sailing up and down the Huang Pu, a recognition of their courageous industry which has made possible all that this memorial stands for.

From afar is seen the six-columned colonnade in the middle of the Bund front with the triple-arched main entrance beneath, forming their deep-lined shadows in the whiteness of the Hongkong granite with which all the principal facades are built. Approaching the sixty-two feet long flight of steps to the entrance the two bronze lions flanking it are a striking feature against the stone. These lions are seen to be of a novel character, in that one is roaring aggressive and the other quiescent. They have been cast from models prepared by Henry Poole, A.R.A., and are very happy symbols of protection and security.

The carved head forming the keystone of the middle arch of the entrance represents agriculture, the source of all wealth, and the similar heads over the two side arches are industry and shipping.

Passing through the bronze entrance gates one enters a spacious Portico, its inner archways filled with glazed bronzed screens. Beyond these is the entrance hall.

## The Entrance Hall

The artistic conception of the bank has centred itself in this feature of the entrance hall. The hall is octagonal on plan, the motive combining the number eight which figures so largely in Chinese mythology with the idea (and practical utility) of the meeting and distributing place of commercial avocations. The octagon is fifty-two feet across and has the unusual feature of a dome of novel section. This is supported on eight detached Sienna marble columns. The outer arcade of the octagon is of the same marble. The bases and capitals of the columns are of bronze. The idea of the Dome, the conception of Aspiration, is carried upward connecting with the dome above the roof of the building ; and, so that there shall be no break in the continuity of thought, even the medium of the finish is the same throughout. The dome ceiling of the entrance hall is of rich Venetian mosaic, and the outside covering of the roof dome one hundred and fifty feet above it is also mosaic, terminating in the golden mosaic of the finial.

The idea of aspiration is further emphasized by the decoration of the entrance hall dome, as the following descriptions will show.

The eight principal panels represent the banking centres of the East and West :—

LONDON

*Central Figure.*—" Britannia " with Trident and British Lion.

*Left.*—Figure with arms of " London."

*Right.*—Symbolic figure of Thames with model of ship, compass and rule.

*Background.*—Houses of Parliament and St. Paul's Cathedral from over the rider.

*Heraldry.*—England, Scotland, Ireland, Wales.

PARIS

*Central Figure.*—" The Republic " with tablet inscribed Libertê, Egalitê, Fraternitê.

*Left.*—Figure of the Arts with the Victory of Samothrace on prow of boat—*Louvre.*

*Right.*—With arms of the Republic.

*Heraldry.*—Fleur de lis, Paris. Paris Fieur de lis.

*Background.*—A view of the Seine and Paris, principally of the Cathedral of Notre Dame.

CALCUTTA

*Central Figure.*—Symbolic of " Mysticism " with the Star of India on Forehead.

*Left.*—" Philosophy " with scroll.

*Right.*—With the arms of the City.

*Background.*—The Hugli River and the High Court of Justice.

*Heraldry.*—Crest of Calcutta, and the supporters of the arms of Calcutta.

BANGKOK

*Central Figure.*—Symbolic of " Fertility."

*Left.*—Representing hewers of timber.

*Right.*—Agriculture and Rice Cultivation.

*Background.*—Temple at the mouth of the Chao Phya Menam River—the Mother of Waters.

*Heraldry.*—The Traironga—national flag.

Old arms of Siam

New arms of Siam.

The flag of the Royal Navy.

HONGKONG

*Central Figure.*—With Union Jack symbolic of its becoming a British Crown Colony.

*Left.*—History with date of above MDCCCXLII.

*Right.*—Suggessive of Canton River.

*Background.*—View of Hongkong and Peak from the Harbour.

*Heraldry.*—Flag of Diplomatic Service.

Chinese characters for Hongkong.

Flag of Admiralty.

SHANGHAI

*Central Figure.*—of " Foresight " or " Sagacity " with steering wheel.

*Left.*—Symbolic figure of the Yangtzekiang.

*Right.*—Shipping.

*Background.*—Hongkong and Shanghai Bank and the Chinese Maritime Customs from the river.

*Heraldry.*—The flag of the Chinese Merchant Service.

Chinese characters for Shanghai.

The flag of the British Merchant Service.

TOKYO

*Central Figure.*—" Learning."

*Left.*—Youth symbolic of " Progress " with national emblem on shield.

*Right.*—" Science " with scroll and instruments.

*Background.*—Enclosing wall of Imperial Palace.

Court of Justice, Admiralty and Government Offices. In the distance separated by a band of clouds Mount Fuji.

*Heraldry.*—The flag of the Japanese Merchant Service.

Japanese characters for " Tokyo."

The Imperial Flag.

NEW YORK

*Central Figure.*—Bartholdi's well-known figure of "*Liberty enlightening the world.*"

*Left.*—" *Hermes* " the promoter of social intercourse and of commerce among men, with his symbols the winged hat and caduceus.

*Right.*—Figure with arms of the United States.

*Background.*—A characteristic view of New York from the sea.

*Heraldry.*—The flag of the Merchant Service.

The arms of New York.

The American Eagle.

Between the panels are the characters of an inscription from the Chinese classics with the English words above, circling the dome : "*Within the four seas all men are brothers.*"

Surrounding and above these panels are the signs of the Zodiac :—

| | |
|---|---|
| S. Aquarius | S. E. Pisces and Aries |
| E. Taurus | N. E. Gemini |
| N. Cancer and Leo | N. W. Virgo |
| W. Libra and Scorpio | S. W. Sagitarius & Capricornus |

on a dark blue ground with wide gold borders.

*Within and above again are :*—

Eight heraldic lions in gold, and geometric symbols in squares—the Swastika (good fortune), Solomon's Seal (wisdom), etc.

*And finally the circular topmost centre panel showing :*—

Ceres, the Goddess of Plenty or Abundance.

Helios, the God of the Sun, and the Horses and Chariot with which he traverses the Heavens.

Artemis, the twin sister of Helios, the Goddess of the Moon, on her forehead the crescent.

One half of background, Day ; the other, Night.

## The Bank

The plan of the bank radiating from the octagonal entrance hall is of the happiest simplicity. All parts are readily and easily accessible in spite of the diversity of the departments and the immense size of the building.

From the south-east archway of the octagon is reached the brokers' room and south of that is the managers' suite, consisting of managers' office, manager's private room, telegrams, books, stenographers, waiting room, with a private corridor giving access to each.

The accountant's department is approached through the north-east archway of the octagon. Eight telephone booths are provided around the entrance hall, six for the brokers' use and two for the general public.

The remaining five archways of the octagonal hall give upon the main banking hall. The first impression is of the grandeur of sheer space and proportion and light. This hall, running practically the whole length of the building, has an area of twenty-one thousand five hundred feet. The walls and columns are faced with soft-toned grey Italian marble with a seven-arched arcade throughout the length of the west walls in Sienna marble corresponding with the octagonal arcade of the entrance hall. The lighting, which has the effect of unobstructed open-air daylight throughout, is by the openings of the western arcade, the large bronze windows of the northern end and especially the great semi-circular vault of the lantern light above. This lantern is one hundred and twenty feet long and thirty-three feet span. Specially to be noticed in the marble work of this hall are the four monolithic columns, two at each end, which were worked in Italy and delivered to the bank without damage ; each column weighs about seven tons. At the South end of the banking hall is a double staircase of white and Sienna marble with an entrance-way from Foochow Road beneath. The staircase leads to the

Mezzanine floor where are provided the stationery rooms, Record rooms, manager's changing room, telephone exchange, staff changing rooms, tiffin and service rooms and lavatories. There is a corresponding mezzanine gallery as the north end and an entrance to the bank at this end from the private road. The strong rooms for books and documents are along the west side. The savings bank to the south-west of the banking hall has a separate entrance on the Foochow Road as well as from the main hall. The great impregnable treasuries, eighty feet long and thirty-five feet wide and nearly thirty feet high, occupy the north-west corner of the building, with the smaller treasuries around them.

The bronze work throughout the building calls for special notice ; and nothing finer can be seen anywhere in the world. The main entrance gates, each of the three pairs weighing five tons, proclaim themselves as works of art. The revolving doors, electric light fittings, bronze grills, bronze screens, door furniture, and in fact all of the metal work, have been very skilfully designed and executed.

With the exception of the marble used in the accountants' department, which came from Devonshire Quarries, the whole of the marble used is Italian, very carefully selected and matched. The flooring to the public space is finished in marble mosaic with marble borders ; marble mosaic was chosen as being less slippery than marble slabs during damp weather.

The design for the managers' office required very careful consideration ; it is the hub of the whole bank, and the walls have been so broken with doors and windows that the ordinary design of panelled walls could not be adopted, but the difficulty has been overcome very happily. The rich ceiling, which is fibrous plaster modelled in England, also calls for special notice ; also the fire places and fire grates.

The furniture to the general offices and the fittings in all strong rooms and book rooms are of steel made in England and shipped out in sections. The furniture in the managers' office and private room is of teak-wood.

The artificial lighting of the banking hall received special consideration, and a novel method has been adopted. The architects particularly wished to avoid the ordinary method of lighting, whereby points of light are seen through the hall, and so it was arranged that small search lights should be fixed in the central area at a considerable height above the Dome light and so flood the banking hall with artificial light, which should give the same effect as daylight.

## The Chinese Bank

Whether one enters by the special south-west gateway from the Foochow Road or by either of the marble archways at the south-west corner of the main banking hall, one is arrested on the threshold by the totally unexpected sight of a blaze of Chinese decoration. This is the Chinese bank. The architect has attempted here the boldest scheme of decoration ever tried in a modern building, and he has been utterly successful. While the design, both in the mass and in its details, is entirely new, one feels the influence of the best traditions of fourteenth century Chinese art in this gorgeous Oriental decoration of a hall of twentieth century western construction. Those fortunates who have seen the palaces of Peking are immediately reminded of the dazzling colorings of those wonder-halls. For others the impression will be a new one of barbaric splendour, a riot of pure decoration for the laughing joy of color.

Passing to the compradore's outer office to the south of the bank one's joy sobers to smiles of appreciation of the intricacy of the gilded ornament of the beams, the gold and red and black. No riot here ; a fine restraint, though still no fear of pure rick color and fantastic design.

Thence to the compradore's private room. The brightness is dimmed. The reds and greens and yellows have gone. Here the splendour curbs all smiles. Black and the dark blue of clam ; the fit setting for the dignified office of compradore of the Hongkong and Shanghai Bank.

## The Building Generally

The building is of fire proof construction throughout, practically no wood being used on the ground floor.

The upper floors are designed as suites of offices, which are served by four staircases and six electric lifts. Other staircases are provided for coolies and for escape in case of fire.

The most up to date systems of ventilation and warming have been adopted for these premises. Fresh air is drawn in at suitable points and washed by passing through a water screen. The cleansed air will in the winter be warmed and pumped through a system of ducts into the rooms. The vitiated air is drawn out through a separate system of ducts and discharged above roof level.

The materials for the building have been obtained from all over the world. No difficulties, no pains or trouble have been spared in finding and securing whatever seemed most suitable for the different parts of the structure. The crafts and trades of all nations have been employed The following list of some of the quantities of materials that were needed will give some idea of the vast extent of the operations

| | |
|---|---|
| Structural Steelwork .. .. .. | 3,700 tons |
| Steel Reinforcing Bars for Concrete .. | 1,350 tons |
| Bricks .. .. .. .. .. | 3,500,000 |
| Cement .. .. .. .. .. | 50,000 casks |
| Granite (83,771 cb. ft.) .. .. .. | 6,481 tons |
| Patent Plaster .. .. .. .. | 1,480 tons |
| Sand .. .. .. .. .. | 5,500 fong |
| Cables .. .. .. .. .. | 140 miles |
| Tubing .. .. .. .. .. | 49 miles |
| Total weight of building about .. .. | 50,000 tons |

The huge edifice is supported by 2,600 Oregon pine piles, some of them 40-ft. long, but the general average being 25-ft. in length, twelve inches at the butt and ten inches at the tip The frictional resistance of these piles in the Shanghai mud is over 1,700-lb. to the square inch. In designing the raft and foundations the engineers were faced with the problem of having to allow for the very greatly varying weight of the treasuries consequent upon the big fluctuation in the amount of silver stored therein as different times, and it is a striking tribute to the success of the designers that the very slight subsidence which has occurred to date has been completely uniform at all four corners.

The bronzework in the building calls for genuine admiration, in which regard the magnificent bronze entrance gates, countergrille, electric light brackets, etc., are worthy of special mention, as also the two bronze lions flanking the main entrance, which were modelled from a design by Mr. H. Poole, A.R.A.

The Venetian mosaic in the Octagonal hall was fixed by two Italians specially brought out for this work, while the whole of the marble work in the building has been matched and erected under the expert supervision of Mr. D. Collins, on the staff of the building contractors.

## The Responsible Contractors

The sub-contractors employed on the building were :—
Redpath, Brown & Co.—Structural steelwork.

Wheeler & Comyn Ching—Heating, ventilating and vacuum cleaning plant.

Jenkins & Son—Marble work throughout.

Art Pavements & Decorations, Ld.—Venetian mosaic work to walls and ceiling of Octagonal Hall.

George Brown & Son—Fibrous plaster ceilings and friezes.

Luxfer Prism Co.—Top light over Banking Hall.

J. W. Singer & Sons, Ld.—Bronze entrance gates, doors, lions, etc.

W. F. Ramsay & Co.—Bronze counter-grille, electric light pendants and brackets, bronze caps and bases to marble columns, door furniture.

Hope & Sons—Bronze and steel windows throughout.

Otis Co.—Electric passenger lifts.

Chubbs & Chatwood—Treasury and strong room doors.

Chatwoods—Safe deposit fittings.

Shanks, Doulton, and Dent and Hellyer—Sanitary fittings.

Merryweather—Fire appliances.

Roneo Co.—Steel furniture.

Arts & Crafts—Joinery, manager's office.

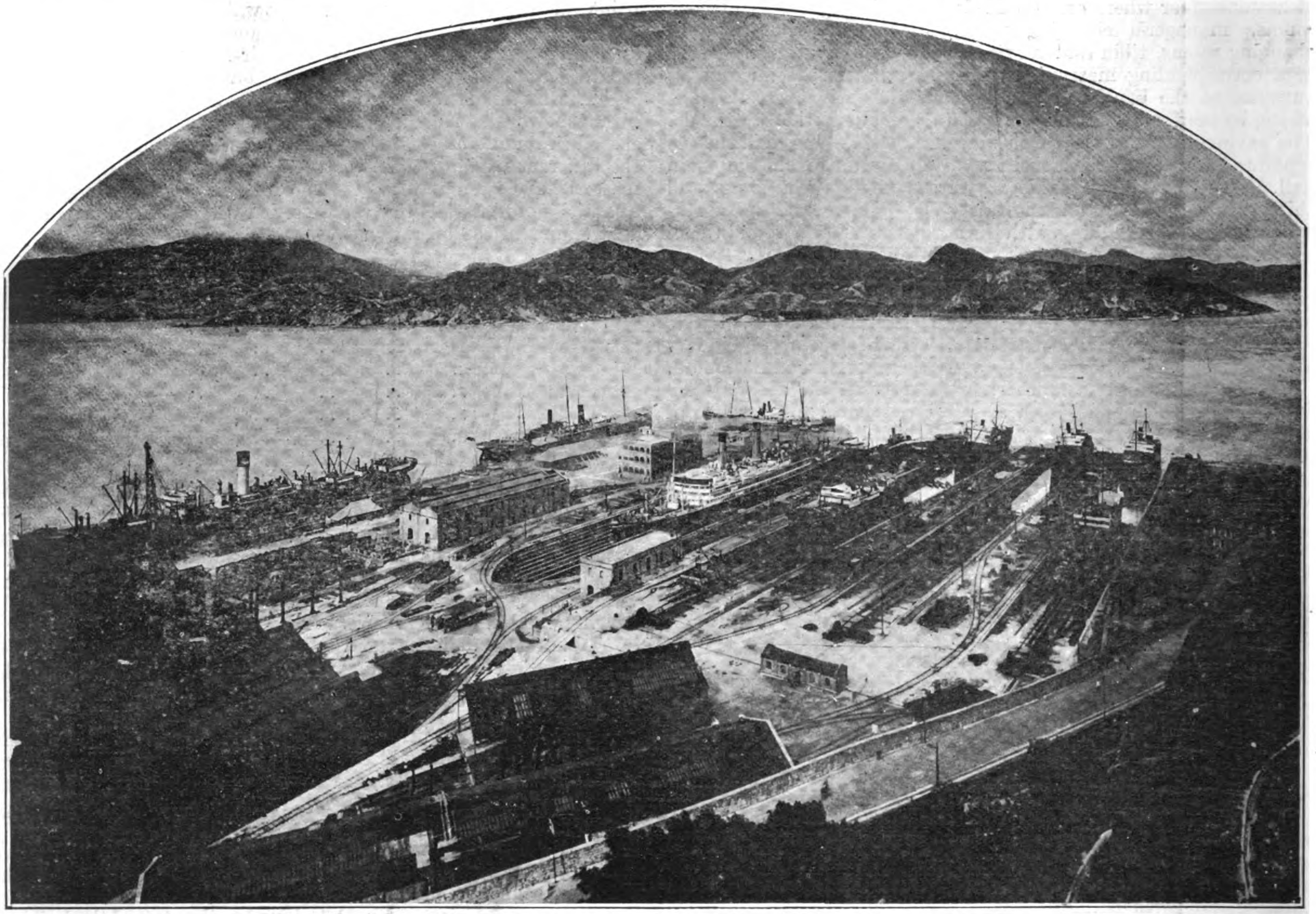
Weeks & Co.—Joinery, manager's private office and furniture.

Felgate & Co.—Interior painting.

The Crittall Manufacturing Co., Ltd.—Wrote iron gates, internal railings and bronze work.

The steel and bronze windows have been supplied by the well known firm of Henry Hope & Sons, Ld., Birmingham, England, who are represented in Shanghai by Messrs. Duncan & Co., who have also supplied the same windows to other large buildings here.

Messrs. Caldbeck, Macgregor & Co. were responsible for the catering arrangements at the opening ceremony, and the big undertaking was attended to with the firm's usual efficiency.



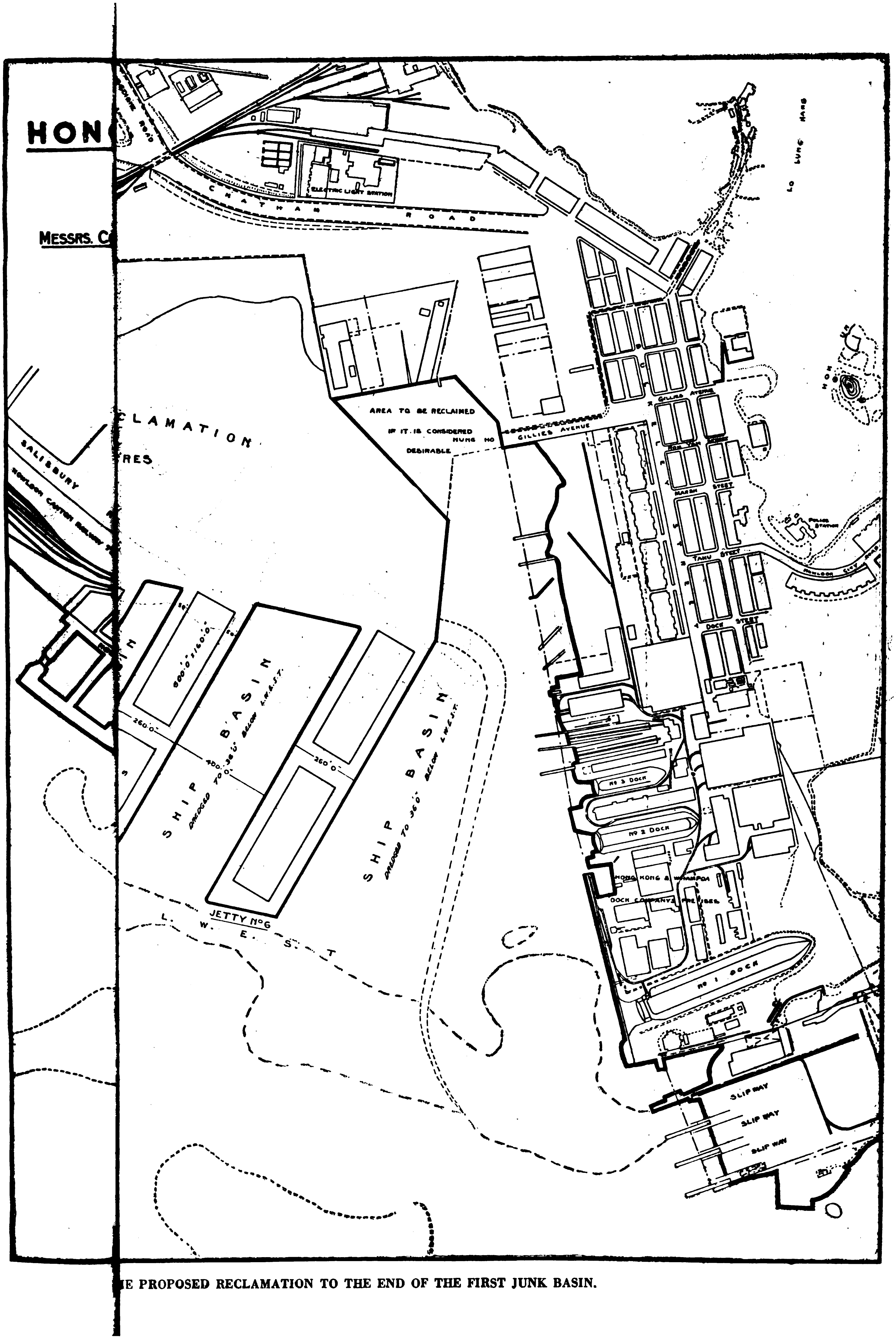
The Nucleus of a Great Engineering Industry : The Taikoo Dockyard and Slipways at Hongkong

# Hongkong Harbor Improvements

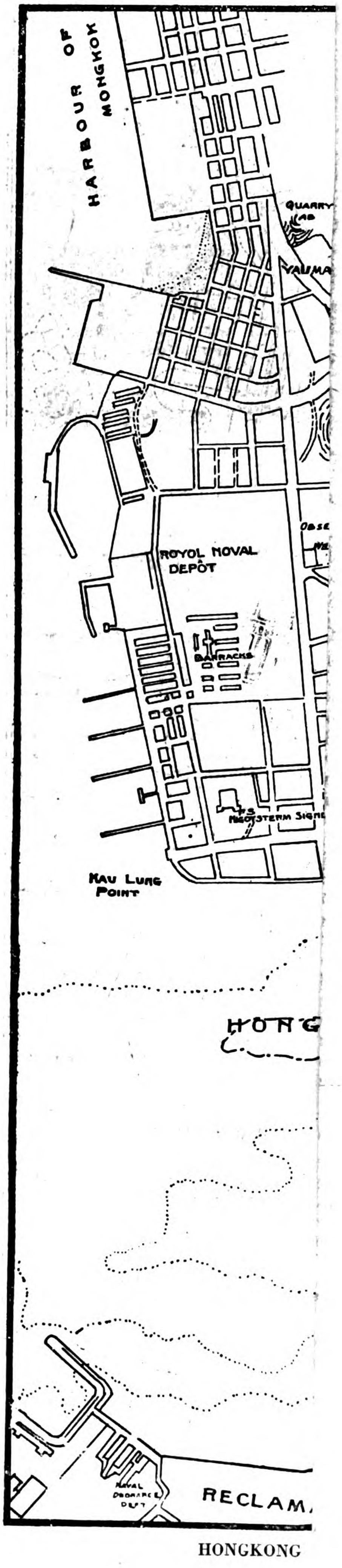
THE authorities of Hongkong are looking far into the future with their plans for the development of the port and its industries. Two years ago, the disclosure of the terms of the Cassel convention conceding to British interests a practical monopoly on the coal mines and transportation facilities of the province of Kwantung provided an insight into the program for the future industrial development of the colony. Later, the report on the industrial possibilities of the colony submitted by a special commission together with further information threw further light on the plans entertained for making Hongkong the leading manufacturing centre of the Far East. The recent understanding between Hongkong and Canton is another manifestation of the working of the far-sighted policy for developing the natural resources of South China and advancing the general welfare of the colony. In another article in this issue of THE FAR EASTERN REVIEW will be found a comprehensive survey of the magnificent road program of the public works department which is also looking far ahead to the requirements of a great industrial and residential centre. A new interest has now been added to the general development plans of the colony by the publication of the report of Sir Maurice Fitzmaurice on the needs of the port, the basis of Hongkong's past, present and future greatness. In line with the other great harbors of the world, Hongkong with all its wonderful natural advantages is compelled to visualize the time near at hand when vessels of 35 feet draft will use the Suez Canal. With this possibility in view, the report has been drawn up.

Without attempting to express any opinion on the merits of the scheme, it occurs to us that within ten years, or by the time the present scheme is finished, it may be necessary to make provision for still larger ships. At present, the Orient takes over one-fifth of America's trade, having doubled in the last ten years. If the same rate of increase is maintained during the next decade, larger and larger vessels will be needed until 30 to 50,000 tons leviathans will be plowing their way across the Pacific in the same manner they now traverse the Atlantic. Given ten years of stable government in China with an opportunity for safe investment in the development of her resources, the trade of this country alone will demand this increase of tonnage. However, this applies equally to all Oriental ports where the size of the ships must necessarily be subordinated to the depth of water and facilities to handle the cargoes. If the ports of the Orient are to be limited to a maximum depth of 36 feet alongside the wharves, the history of shipping on the Pacific will soon be written.

The plan for the development of the port of Hongkong looks ahead to the time when large bulk rail shipments will be made from interior Chinese points to foreign countries unloading from the cars direct into steamers at Kowloon. This visualizes the completion of the Canton-Hankow railway and other lines terminating at a deep-water outlet over the Canton-Kowloon rails to the proposed Hung Hom wharves. There is just the possibility, however, that by the time this development warrants the use of these wharves for such cargo, the port of Canton may have been improved to such an extent that it will prove a serious competitor for this business. In




IE PROPOSED RECLAMATION TO THE END OF THE FIRST JUNK BASIN.


HARBOUR OF
MONGKOK
QUARRY
YAUMA
ROYOL NOVAL
DEPÔT
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KAU LUNG
POINT
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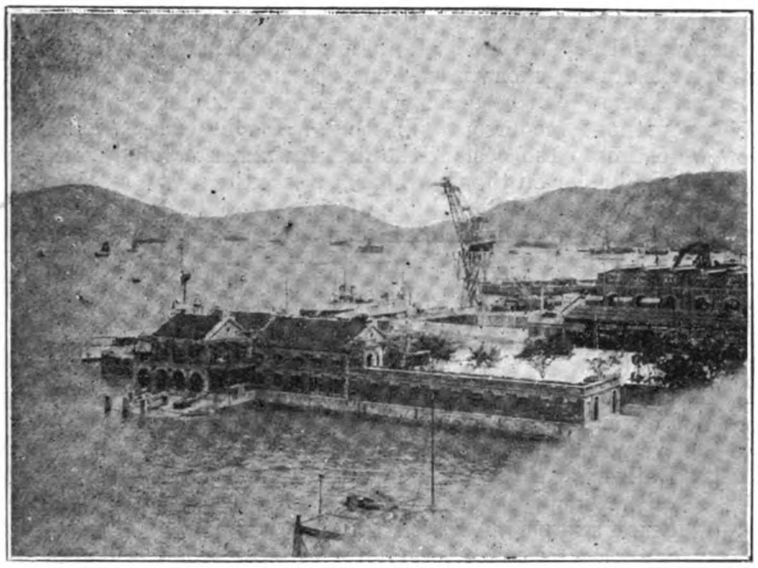
NAVAL
ORDNANCE
DEPT

HONGKONG



Royal Naval Station at Hongkong

River and Coastwise Steamer Wharves. Hongkong

fact, if Dr. Sun Yat-sen can raise the funds, the time must arrive when Hongkong must face the competition of a port at Canton, and although this may never affect the importance of Hongkong as a distributing centre it would certainly take away much of its importance as a point of bulk shipments from the interior.

The consulting engineers have devised a scheme which would afford at an early date a certain amount of berthage for large vessels and junks and which would admit of future extension as the trade of the port required. "For the complete scheme we propose to construct in the bight of Hung Hom Bay a large reclamation of about 48 acres, from which will project in a southerly direction a series of six jetties." For the first instalment the construction of two jetties is proposed, together with a portion of the reclamation to the extent of seven acres. The estimated cost of this first instalment is £1,260,000.

The salient features of the report are covered by the following excerpts :—

## Designs Based on two Propositions

There is nothing in connection with tides and currents which can cause any difficulties to ships coming alongside or leaving the wharves proposed by us, and in fact such conditions are much better than in many ports with which we are acquainted. Until our visits to Hongkong we were a little uncertain as regards the conditions existing in the harbor due to wind during typhoons and other periods. From a careful examination of all data and evidence obtainable, we are satisfied as regards the following two propositions :—

(a) Whatever works may be constructed, ships must get into the open away from wharves during typhoons.

(b) Except during typhoons, ships can at all times lie with safety at wharves in any part of the harbor.

Our designs are based on these two propositions.

## The Requirements of the Harbor Trade

The special requirements of the trade as at present conducted in regard to the large proportion of cargo which is taken away by junks and barges, has already been referred to in this report and is dealt with in these proposals by providing in the case of each jetty (with one exception to be referred to later) deep-water berthage for large vessels on the one side and berthage for junks or vessels of small draft on the other. By this arrangement cargo which has been placed in shed either for sorting or warehousing can be loaded with equal convenience into ship or junk as the case may be. There will also be no difficulty if necessary in transferring directly from ship to junk or junk to ship.

It will be seen that, to meet these conditions, we propose to provide on the western side of Jetty No. 1 a junk basin having berthage of about 850 feet in length. This and the other junk basins shown will, where necessary, be dredged to give a minimum depth of 15 feet below extreme low water spring tides, which from the information obtained appears to us to be amply sufficient. Portions of the basin, depending upon the natural depth of the water, will be of greater depth.

The eastward side of Jetty No. 1 will be provided with a quay 1,400 feet in length, having a depth of water of 37 feet below Hongkong ordinance datum (*i.e.*, low water ordinary spring tides) or 36 feet below extreme low water level. This depth, for the reasons already given, will in our opinion be amply sufficient for all purposes.

Jetty No. 2 is provided on its western side with a deep-water quay 1,200 feet in length, and on its eastern side with a quay for junks of the same length. The ship basin provided between the deep-water quays of the Jetties Nos. 1 and 2 will be dredged to a depth the same as that alongside the quays, viz., 36 feet below extreme low water level. This dredging will be continued seaward until it reaches the 36 feet contour line as shown on the drawings.

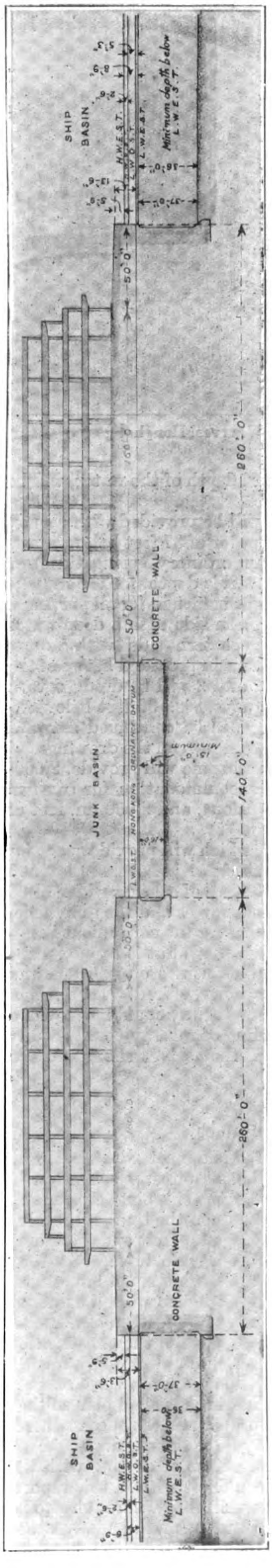
The first instalment of the complete scheme will provide, 2,600-in. feet of deep water quays, giving accommodation for say five of six large steamers of varying dimensions, and 2,050 lin. feet of quay for junks and vessels of light draft.

The width of the jetties is 260 feet, which will provide space for the construction in each jetty of two sheds or warehouses lay 500 feet in length and 160 feet in width. This will allow a width of 50 feet on each side of the sheds between the latter and the quay face. This in our opinion will be amply sufficient for the convenient handling of cargo between the vessels and the sheds but is by no means excessive. This width also permits of two lines of railways and crane road, which could be laid as and when required. If cranes of the portal type be adopted, a third line of railway could be provided on the quay. In addition to these, a line of railway could readily be taken into the sheds or warehouses themselves should such a course be considered advisable.

## Type of Warehouses

The type of warehouses to be erected is a matter which will require careful consideration. It may be, as already suggested in this report, that these will be erected by the shipping or godown companies. If so, they will probably be upon the lines of the very excellent warehouses recently erected by Messrs. Holt and the Hongkong and Kowloon Wharf and Godown Co. We have, therefore, not gone into this matter in detail but in Drawing No. 4 have merely shown an outline of a typical four-storied shed placed as above described so as to provide a width of quay of 50 feet on either side. Whatever arrangements may be made as regards the construction of the sheds or warehouses themselves, we would strongly recommend that the government should lay down certain rules and regulations with regard to the arrangement of the ground plan so that the required width of quay surface and proper and easy access thereto both for road and railway traffic may be maintained.

Questions in connection wish the manner of dealing with the cargo in and out of vessels have not been dealt with in this report, but it it be decided to proceed with the work, they will require to be carefully considered. At the port of London, and in many other ports, cranes on high carriages so that they can reach over the sides




Hongkong-Hung Hom Bay : Proposed Jetties and Reclamation : Typical Cross Section of Jetties

of the largest vessels, are frequently provided. Such cranes at Hongkong, where violent typhoons are experienced, would probably be unsafe and it might be preferred that cargo should be placed on the quay by ships' derricks, being afterwards lifted into the upper floors of the sheds by cranes having comparatively low carriages, running alone the quay. All such matters of equipment will have to be fully considered when the time comes.

## The Reclamation

The ground in the vicinity of Kowloon is extremely hilly, and extensive levelling has been done in the district to provide building areas for the increasing population. We would propose, therefore, that the general filling both for the reclamation area and for jetties, be obtained from levelling down high ground in the vicinity. Such procedure would have the double advantage of supplying material more suitable for the purpose than dredgings, and of providing areas of remunerative value for building sites which would be a set off against the general cost of the works. This is a question which would, of course, require careful local consideration, and before any contract was entered into for the construction of the works, the sites from and conditions under which such material could be obtained should be clearly laid down.

With regard to Belcher Ridge, we would propose to dredge down to 36 feet below extreme low water over the area crossed by red lines on the drawings, that is to remove the portion protruding northwards of the general line of the 6-fathom contour as given on the admiralty chart. It will be seen that we also propose in connection with the first instalment of the works, to remove the cust rocks down to the same level, so as to give a perfectly clear access to the jetties, free from any obstruction.

## The Estimates

In estimating the cost of the works we have kept in view the local prices furnished to Mr. Wilson on the occasion of his visit last February, making allowances for the differences in the character of the work, and of the methods and appliances required for their execution, as compared with those to which the local prices actually applied. We have also assumed that material above the lines on the drawings forwarded to us, described as "hard as derived from prickings" can be removed by direct dredging by a bucket dredger without recourse to blasting. Keeping these points in view we estimate the cost of the first instalment of the works as shown by red color on the drawings at approximately :—

| | |
|---|---|
| Jetties Nos. 1 and 2, including filling .. | £1,120,000 |
| Reclamation and dredging in connection with jetties .. .. .. .. .. | 98,000 |
| Dredging Belcher Ridge .. .. .. | 13,000 |
| Dredging Cust Rocks .. .. .. .. .. | 29,000 |
| | £1,260,000 |

The above estimate includes 10 per cent. for contingencies but does not cover the following items :—

(1) Warehouses which we have already referred to.
(2) Railways, which we presume would be dealt with by the railway department.
(3) Crane equipment, which will depend upon the method of dealing with cargo which may ultimately be decided upon. Assuming, however, that in the first instance four 3-ton cranes were to be provided on each of the four quays, the approximate cost at present prices would be about £60,000.
(4) Electric power and lighting, with cables and wiring, which we presume would be dealt with locally.
(5) Water supply, which would also no doubt be dealt with locally.
(6) Acquisition of land from which to obtain filling, or for other purposes.

Although we have not included the provision of pipes for oil bunkering purposes along the jetties, our proposals will not interfere with laying such pipes in the future if and when the oil companies wish to provide a supply of bunker oil to ships lying alongside.

We estimate the time required for completing the whole of the works included in the first instalment at about 3½ years.

With regard to the actual execution of the work, we would strongly recommend that the course which has been satisfactorily adopted in connection with large works carried out under our direction for your department in the Straits Settlements. Federated Malay States, Kenya Colony and Nigeria, be adopted, and a contract for the works entered into, tenders being invited in the usual way from responsible British contractors with experience in carrying out large marine works of this character. Such a course has many advantages.

## Future Extension

The works recommended for future extension would be generally similar to that already described in connection with the first instalment. and the jetties could be carried out as and when required. When completed there will be available 8,600 lin. feet of deep-water quay, or say 18 to 20 berths for large vessels of varying dimensions and 5,650 lin. feet of shallow quay for junks and barges, without taking into account the quay at the eastern end of the reclamation colored yellow.

## Systematic Observations of the Harbor Needed

The report says :—

We have been unable to find that any systematic observations have been made at regular intervals of the depth of water in different parts of the harbor. It is of great importance in every harbor that a proper and complete history of the changes which occur from time to time should be available.

Hongkong has an area of sheltered water so large and so deep that in all probability it has not been considered necessary up to the present time to keep such records as are essential in other harbors which have not got the same natural facilities. On the other hand the possession of such a magnificent harbor is just the reason why everything possible should be done to prevent any deterioration in its condition.

As far as we have been able to ascertain there is not much sign of shoaling between the Lye Mun entrance and a north and south line through the observatory, except in some sheltered bays. We have, however, not got the same confidence as regards the area of the harbor to the west of this line.

On May 12, 1905, our firm reported to you on shoaling in the harbor. In that report we considered certain investigations as regards shoaling made by the late Mr. Boulton in 1904. We went into this question very fully, obtained much information from the admiralty on the subject, and came to the conclusion that the amount of shoaling was much less than was suggested by Mr. Boulton, but stated that "it is of great importance that the question which has been raised with regard to the silting should be carefully considered and thoroughly investigated," and proposed that a very complete survey of certain portions of the harbor should be carried out.

As far as we know the recommendations then made have not been carried out, and we consider that no further delay should occur in making a systematic survey of the portion of the harbor to the west of the north and south line through the observatory. This survey should be made on standard lines so that all soundings and other observations can be reported on the same lines from time to time.

The report is concluded by the following paragraphs :—

We have given consideration to the provision of better facilities for traffic between Hongkong and the mainland, particularly for vehicular traffic. The only feasible method without great expenditure of money is the provision of ferry boats. There are numbers of these in existence at the present time. Some of the most important are those crossing the Thames, the Mersey, the Clyde, New York harbor and San Francisco harbor.

These ferry boats carry very large numbers of both horse and mechanical vehicles. That on the Thames at Woolwich is under the control of the London county council and is looked upon in the same way as a bridge over the Thames or a tunnel underneath and no charge is made for either vehicles or passengers. It in fact takes the place of a road. On the Mersey there are several ferry services controlled by the Birkenhead Corporation and the Wallasey Corporation and a charge is made both for vehicles and passengers.

We consider the cross traffic between Hongkong and Kowloon is growing sufficiently to warrant the provision by the government of a good vehicular and passenger ferry service.

* * *

## Harnessing the Sun's Rays

DR. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, one of the formost inventors of the day, is looking ahead to that time in the future when the coal supply will be exhausted and all the water powers developed, when the babbling brook and the roaring cataract will be gone, and sluggish pools extend from powerhouse to powerhouse, to feed the power demand of an ever increasing population. Will our civilization, he asks, come to a standstill for lack of further energy supply, and then begin to decay, because there is no standstill in nature ? Or what other energy supply can be opened up ? Oil and natural gas will long have vanished ; indeed, they will be the first to go. Wind and tides and wave power may be used as far as possible, but their total is so insignificant that it does not come into consideration. There is only one other source of energy left, and that is the energy of the sunlight, but this is the greatest of all the energies—though we have no economical means yet to utilize it. The amount of energy of the sunlight falling on the uninhabited and uninhabitable regions of our country, the deserts, is over two hundred thousand millions of horse-power, thousands of times larger than all the water power and all the power we now get from coal. So this is the problem for the engineers of the future—to harness the energy of sunlight, this accomplished, there will never be any more lack of energy.

In reality, the energy which we use to-day is the energy of the sunlight. The heat of the sun's rays evaporates the water, the water vapor rises to the clouds, condenses and comes down as rain feeding the rivers which give us the water power, and thus the energy which raised the water and which we get from the water power plant, is the energy of present day sunlight. When we burn coal, it is again the energy of sunlight we use, but from the rays of the sun millions of years ago on the primeval forests of the Carboniferous period, when the earth was still younger. Then the plants stored the energy of the sun's rays in their wooden structure, and the wood turned to coal through the ages, and we are using up in a few centuries the energy of the sunlight which nature has stored through millions of years in the coal mines.

The end of the era of gas and gasolene is in sight unless new and important fields are discovered, and to-day the nations endowed so by nature are harnessing their water powers to meet the demand for power and save their coal. Japan is forging ahead in this respect, taking the lead in the creation of huge super power zones and electrifying her industries and railways. With an available 13,000,000 horse-power in her rivers relasing about 130,000,000 tons of coal she, will, in time, solve her present fuel shortage.

The United States uses 50 million horse-power for power purposes. Of this amount, exclusive of that used by railroads, 40 million horse-power is produced by steam, and 10 million by water power. Undeveloped water power could produce 30 million horsepower and the entire potential horse-power Dr. Steinmetz estimates at 300 million.

The 10 million horse-power developed by water power in America at present saves the consumption of 100 million tons of coal. The industries and public utilities of the United States now use about 230 million tons of coal, railroads 160 million tons, 110 millions are used for heating purposes, and 110 millions more for miscellaneous uses. Thus, if the 50 million horse-power potent in now undeveloped water power were utilized, Dr. Steinmetz says, it would result in the saving of some 500 million tons of coal, or more than all that is now used by the industries and railroads in the United States, with some to spare.

## Power Standardisation in Japan

THE Japanese imperial department of communications has been working on a plan for standardising the electric-power supply, with the object of cutting cost and increasing the actual supply. Fundamental to the plan, Japan needs to standardise the cycles used. The number of cycles now general for transmission in Japan varies considerably, from 25 to 100, including 30, 40, 50, 60 and 80. However, the number is gradually becoming standardised at 50-60. Classifying the electric power enterprises in Japan according to the number of cycles, the following is obtained :—

| *Districts* | *Cycles.* | *Kilowatts* | *No. of Enterprises* |
|---|---|---|---|
| Kwanto .. .. .. | 50 | 158,669 | 45 |
| | 60 | 11,111 | 6 |
| | Others | 20,543 | 4 |
| Osaka and Nagoya .. .. | 50 | 38,442 | 71 |
| | 60 | 338,219 | 112 |
| | Others | 10,912 | 4 |
| Chugoku .. .. .. | 50 | 5,011 | 9 |
| | 60 | 37,921 | 26 |
| | Others | 0 | 0 |
| Shikoku .. .. .. | 50 | 3,153 | 10 |
| | 60 | 20,369 | 13 |
| | Others | 537 | 1 |
| Kyushu .. .. .. | 50 | 63,450 | 30 |
| | 60 | 86,020 | 23 |
| | Others | 0 | 0 |
| Tohoku .. .. .. | 50 | 27,090 | 67 |
| | 60 | 73,288 | 37 |
| | Others | 0 | 0 |
| Hokkaido .. .. .. | 50 | 20,501 | 31 |
| | 60 | 38,138 | 15 |
| | Others | 0 | 0 |
| All Japan .. .. .. | 50 | 316,321 | 263 |
| | 60 | 605,066 | 232 |
| | Others | 331,993 | 9 |
| Total .. .. .. | | 1,253,380 | 504 |

By using converters, the standardisation can easily be accomplished, although a loss of more than 10 per cent. is caused in conversion, and it not only affects profits, but requires a change in the motor, generator, transformer, electric-motors, etc. The question of standardisation of transmission was discussed in the Diet this year, and the imperial department of communications is making a study of the question.

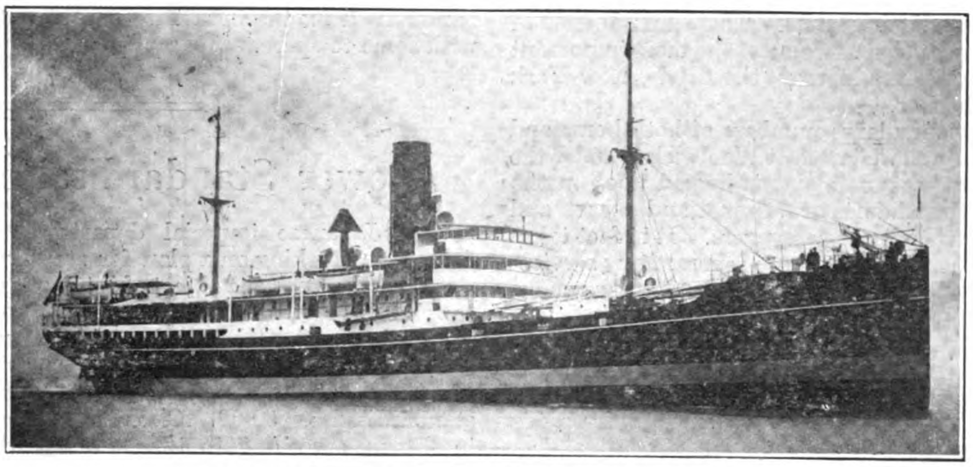
# Taikoo Builds Turbines

## The Engineering Future of Hongkong

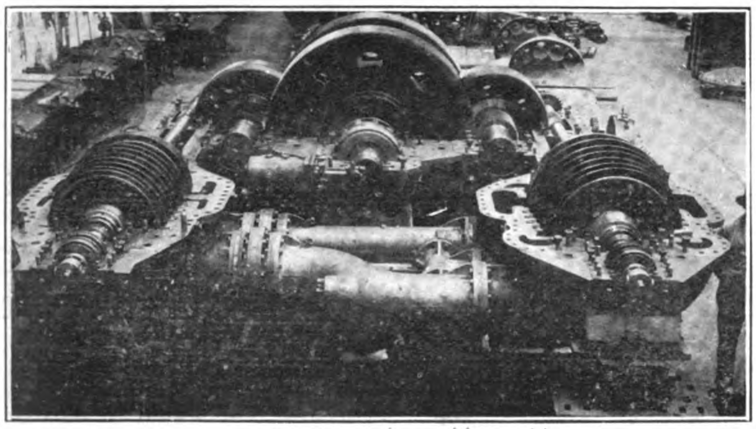
THE success of Dr. Sun Yat-sen in establishing liberal rule in the province of Kwantung, brings so much nearer the day when co-operation with Hongkong will bring with it practical results towards the expansion of engineering industries in that colony. As pointed out in previous editorial articles in this magazine, the one thing essential to the development of Hongkong into a great manufacturing centre is cheap coal, which can come only from opening the mines in the neighboring province of Kwantung. With an unlimited supply of cheap labor drawn from the Chinese provinces, coupled with a supply of cheap coal from the same sources, Hongkong in a few years would become one of the largest manufacturing centres of the world. This might also be true of other parts of China were conditions different, but Hongkong has one advantage over Shanghai, Hankow or other important Chinese centres. There is law and order, security and guarantees in Hongkong for capital which do not exist in other parts of China, and this, for some years to come, will be the determining factor in any large scheme for industrial development. In the eighty-one years of its existence, Hongkong has grown from a pirate's headquarters into the largest port in the world, its population increasing from 5,000 in 1842 to nearly 700,000 in 1922. With cheap coal and the stimulus this will give to industrial enterprise in all lines, the population should in a few years reach 5,000,000. Nothing can then prevent the growth of enormous steel works and allied industries, which will produce machinery at a price that will defy competition from Europe, America or Japan.

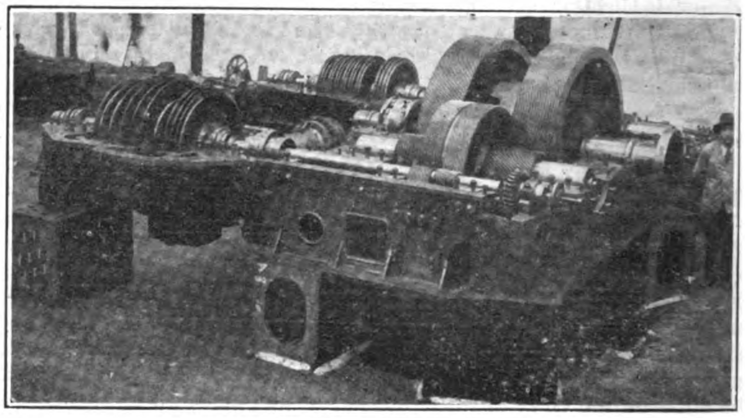
The basis for these engineering enterprises already exist in the great dockyards of the Hongkong & Whampoa Dock Company, The Taikoo Dockyard and Engineering Company, W. S. Bailey & Company and several minor European and Chinese engineering concerns. The first two companies are equipped to build the largest steamers and the most modern machinery, while the last handles the smaller business and is now preparing to build its own drydock. All of these enterprises have been at various times fully described in past issues of THE FAR EASTERN REVIEW.

As an indication of the importance of these shipbuilding works, we give prominence to a set of illustrations showing the construction of geared turbines made by the Taikoo Dockyard and Engineering Works, Ltd., for the s.s. *Kaying* built at the works last year. The vessel has a gross tonnage of 2,626 tons, with a length of 321 feet, beam, 44 feet, depth moulded, 23 feet, and was built to the order of the China Navigation Co., Ltd. for their Bangkok trade. It has two decks, a long combined poop and top gallant forecastle. Accommodation is provided on bridge deck amidships for the officers, engineers and first-class passengers. Cabin accommodation is also provided at the after-end of the upper deck. The 'tween decks have also been made suitable for carrying passengers. The cargo gear consists of eight steam winches and derricks capable of dealing with weights up to 30 tons. The steam steering gear is of the "Wilson Pirrie" type, fitted in house aft and controlled from amidships by telemotor gear. The cellular double bottom is constructed for the carriage of oil fuel, if required, and the fore and after peaks can be used as trimming tanks. The propelling machinery consists of a set of "Brown-Curtis" type of turbines, built by The Taikoo Dockyard & Engineering Co. of Hongkong, Ltd., comprising H.P. and L.P. turbines, combined with astern turbines, driving a single propeller through double reduction gear, capable of maintaining a total combined shaft horse-power of 1,600 on ordinary sea service, with the turbines running at 3,500 revolutions per minute and propeller at 102 revolutions per minute. This machinery is supplied with superheated steam from one large multitubular marine boiler at a working pressure of 200-lbs. per square inch. The boiler is fitted so that either coal or fuel oil can be used for generating steam under forced draught on the "Howden" system. The vessel is also fitted with a "Cochran" donkey boiler and the latest auxiliary machinery, and is lighted by electricity throughout.



Turbines Steamer "Kaying" built at Taikoo Dockyard





General Turbines for the s.s. "Kaying" built by the Taikoo Dockyard and Engineering Works, Ltd., of Hongkong

# The Promising Coal Fields of Taiwan

THE Japanese government promulgated mining regulations for Taiwan in 1896, and ordered an official survey of the coal fields in the northern part of the island to be made. During the decade following mining progress was exceedingly slow, only about 100,000 tons a year being mined at the best. After the Russo-Japanese war, however, the prosperity of Japan, and the opening of mine fields previously reserved for the navy resulted in a general development of coal mines on Taiwan, and by 1912, the output was increased to 300,000 tons. The mining methods were very primitive, and the product could not compare with either the Japanese or the Chinese coals. The demand caused by the European war increased the output to more than 1,000,000 tons. Japanese capital was now for the first time invested in the Taiwan coal fields, the Keelung Coal Mining Co., the Taiwan Coal Mining Co., and others of sound standing being established, with modern equipment and the output marketed throughout the Far East.

Exports were confined to Hongkong, Canton, and Amoy reaching 230,000 tons in 1918.

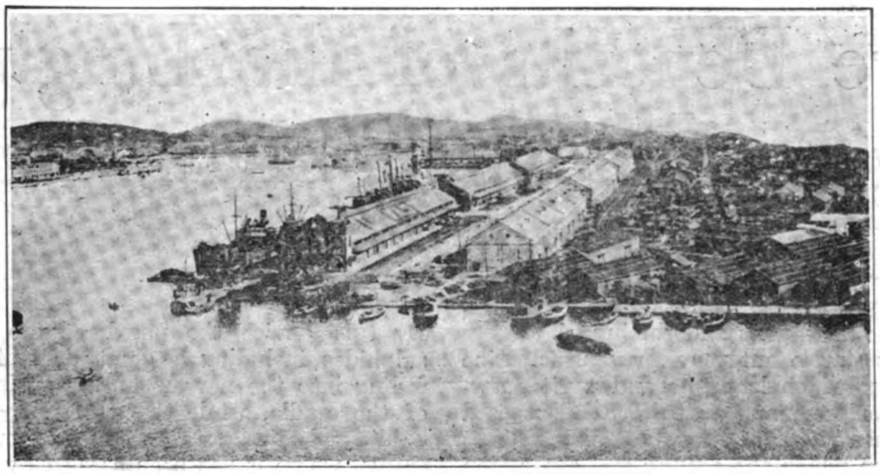
Since 1919, the exports to the above ports have increased and new markets found in Shanghai, Manila and Singapore. In 1921 exports to Hongkong and Canton exceeded 430,000 tons. This record was maintained in 1922, while in the same year over 200,000 tons were shipped to Japan proper. Production in 1922 amounted to 1,250,000 tons, while the export was greater by about 50,000 tons. The following table shows the production and export of Taiwan coal to foreign countries and to Japan proper since 1912:—

| *Years* | *Production* | *Exports* |
|---|---|---|
| 1912 .. .. .. | 276,240 | 285,593 tons |
| 1913 .. .. .. | 319,371 | 326,231 |
| 1914 .. .. .. | 342,787 | 369,078 |
| 1915 .. .. .. | 379,268 | 384,932 |
| 1916 .. .. .. | 517,581 | 452,693 |
| 1917 .. .. .. | 673,008 | 645,636 |
| 1918 .. .. .. | 757,497 | 669,641 |
| 1919 .. .. .. | 1,078,589 | 1,090,202 |
| 1920 .. .. .. | 1,088,652 | 1,117,391 |
| 1921 .. .. .. | 994,125 | 1,034,875 |
| 1922 .. .. .. | 1,246,115 | 1,311,973 |

The coal fields of Taiwan extend from Keelung in the north to the Mt. Ari region in the south. Fine coal is mined in the north around Keelung, and towards the south the quality gets less fine. The principal coal fields in Taiwan are the Shikyakutei and the Mokuzan seams, the first having a width of 3 feet of excellent quality and graded as the best of all Taiwan coal. The second seam is 1.2 to 2-ft. wide but its quality of the coal is lower than the output of the Shikyakutei.

A recent survey estimated the amount of coal in Taiwan at 690,000,000 tons, of which 460,000,000 tons can be mined. Excluding the coal already mined, amounting to about 8,000,000 tons, there remain about 452,000,000 tons potentially available. Estimating the output at about 2,000,000 tons per annum, there are supplies available for another 220 years. The estimated reserves of coal in the Taiwan fields will stand comparison with that of the Fushun Mines in Manchuria. In addition to these potential resources, there are several districts in the savage regions where surveys have not yet been made.

It is generally taken for granted that Taiwan coal is poor in quality. This is a mistake. The primitive method of mining and careless grading are mainly responsible for this idea. When the Taiwan government sent Ryoko and Kinhori coal from the Shinkyakutei seams to the Kure Naval Arsenal in June, 1918, it were graded as "second," and used for fuel in battleships. The dust coal of the same mines passed the tests as "third," and recommended for factory use.



General View of the Port of Keelung: A Coal Handling Wharf is being constructed to handle 800,000 tons a year.

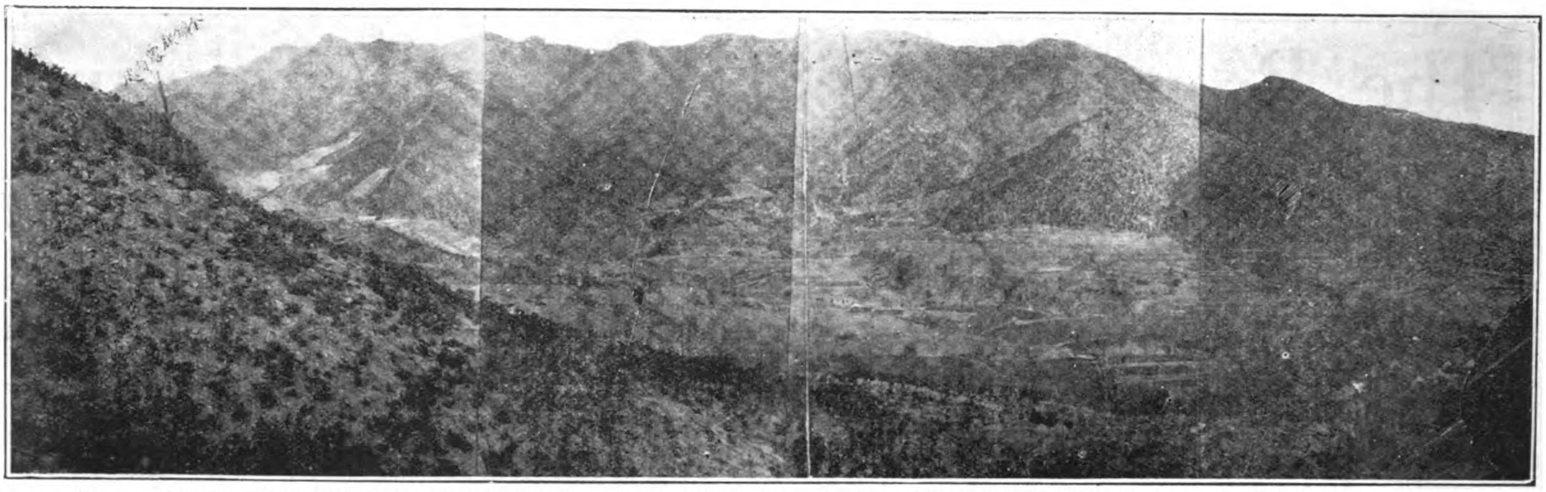
The recent expansion in the demand for Taiwan coal in the markets of the Far East is due to the efforts of the dealers, and to its good quality. Taiwan holds an excellent geographical position and its output can compete with the best Japanese Fushun and Kaiping coals in the matter of freights and deliveries. The mines are located not more than two to ten miles away from shipping ports making for low shipping costs.

The Keelung Coal Mine Co. has installed a grading machine with a daily capacity of 1,000 tons at Kokan station on the Zuiho Railway line, near the port of Keelung. Other mines are using women workers for coal grading, and the reputation of Taiwan coal is rapidly increasing.

The port of Keelung is being modernized. Its present capacity is two steamers outside the port, and 15 inside, a total of 17. It has no mechanical equipment for coal handling, which is done exclusively by coolie labor. The total capacity for cargo handling in Keelung is 2,000 tons of fuel, and 3,000 tons of cargo a day. A quay for the exclusive handling of coal is now under construction at Gyochu in the western part of Keelung Bay, and when completed it will be possible to handle 800,000 tons of coal a year there, and when the railway system is improved this can be increased to 1,000,000 tons.

The future of Taiwan coal is, therefore, promising. Foreign steamers coming to the Far East have always obtained coal in Hongkong, Manila, or Singapore. It is very rare that coal at Keelung. But in years the amount of coal supplied to foreign vessels has steadily increased. In 1918, only 400 tons of bunker coal was supplied, in 1919, 11,000 tons, and in 1920, the total reached 24,000 tons. This fell off to 8,000 tons in 1921, and climbed up again in 1922 to 13,000 tons. Because of poor port accommodation it is impossible to attract all steamers to Keelung for coaling, but it is hoped that in time at least half of the bunkering done at Hongkong amounting to 200,000 tons a year may be deflected to Keelung.

Japanese privately-owned steamers plying to the South Seas all coal at Keelung on their home voyages. The Toyo Kisen Kaisha South Sea line also commenced coaling at Keelung last year. These steamers require only a half day, or at least a few hours to put into Keelung, and with Japanese first grade bunker coal at Y.20 in Hongkong, and Taiwan coal at Keelung Y.14, there is a saving of Y.6 a ton. The total handling quay will be completed by the end of 1924. Thereafter Keelung should become a coal trade centre of the Orient.



**Panoramic view of the hills to the south of Linglungshan mountain together with the southern end of the outcrops of one of the principal fissure veins in the Linglungshan region. Looking east-northeast**

# Gold Ore Deposits of the Linglungshan Region, Tsaoyuen, Shantung—2

*By Y. Tsenshan Wang*

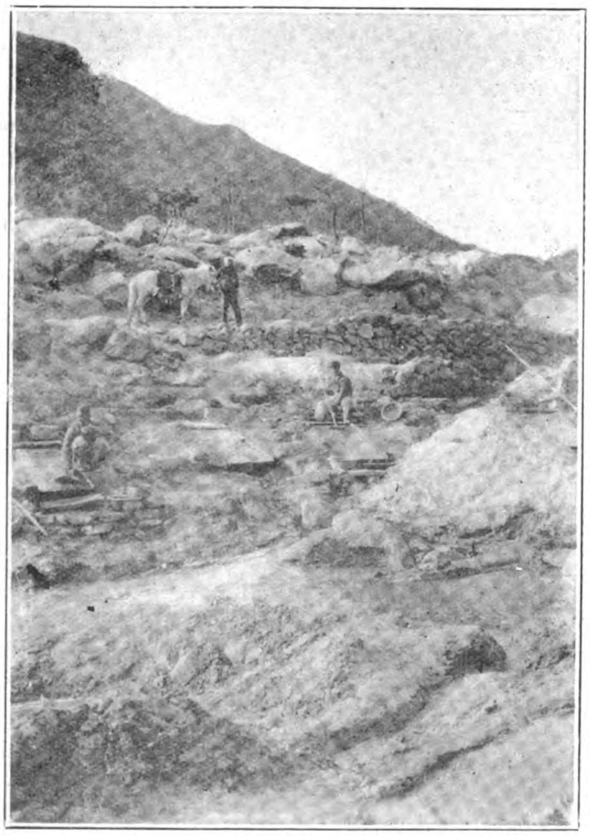
*(Continued from page 389)*

ORE *dressing.*—The treatment and sorting of the ore at these mines is simple but very unscientific. The general occurrence of chalcopyrite and pyrite, particularly where the former appears to have decomposed in cracks or on open surfaces in the quartz veins, forms the principle upon which the sorting and separation of the ore is based. The presence of chalcopyrite and sometimes of the native copper disseminated in the quartz, is invariably much richer than the veins carrying both chalcopyrite and pyrite or the latter alone, and the separation of the two classes of ore becomes of importance.

1st step: The ore is carried down from mines in baskets by the Company's own men to the "ore dressing room." The ore is separated into classes, and is broken on a hard rock with hammers into pieces 2 c.m. square.

2nd step: The broken pieces are then transfered to a stone grinder, upon which was placed a stone roller of 40-50 c.m. in diameter and about 70 c.m. in length. By means of ropes attaching to both ends of the stone roller, it is pulled around upon the grinder by a mule. In the grinding house, the floor is not covered in any way, so the loss or waste of the powdered ore must be astonishingly great. After the ore has been pulverized, it is transferred to boxes and conveyed to the milling plant which lies just on the other side of the main buildings of the Company.

3rd step: The ore is then mixed with water and the wet material is placed on a board 6 feet long and 3 feet wide, inclined at an angle 10°-14°. This may be called a true cradle. A man sitting at the upper end of the cradle is equipped with a long handle wooden claw, which he moves up and down by hand, much water being added from time to time. By this device the powdered ore is washed and sorted, the sulphides including a great deal of gold and other admixtures, falling into the narrow tanks or sinks placed at the lower end of the cradle, while the gold mixed with much sulphides, iron oxides and silica, are allowed to accumulate at the higher end of the cradle, where it has been carried by the moving up and down of the claw. The fine wet products from the sinks are again ground on a smaller stone grinder which is moved around by two or more men. The finer products from this second grinding are again worked on the cradle and the gold together with some other materials, is separated in the manner described. The fine materials in the sinks may be re-worked in that way for several times, but in general the process is not repeated more than three times, this being usually decided by the amount of gold sorted out in a preceding operation. If the amount of gold obtained from the second or third operation, is very small, the material is sold to the near-by farmers at a price of 100 coppers per 100 catties in a partially dry condition.



**The cradles upon which the gold is washed and separated in the manner as described in the text. In the backgound shows the northern limit of the Linglungshan Summit. Looking west**

4th step: The auriferous material accumulated at the upper end of the cradle at each time, is treated in a pan with water whatever amount of gold may be there being panned out. The gold obtained in this way is said to have 85-90 per cent. pure, the other admixtures, iron oxides and silicate, constitute about 15 per cent. or 10 per cent.

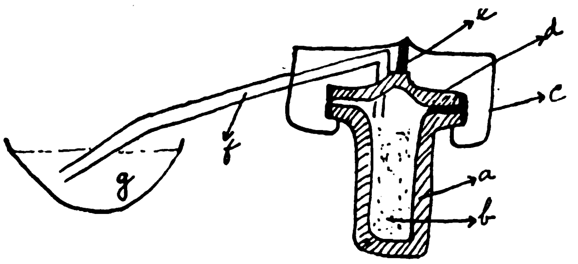
The separation of gold from the powdered ore is also effected in another way. The powdered ore from the first grinding is mixed with water and the wet material is washed in a dish 8 inches in diameter and 3 inches deep perforated in the bottom with numerous minute holes. The dish is held in the hand over the amalgamation table and under a small stream of water. The water and the powdered ore are allowed to discharge

through these minute holes and the gold is caught by mercurry on the amalgamation table which is about 10 feet long and 2 feet wide inclining at an angle of 25°. The mercurry is added from time to time and the run-offs from the amalgamation table are arrested in a sink at the lower end of the table. These run-offs are re-worked in largely accordance with the desire of the proprieter. In short, gold extraction in all cases, is lamentably low, due largely to inefficiency and lack of proper knowledge in dealing with this free milling-gold ore.

The amalgam is dried by squeezing several times in a soft sheep skin and when enough is obtained, the mercurry is distilled off.

## Distillation and Smelting

*Distillation.*—The amalgam is placed in an iron vessel which is 1 c.m. thick with an outside diameter of 9 c.m. and inside diameter of 7 c.m. The inside depth is 16 c.m. The top is fitted with an iron cover which is perforated with a hole to which is fitted with an iron tube a little less than 1 c.m. in diameter and about 2 feet long, bent at right angle at the upper and slightly at the lower end. The iron cover is fastened on the vessel by means of a hook and a little bar, all of which are made of iron, the bar being placed in the middle between the hook and the cover (see the following diagram):—




*Smelting.*—The product extracted by the panning process is more or less mixed with some iron oxides and silica, and probably with some sulphide of iron, too. It is first dried and is then placed in a sand crucible without the addition of extra flux. The charged crucible is then placed in a Chinese blacksmith's furnace and is heated by means of an " air blower." By this way of heating, the entire contents is soon melted into a regular metallic bath, in which the undesirable part, principally in form of iron silicate, is concentrated on top of the bath, and the gold collects at the bottom. At this stage, the top portion or the iron silicate is poured off and the gold is poured into an iron mold and allowed to solidify. The gold obtained in this way is said to be 90-95 per cent. pure.

## The Cost of Mining and Labor Conditions in the Region

*Cost.*—The men who are making chazel holes under contract are paid according to the regulation size of holes. For a hole 10 feet long, 6 feet high and 5 feet wide, the payment is 2,500 coppers, or about $20. All the material and tools required in this work is furnished by the company. There were about 80 men under contract at the time of the writer's visit.

The men who carry the ores in baskets from different parts of the mines are paid from 15 to 25 coppers per 100 catties of ore according to the distance they have to travel between their starting place and the sampling house.

The men working on small grinders, get 20 coppers each per day and those working on the cradles get 35 coppers each.

The men working with his mule on the large grinder, gets 34 coppers for every 100 catties of powdered ore produced including the work of breaking the ore into small pieces before it is transfered to the grinder. The men were formerly paid 43 coppers per 100 catties, but owing to the declining condition of the mines, a reduction in their wages has been made. They have however, been assured that their original wages will be restored as soon as the Company can increase its output.

*Labor Condition.*—The nominal wages as stated above, seems to have satisfied the poor community. The total number of men employed by the Company (the Tsaoyuen Gold Mines Company) was only 120 at the time of the writer's visit with the exception of those who worked for the Company under contracts. Out of 120 men, 35 were working in mines ; 12 were rock carriers ; 15 were in sampling house ; 3 were foremen ; 46 were engaged in the milling plant ; 3 were blacksmith ; 6 coolies. The aggregate monthly pay roll of the Company amounts to $250. It is said there were not less than 3,000 men who had worked for the Company some 18 years ago when the Company was in the most prosperous condition.

In spite of the nominal wages the men seem to be quite satisfied, as no strike of any nature has ever been originated in the history of that Company.

*Financial Conditions.*—Without exception the mining property is usually leased and seldom sold to the Tsaoyuen Gold Mines Co. The owner of a mining property may do some developing work at the beginning before the property is leased to that Company, but such a case is rather rare. Most of the owners do not take any trouble to secure their mining rights nor do they develope their property to any extent. If a property is required by that Company, the owner of that property will be asked to sign a lease, for which rent is given which varies with each property. A great portion of the Company's property was leased in that way and the leasing system has perpetuated itself and is still in extensive practice. In many cases leases run from five to ten years, and in others are renewed every year. No royalties are paid to the owner of property whatever success may attend the efforts of the Company.

It is said that the Tsaoyuen Gold Mines Company has had no great success for the last 15 years. It was particularly true that the production of gold in the early part of 1917 was hardly enough to cover their expenses.

## Structural Features of the Gold Deposits

*Principal Types.*—The prevailing types of this auriferous sulphide ore may be referred to (1) banded and (2) irregular ore bodies. These two types are not sharply distinct and they may occur together. As here developed, the first type consists of varying width of banded ore bodies (Figs. 2 and 6) approximately parallel to each other, ranging individually from a few millimetres to several centimetres in width, rarely exceeding 39-40 centimetres, whereas the second type consists of irregular patches as shown in Figs. 3, 4 and 5. Within these unusually wide belts of fracture, can be distinguished two or more zones of concentrated fissuring, which lie close enough to be regarded as compound fractured zones (Fig. 4).

In addition to these two types, the auriferous sulphide ore bodies may be found scattered individually in quartz, or form aggregated patches, more or less parallel to each other. Further, a narrow fissure may be accompanied by curved and irregular fracturing and in these instances usually occur the ores of great value and may be regarded as stringers (Fig. 6). This type which is commonly found in the productive part or on the upper levels, is believed to represent some of the ore shoots. In all these cases, the evidence of the ore deposition in open fissures is strongly indicated. In others the ore stringers became small and barren toward the side of the vein, and the rich ores may be concentrated only in the midpart of the vein forming an exceedingly fine net work of veinlets as shown in Fig. 6.

The structures thus far described are those associated with the mode of occurrence of the gold ore in quartz veins. As to the shape of the quartz veins themselves, they are more or less lenticular (Fig. 1) and not uncommonly follow the strike and dip of the inclosing rocks, chiefly gneissic granite.

It is very striking that many of the fissures occupied by those quartz veins are in some cases immediately close to the dolerite dykes, whose structural details connected with such associations are here briefly recorded. As seen in the underground workings, these basic dykes have a general tendency to split, as a result of underground weathering, into thin slabs roughly parallel to the dyke walls. Fissuring along the line of such a dyke forms a well-defined sheeted zone which generally constitutes a belt of productive lodes. A considerable number of the productive lodes on various levels in the Linglingshan mines, lie alongside these weathered dykes, and this fact has been used by the miners in that region, as a criterion for the discovery of rich veins. But the fact that the dolerite dyke itself is, so far, not known to carry any gold and that the dyke traverses some quartz veins at several places, no genetic relation between the auriferous sulphide deposit and the dolerite dykes, is indicated.

*Distribution of the Lode Fissures.*—As a structural element, the auriferous sulphide quartz lode fissures of the Linglungshan region

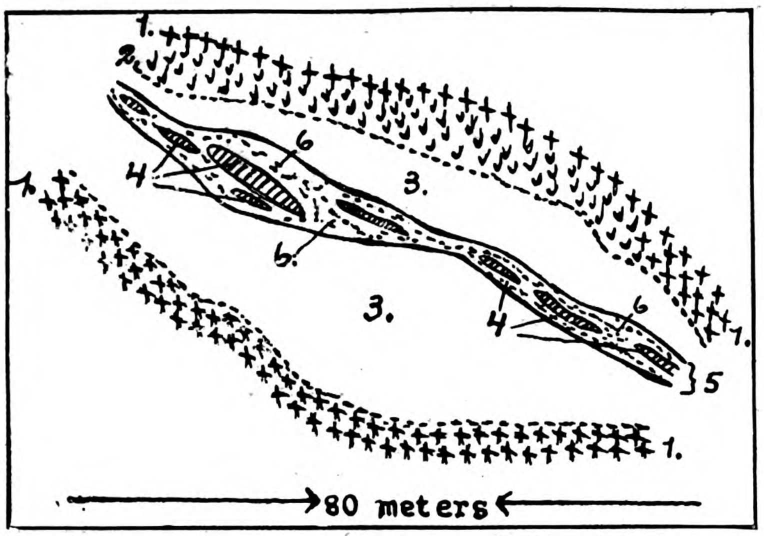



Fig. 7

1. Gneissic granite.

2. Dolerite dyke.

3. Portion of the quartz vein without any ore.

4. Irregular auriferous sulphides in the fractured zone in the quartz vein.

5. Fractured zone.

6. The primary and secondary quartz in the fractured zone.

Section showing the character of the replacement ores which are cemented by coarse and fine-grained quartz in one of the richest quartz veins in Linglungshan. Looking N.E.

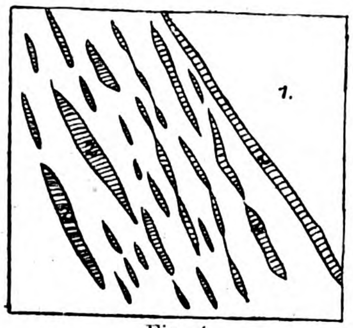


Fig. 4

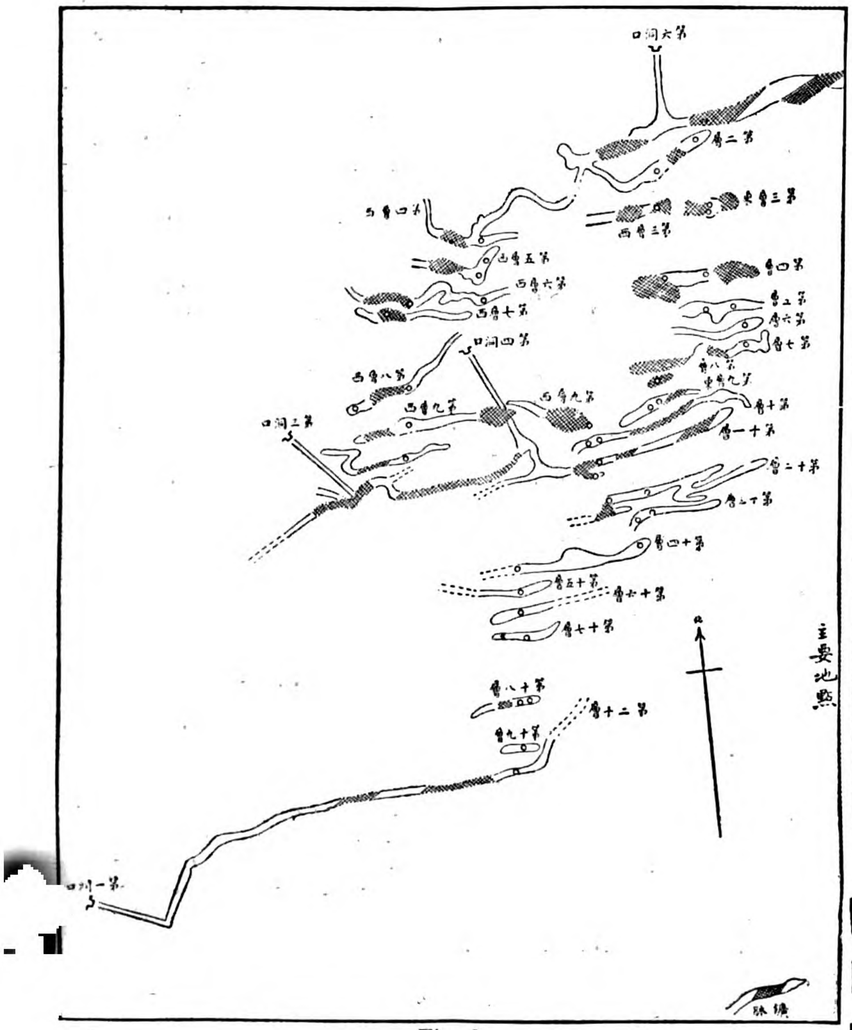


Fig. 6

Plan showing position of various levels and some of the principal locations, where a large ore body has been mined out in the Linglungshan Mine, Linglungshan, Tsaoyuen Hsien, Shantung.

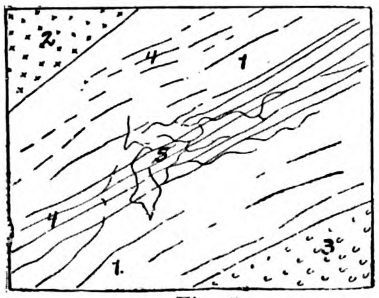


Fig. 5

1. Quartz vein.

2. Coarse or gneissic granite.

3. Dolerite dyke.

4. Bands of auriferous sulphides in the quartz vein.

5. Stringers of auriferous sulphides in the same vein.

Sketch of a compound fractured zone showing the bands and stringers of auriferous sulphides in a quartz vein. Level 7.

10 Meters

Fig. 3

1. Coarse or genissic granite.

2. Dolerite dykes.

3. Quartz veins.

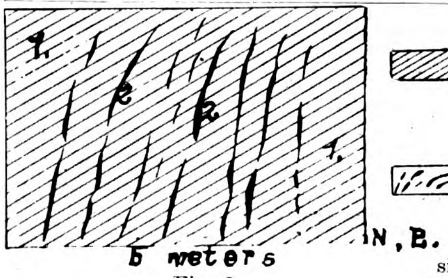
4. Patches of auriferous sulphides.

Vertical section showing irregular patches of ore bodies in a quartz vein with intersection of the vein by a dolerite dyke. Level 1.

1. Quartz vein.

2. Irregular bodies of auriferous sulphides.

A section drawn from a specimen showing the actual shape and distribution of the irregular auriferous sulphides in a quartz vein.

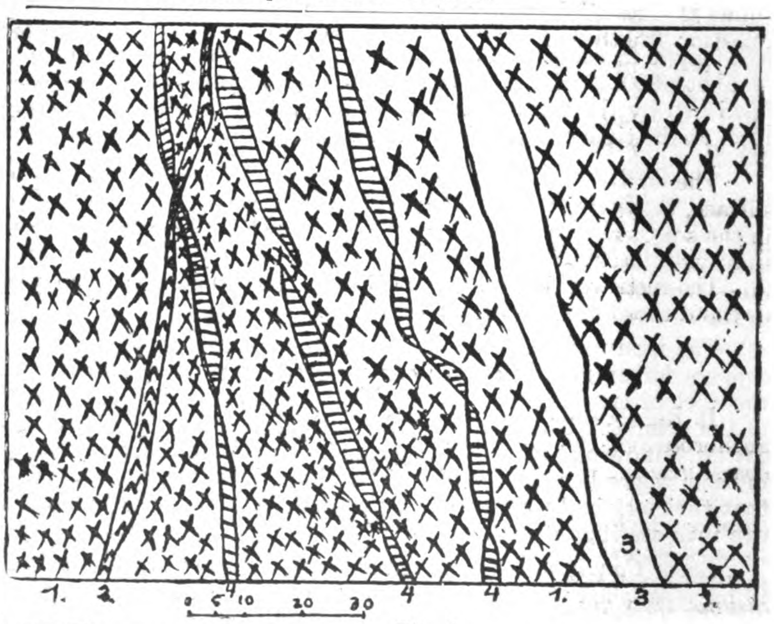



1. Quartz vein.

2. Auriferous sulphide bands.

Fig. 2

A section in which varying size of auriferous sulphide bands distributed almost in the whole width of a quartz vein. Level 11.




1. Coarse or gneissic granite.

2. Dolerite dykes.

3. Quartz vein without auriferous sulphides.

4. Quartz veins with auriferous sulphides.

Fig. 1

Vertical section of Hungtsinpeh Quartz veins, their distribution and lenticular structure with intersection of one of the ore carrying veins by a dolerite dyke.

are exceedingly conspicuous. They are in some cases marked by bold outcrops of quartz which usually show the character of re-crystallization and which are often superficially coated by ferruginous gossan. It is equally perceptible that the structures of these fissures, at least the principal ones, have been traversed through by faults, the most notable ones are Hsanshan fault and Lushan fault. They are, however, difficult to recognize as the mass of their rocks along these fault lines, is identically the same everywhere, so they are for the most part indicated only by broken lines on the geological map.

Both folding and faulting especially the latter, have undoubtedly influenced the present topographic development of the region, It is this relation what facilitated the discovery of the ore deposits and which renders it possible to follow the veins along the upper part of the hills without stripping off the overlying rocks, and sinking test pits in the early stages of the mining development in this region. Consequently most of the claims of the Tsaoyuen Gold Mines Company were laid out along the aforesaid fault lines which have proved to be the lines of productive lodes. Furthermore, the principal lodes, such as those of the Linglungshan and Lushan systems are quite apparent on the surface.

On the geological map, the outcrops of the principal lodes are represented with their relative positions and courses. The parts, which are obscure or are abruptly disconnected, are represented by dotted lines. As far as our observation goes, the group of the productive lodes is found invariably in the gneissic granite and is strongly developed within the area occupied by Linglungshan and Lushan ranges, which are approximately 12 *li* in length and 1½ *li* width.

Beyond this general productive tract a few productive fissures are also known to occur in some superficially isolated gneissic granite hills, only a short distance south of Linglungshan. The west part of Lushan range, extending for a distance of about 3 kilometres to, and include Mashan mountain, is a part of the region under consideration, and has been prospected by the Tsaoyuen Gold Mines Company at different times. It also exhibits outcrops of lode fissures, though the line of outcrops is not clear and it is not shown on the accompanying geological map.* The area which lies immediate southeast of the present main camp does not appear to be productive as far as the gold deposit is concerned. But about two or more kilometres, south-east of Linglungshan range. A vein known as Koshenkeh-Pudehkong vein, appears to be economically important. While the vein is moderately developed, the productive part has not, as yet, been reached. It appears, however, to be less fissured than the portion stretching from Linglungshan to Dayingting and reappearing to the east and northeast of Tutsingkeu.

It is certain that the region probably contains many more important fissures than are shown on the map, but this probably shows the essential arrangement of the lode distribution. As to the question whether the productive fissures are truly local and extend in depth with undiminished intensity, nothing can be said with certainty at the present time. Such conclusions cannot be drawn until some further development work has been done for a depth, say of 300-500 feet below the present lowest level.

The strike of the principal lode fissures, as they appear on the surface, is generally southwesterly in Linglungshan mountain while in the southern half, on the east side, of Lushan mountain, a west-southwest strike appears to predominate. It should also be understood that the above applies to the fissuring which has been observed in the course of topographic surveying.

## Origin of the Fissures

It has been shown that the principal fissures in which the auriferous sulphide quartz veins occur, are largely confined to the coarse grano-gneiss or gneissic granite, and that their formation was undoubtedly accompanied by slight faulting in character. The fissures which are occupied by the dolerite dykes are very similar to those occupied by auriferous sulphide ore-bearing quartz veins and more or less related in direction and distribution. Under these conditions, they might well be taken to have been associated with the gold deposit in quartz veins in point of geological time. But from the fact that no gold has so far been found in these basic dykes, it is believed that the ore-bearing solutions worked into the cracks and small fissures developed on cooling in same of the quartz veins, probably long before the intrusion of the dolerite dykes. This is clearly shown in the underground workings where a basic dyke traverses some quartz veins (Figs. 1 and 2) particularly in a sheeted zone. The sequence of the events seems to have been as follows :

1. Fracturing and sheeting in gneiss probably during the period of its metamorphism.
2. Intrusion of grano-gneiss or gneissic granite.
3. Intrusion of pegmatitic veinlets, and of quartz veinlets into the geniss toward the end of intrusion (2).
4. Fracturing on cooling in the gneissic-granite.
5. Intrusion of quartz, largely as quartz dykes into the gneissic-granite and gneiss, and slight fissuring in part of these quartz dykes probably by mere contraction on cooling, whereby cracks and small fissures were developed particularly at the contact with the already cooled gneissic-granites.
6. Ore deposition by emmanations and ascending solutions, as a result of the dying out the volcanic activity.
7. Intrusion of basic dykes filling the rest of the fissures in the gneissic-granite and gneiss.

The areal distribution of the fissures and their relative position to the dolerite dykes point to the fact that they were produced by local and not by regional stress. In seems most reasonable to regard the Linglunshan fissures as having resulted from certain local stresses.

Since the rocks were in most cases fractured and not noticeably displaced there is no clue to the direction and character of the forces which produced the faulting. Under these conditions the possible explanation for the characteristic sheeted structure of the auriferous sulphide quartz veins in this district necessarily involve compressive stresses. In the process of the solidification of the coarse granite intrusions, a slight sinking in part by forcing a rigid mass to adjust itself to a slightly smaller space of different shape, would produce compressive stresses in the subsiding mass. These stresses would be relieved by fractures on cooling. Similarly the quartz dykes would produce the same effect on solidification by their own compressive forces. Faulting had undoubtedly assisted the formation of fissures in the granite system, but the amount of settling due to cooling necessary to produce fissuring of the kind in the quartz system would be enough and needed no faulting to assist. It is believed, however, some leter process by solution such as the process of replacement had also taken part in the formation of these fissures in the quartz system prior to and during the same period of the ore deposition in it.

This explanation supplies also a clue to the observed relation between the dolerite dykes and the auriferous sulphide quartz fissures. The former may be regarded as a final but a separate magmatic eruption of the volcanic reservoir, squeezed, after the formation and mineralization of the latter, into the fissures formed largely by settling of the solidified grano-gneiss or gneissic granite intrusions. Thus the intrusion of the dolerite dykes cannot be regarded as genetically related to or directly connected with the gold deposition or the intrusion of the quartz dykes which will be called quartz veins in the discussion of ore deposits in this paper. The dolerite intrusions were the final structural manifestations of volcanism in the region and succeeded, not directly, the gaseous and aqueous emmanations and ore deposition in quartz.

## Summary of the Ore Deposits

*General Character and Occurrence.*—The characteristic feature of the Linglungshan ores is the occurrence of the gold mechanically mixed with sulphides in quartz veins. The sulphides are chiefly iron pyrite and, to a minor extent, chalcopyrite. The copper pyrite, with which is generally associated an unusual quantity of free gold, occurs mostly in ore shoots. Galena and sphalerite are only sparingly present in the majority of the quartz veins, and as a rule they contain very little or no gold to form ore. Silver is usually present in the ore and its proportion to the amount of gold is shown in the following table :—

* See previous issue.

| Location. | Condition of the sample analysed. | Au in oz. per ton. | Ag in oz. per ton. |
|---|---|---|---|
| Laoniutung | Oxidized .. .. .. | 3.4406 | .2150 |
| Linglungshan | ,, .. .. .. | 5.268 | nil |
| ,, | ,, .. .. .. | 3.763 | ,, |
| ,, | ,, .. .. .. | 3.010 | ,, |
| ,, | ,, .. .. .. | 7.848 | ,, |
| ,, | Fresh, richly auriferous .. | 17.203 | .322 |
| ,, | ,, .. .. .. | 4.838 | 2.472 |
| ,, | ,, .. .. .. | 10.752 | .430 |
| Hungzaya pit | ,, very poor ore .. | trace | trace |
| No. 6th adit. | ,, poorly auriferous .. | ,0269 | ,, |
| Linglungshan | ,, taken from the edge of a rich vein .. | trace | ,, |
| No. 20th adit. | . .. .. .. | ,, | ,, |
| No. 10th level | ,, .. .. .. | 2.7955 | 1.9384 |
| No. 5th ,, | ,, wholly pyrite .. | trace | trace |
| No. 14th ,, | ,, ,, ,, .. | nil | nil |
| No. 14th ,, | ,, ,, ,, .. | trace | trace |

The quartz, whether or not it carries auriferous sulphides, is believed to have partly accompanied and partly succeeded the intrusion of pegmatitic and quartz veinlets in the gneiss system after the main eruption of the grano-gneiss or gneissic-granite. The strikes of these quartz veins seem to have followed the fissures which mostly run northeasterly and to a less extent those which run east-northeasterly. Only in a few cases does the strike of certain veins appear to have run across that of the country rock almost at a right angle, that is northwesterly, but these veins merely represent branches of their respective mother veins. The angle of the dip of the quartz veins varies from 45 to almost 80 degrees to west and northwest as the case may be.

In some cases the ore forms lenses or patches that differ considerably in horizontal extent and thickness and these patches may be distributed throughout the veins of quartz which is almost the only gangue mineral.

Large grains and threads of gold arranged in radial manner were once found in a quartz nodule enclosed in a mass of quartz, but in the cases investigated the gold was found to exisit in that portion of the vein particularly rich in *massive* iron pyrite or chalcopyrite or both. As a rule the iron pyrites are in broken masses and in part cemented by chalcopyrite. They often completely surrounded the quartz of coarse grains, though the masses of the ore occur along the crevices and joint planes in small crescents in the quartz. Wherever the ore occurs, the quartz is fractured and much of it appears granular between the cross nicols and is commonly enclosed in sulphides. The veins of value rarely exceed 40 feet in width and in most cases are only several inches to 7 or 8 feet wide, and from a few feet to 100 or more feet long. Within this whole length, the width of the vein is by no means uniform but is habitually characterized by swells and pitches. (See Fig. 1). Whether or not the veins are continuous in depth is not, as yet, ascertained.

While these auriferous sulphides largely occur as fillings in numerous cracks in the quartz veins, they are, especially pyrites, sometimes found in small crystals among the quartz grains. As previously stated, some of the rich gold deposits occur as ore shoots. These ore shoots consist of quartz, pyrite and chalcopyrite, the latter is the most abundant admixture of the ore in these ore shoots. The deposits of this character seems to have been confined to the uppermost horizon of the mine, as they are seen only on the high levels. They have been and still are worked for their gold contents, the copper being entirely neglected as in the case of the pyrites. As a rule, the gold content in these deposits is usually high. An average percentage reaches 11.934 ounces gold per ton, and the amount of gold from a group of specimens taken from one of those ore shoots, showed 17.203 ounces gold per ton. Much to our regret the data on the copper content in these gold deposits is not available because of unwillingness of the industrial chemical bureau to make the complete analysis for us.

There are also variations from what may be considered typical quartz veins. The fissures or cracks which were filled by a granular mass or crystals of pyrite, are of no importance, as appreciable amounts of gold are usually found only in massive pyrite. This is clearly shown by the productive veins above and below the 8th level.

Aside from the occurrence in sulphides, the gold is usually present and rich in that portion of the quartz vein which has been more or less oxidized under the influence of weathering. In this connection, some of the richest ores have been mined wholly from the weathered or oxidized quartz veins and this will be discussed more fully when we come to consider the vein oxidation.

As to the extent of this gold deposit, it may be safe to say that the sheeted zones in which the auriferous sulphide quartz may lie extent, on the east side of the present main quarters of the Company, from the hill just south of the village of Tatsiachia, to the northeast of Hsanshan ; on the west side from Hunzaya to Laochukeh, and from Ditaokien to Mashan mountain ; and on the southeast, from Pugehkong to Kohshankeh. The outcrops of these lodes are best shown on the east side of the main quarters of the Company while those in other parts are not all connected or wholly recognizable on the surface.

## Vein Oxidation

*The Extent.*—As generally understood, the depth of oxidation coincides with the depth of the ground water level of the region, but there are exceptions to this general rule. The oxidized veins are largely confined to a very narrow zone below the surface, as fresh quartz veins carrying auriferous sulphides, occur high above the water level. Where the oxidation has gone far enough in a quartz vein, the changes are usually so thorough that the pyrite is completely changed into iron oxides and the copper sulphide, if any, is either reduced to native copper or oxidized to a sulphate. In these cases, the original structure of the quartz vein is usually destroyed and shows a peculiar cellular structure, the cavities and vugs being lined with minute crystals of quartz and their walls being generally coated with iron oxide as observed in severed pits at Huntsinpeh and Laoniutung. From a close examination the gold may be seen to be practically confined to these cavities, or vugs, or to that portion of the quartz veins, in which the oxidation is most thorough. In other cases, the oxidized auriferous quartz vein appears as homogeneous brown soft mass ; in still other cases the very rich oxidized ore-bearing veins are composed of a white compact material, very much like alunite, or a soft mud more or less mixed with jasperoid or a material like a thick brown mud of limonite, kaoline and quartz sand.

*The Process and Influence of Oxidation.*—In the process of oxidation, the meteoric waters are the most important, if not the only, agent. The pyrite in fissures, cracks and joints, which from the most common mode of occurrence, is most easily attacked by such waters, and from its oxidation, yields ferrous sulphate and sulphuric acid,

$$2FeS_2 + 7O_2 + 2H_2O \text{———} 2FeSO_4 + 2H_2SO_4$$

the latter is easily oxidized to a basic ferric sulphate,

$$4FeSO_4 + {}_2O + 2H_2O \text{———} 4Fe\ (OH)\ SO_4$$

While these waters reduce considerably the volume of the ore and remove many of the constituents, mainly of pyrite, the gold content in the veins becomes prominent and is concentrated as the oxidation proceeds. It was due chiefly to this influence of oxidation that a very decided enrichment was found in the oxidized part of the deposit. As far as the Linglungshan region goes, this zone of oxidation (sometimes called zone of weathering) is extremely shallow in many parts of the region.

In some cases a solution and redeposition of gold must have taken place. A part of the gold in the oxidized veins is likely dissolved by the percolated waters carrying ferric sulphate commonly formed in such waters as shown in the equation (2). As soon as the oxygen in the percolated waters is used up the undecomposed sulphides of the cementation zone will act reducingly upon the decending solution to re-percipitate the free gold. So a part of the gold of this zone is really of secondary enrichment and accounts the fact that it either coats the primary sulphides or, as is more frequently the case, fills the cracks within them as an additional portion of gold to the already existing auriferous sulphides in fissures within the quartz veins.

It is an interesting fact that the ores which have been shipped from these mines came either from thoroughly oxidized veins or those of the cementation zone, which is immediately below the zone of oxidation. The analyses obtained of the samples taken from various parts of these mines, tend in the same direction. The ores from the cementation zone yielded, on average, 4.452 ounces gold per ton while the ores from the oxidation zone yielded 4.6655 ounces of gold per ton.

It is also common to find that a very decided leaching of silver has taken place in the most oxidized gold quartz veins. Much more silver occurs in the unoxidized parts of the rich veins than in the oxidized portions, for the unoxidized ores as much as 2.472 ounces silver per ton was obtained, while only .215 ounce (only two-fifth of an ounce) silver per ton, or merely a trace, or, as is frequently the case, none at all is found, in the oxidized ores. This difference may be taken as an indication of the removal of silver during the oxidation of the auriferous sulphide quartz veins or lodes, though the difference may possibly, but not probably, be due to original unequal distribution of silver in the veins.

As to the question whether the gold content in the metal sulphides in the quartz veins in this region decreases, or increases, or remains constant in all depths, it is not easy to form an opinion. The writer inclines to the belief that the oxidized ores as well as the ores occuring in the cementation zone, must be richer than the corresponding auriferous sulphide quartz veins, in greater depth. Not till some further development work is done, as recommended elsewhere in this paper, can the exact nature and extent of the ore body be ascertained with certainty.

## Genesis of the Ore-Deposits

*Origin.*—Concerning the origin of this gold deposit, two ways of derivation may be suggested. Firstly, the ore may have been leached from the neighboring rocks, the gneiss, gneissic-granite and dolerite dykes by descending and ascending surface waters, and secondly, the ore may have been segregated from cooling intrusive magmas and brought up as emmanations by ascending surface waters. That it was leached from the surrounding rocks by surface waters is exceedingly doubtful, for this hypothesis does not furnish an explanation of the confinement of the ores to the quartz veins in this region. Furthermore, the determination of gold in any rocks, other than those quartz veins, from this region, would have little value, for the fact that a general permeation by solutions has undoubtedly taken place since the deposition of the ores and that an invisible seam in such rocks might carry enough gold to vitiate the conclusion. From the consideration of the mineralogical character of the quartz veins, which are solely composed of quartz, sulphides (iron pyrite and chalcopyrite) and free gold which is mechanically combined with the metallic sulphides, the writer is forced to fall back upon the second alternative, namely, that the auriferous solutions were emmanations from a dying intrusive magma and were brought within the reach of percolating waters by their own force under the influence of diminishing pressure and the driving force of heat. The emmanations were finally dissolved in these waters and by them carried into vein fissures.

As to the exact chemical conditions existing in the ore bearing emmanations, we are still in the dark, but since the gold is in with the metallic sulphides and the whole metallic mixture often occur with some decidedly secondary quartz in the primary quartz veins, it is here assumed that the auriferous solutions were ionized and balanced as auro-silicanion and as thio-suranion* as in case of most electrolytes. Upon deposition they were freed simultaneously as free gold, metallic sulphides and secondary quartz, due to various physical and chemical conditions. Further, the precipitation of gold in presence of ferrous compounds and sulphides of iron and copper have long been known to chemists and geologists. The abundance of iron and copper sulphides together with the occurrence of gold within them as found in all pay veins, seems to throw further light on the conditions, under which the gold ore in the Linglungshan region as well as in other parts of the province of Shangtung that have been examined by the writer, was deposited as stipulated above.

In the absence of complete data, however, i.e., analyses of all the rocks associated with the ore-bearing quartz veins, the above explanation of the origin and the manner in which this gold ore was deposited must necessarily be tentative.

## Time of Deposition

The ores were formed later than the formation of the enclosing quartz veins and earlier than the intrusion of dolerits dykes. Before the deposition of the ore bodies, the quartz veins in this region had probably suffered from a " Solution of Continuity," thus giving rise to numerous crevices in many parts of the veins. The crevices or cracks developed in that way were cemented by the ores as well as by aggregates of quartz which were probably, if not surely, deposited from the original ore-bearing collcidal solutions as mentioned above, and which is not improbable to have been supplied in part by the collcidal silice in the waters percolating through the zone of weathering since desilication is one of the chemical reactions in that zone. The ore-bearing sulphides are seen not only to have traversed between the grains of original and secondary quartz, but also to have surrounded or been deposited upon the grains of quartz. These characteristic features are clearly shown in thin sections and in some hand specimens.

Concerning the absence of gold in the dolerite dykes and gneissic granites which often show a close proximity of positions to the auriferous sulphides quartz veins, it is believed that gold was not derived from these igneous rocks. This statement is based on the fact that the latter constitutes an early part of the volcanic intrusion of the region and that the former cuts across some quartz veins at one or more places in the mines.

The only possible doubt as to the derivation of gold from dolerite dykes, is suggested by the fact that wherever a dolerite dyke is found to have thoroughly weathered and broken into slabs, or more or less as a darkish thick mud, which the miner calls "Heh-mien," black face, the approaching of an ore-bearing quartz vein may be expected as far as the experience of those miners is concerned. But the weathered dolerite itself carries no gold whatever according to the experience of the same people, and, therefore, throw no light on the consideration of gold from those dykes. It is recorded here for future consideration.

## Conclusions

*Future of the Gold Mines in the Linglungshan Region.*—To predict the future of any mine is no easy task ; the conditions under which most ores deposited are as yet too imperfectly known and the deposits themselves are usually too erratic in form and distribution to give certitude to such predictions, even when these are based upon a careful study of the history and present condition of a mine. Nevertheless, it is part of the duty of the geologist who has officially investigated the gold deposits of the Linglungshan Region to interpret to the best of his ability the bearing of ascertained facts upon the future of mining. For such a forecast of the future moderate probability is all that can be claimed.

As has been pointed out in the preceeding pages, the richest known ore bodies that the Tsaoyuen Gold Mines Company has so far mined, are apparently confined within a zone which extends from the surface to their 11th level, a depth of 300 feet or less. In general, explorations below that level have been very much less satisfactory as regards quantity as well as quality of the ore than explorations above. There is no possitive indication, however, as to the depletion of the ore-bodies below the present lowest level, the level 20. On the other hand, the number of ore-bearing veins that are rich in gold, have all been found in the high horizon.

It is probably true that the ore bodies, known or unknown, occuring below the 300-foot zone, are neither so rich nor so abundant as those occuring within that zone. The discovery and exploitation of those ore bodies in greater depth will undoubtedly encounter increasing difficulties, chief among which is the problem of dealing with the underground water. For these reasons it is unlikely that the zone between the present lowest level and a depth of 500 feet beneath, will yield as much gold as the zone between the surface and the level 11, but it is probable that some strong fissures may carry paying ore to far greater depths than those already attained.

As regards the zone between the surface and the level 11, it is well to bear in mind that it still contains much ore, both as parts of known ore bodies and as yet undiscovered ore bodies. It is certain that many of those undiscovered ore bodies will be developed and mined in the near future and that this zone will constitute the most important part of the entire production.

It is probable that the production of the gold in these mines, while exhibiting fluctuations, will, on the whole, slowly decline. New ore bodies or rich ore-bearing lodes will undoubtedly be found from time to time, and such individual lodes may prove to be very profitable in the future as in the past, or even more so. An increased output of gold may be expected to follow each successful step in deep drainage. But existing conditions seem to indicate that if the maximum production of 50-60 ounces gold per day in the 23rd and 24th years of Kwang Hsü, is to be revived, this will be due to the nature of the ore bodies encountered in the upper zone.

* Gold by Maclaren, page 103.

# Repairing the Yellow River Break

## Kung Chia Ko, Shantung

### Asia Development Company completes a notable work

TWO years ago, to August 1921, to be exact the Yellow River broke through the northerly dike at Kung Chia Ba near Li Ching, Shantung, and spread northward over portions of seven counties. Approximately 500 towns and villages were destroyed and a quarter of a million people were made homeless. In November 1922, Civil Governor, Hsiung Ping chih of Shantung signed a contract with an American firm, the Asia Development Co., Ltd., and thus for the first time in history foreign engineering and technical skill were employed in connection with Yellow River conservancy work. The service in this case was utilized only for the repair of the Kung Chia Ko break but it may point the way to the application of modern engineering principles to the whole Yellow River problem.

The river broke through the dike on the convex side of a sharp bend. At the time, the discharge of the river was near the maximum recorded, that is about 300,000 cubic second feet. The water did not overtop the dike but started to seep through, washing out a gap before it could be stopped. The breach quickly widened to about a mile in width and as the level outside the dike was about 6 feet lower than the river bed inside, the bottom of the channel was lowered for some distance above the break. The old channel below the break silted as the flow through it practically ceased. After several months of survey and study of the problem, the Asia Development Co. engineers adopted the method for repairing the break shown on the plan published herewith. The essentials of the plan actually executed are as follows: The short bend of the river was eliminated by cutting a new channel (L) across the same, 6,000 feet in length, 12 to 16 feet in depth, 500-ft. wide on the bottom and 900 feet wide on top. In order to secure a proper hydraulic gradient a scouring channel (S) was excavated below extending from the lower end of the new or leading channel above seven miles down stream. This scouring channel was made 200 feet wide on the bottom and varied from four to seventeen feet in depth. The excavation of these channels necessitated the removal of approximately 3,000,000 yards of earth. The maximum number of laborers employed at one time on the channel and dike work was 23,500. The excavated material from the leading channel was utilized to build a new dike ("A") on the northerly side more than 200 feet in width. The standard Yellow River dike is 40 feet wide on top.

In order to divert the river into the new channel a dam was constructed across the stream at a point 800 feet in width during low water. This was accomplished by firstly driving a timber trestle or temporary bridge upon which were laid light railway tracks. (Oregon pine piles 50 to 75 feet long were used.) The rock which formed the core of the dam was transported by means of push cars from the storage piles on to the trestle. Altogether approximately 40,000 yards of rock were dumped into the river. This was followed by placing bags of earth, kaoliang stalks, pack-work and an earth fill until the dam was sealed and formed a part of the northerly main dike.

From the dam a new dike (D) was built westerly to a connection with the old northerly dike. Just westerly of the dam a long groin was built to deflect the water into the new channel.

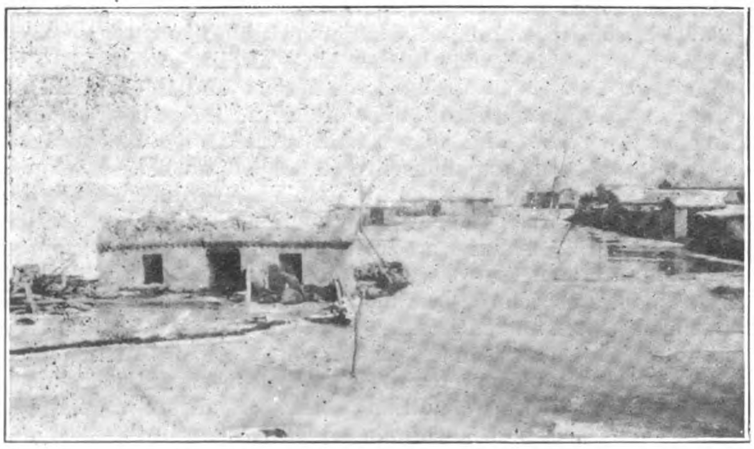
After diverting the river dike (E) was constructed joining the broken ends of the old northerly dike. This forms a second line of defense against the river. Dike (A) was extended north-easterly (C) making it possible to widen the narrow bit of the river just below the leading channel.

From the Chinese standpoint, there was little new in this method except the dam but that was the essential feature which enabled the contracting company to guarantee the success of the undertaking. In other words it was a positive and sure way of diverting the river, while the old Chinese methods are uncertain and cannot be guaranteed. Such of the full breaks as the Chinese have succeeded in closing have been done as follows: First the broken ends of the dike were extended until the stream was confined in a narrow channel. Then big mattresses or rolls of bamboo and kaoliang stocks were floated into the breach and held by means of ropes. In this way the channel, when the attempt was successful, was sufficiently choked to permit complete closing with kaoliang pack-work and earth fill. One of the occasions when this method succeeded was in connection with the famous break of 1887, near Kai feng where the river broke through the southern dike and flooded the Wei River valley. The attempt made the first winter failed but the second year, conditions being more favorable the breach was finally closed.

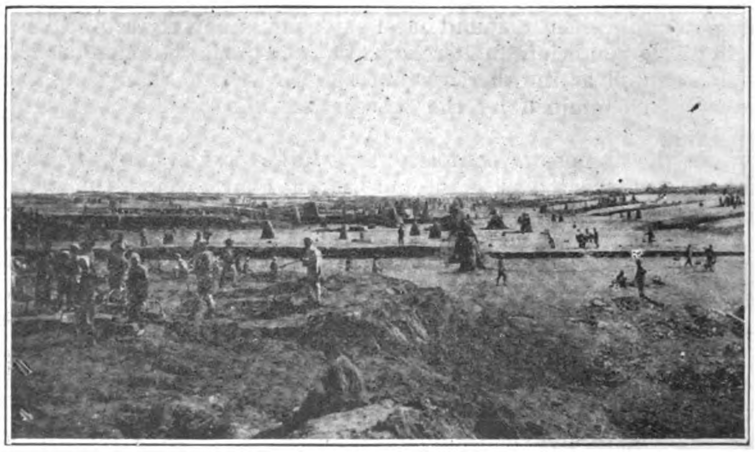
The reported cost was Tls. 6,000,000, while the contract price for the Kung Chia Ko work is $1,500,000 Mex. The Li Ching break is located about 100 miles down river from Tsinanfu or the Tsin-pu Railway, Yellow River Bridge. The transportation of rock, machinery, materials and supplies as well as communication services for the staff presented problems of some magnitude.

The rock for the dam had to be transported from near Tsinan and in all about 400 junks were used in this service. During the time that over 20,000 laborers were employed, approximately 200 tons of grain had to be shipped down river each week. In addition, timbers, pile driver, engineers, pumps, tracks, cars and miscellaneous supplies of all kinds were shipped by boat.

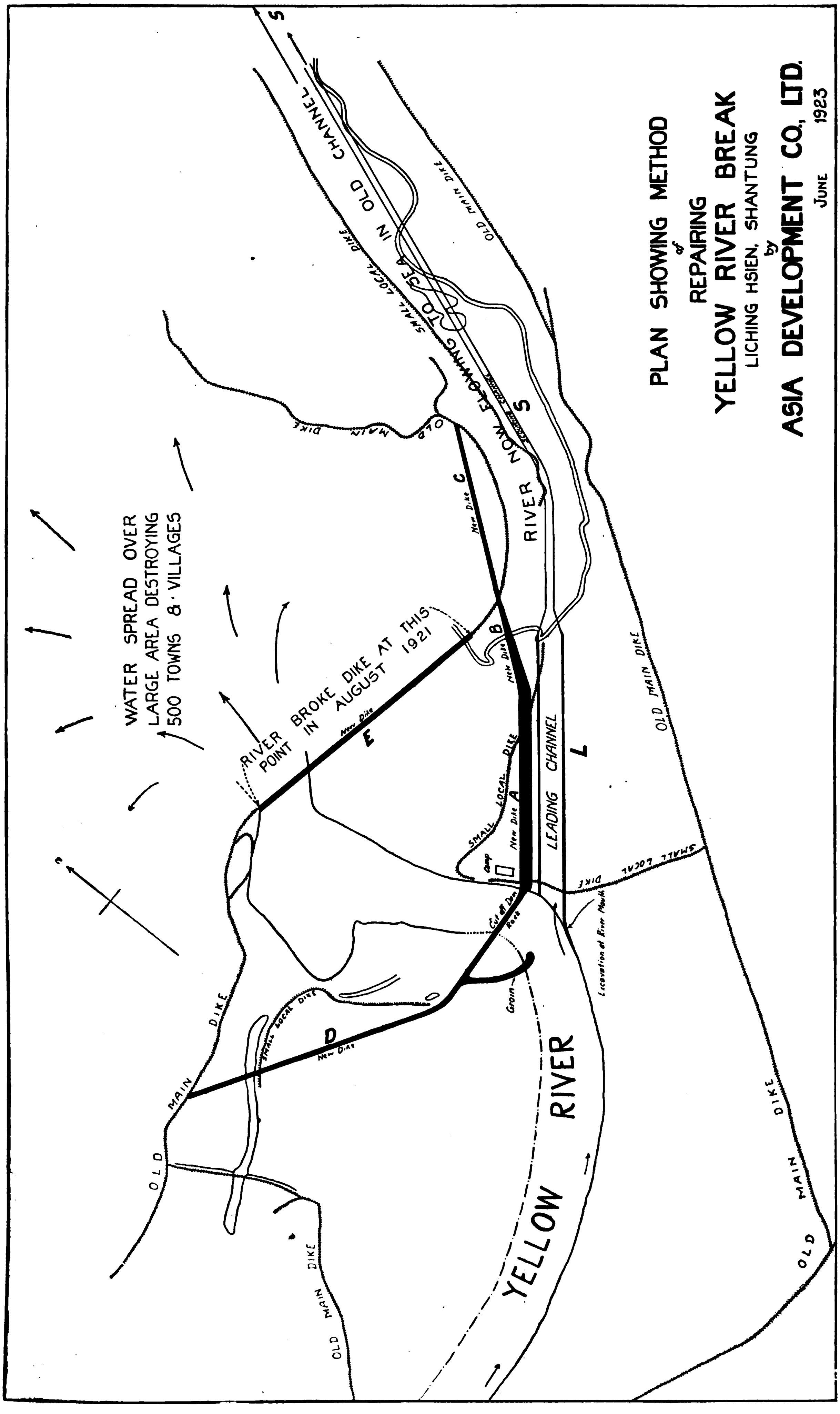
In 1922 The Asia Development Co. constructed for the Shantung international relief committee a road from the Tsingtao Railway at Chowtsun forty miles northward to the south dike of the Yellow River. At the time of starting work at Kung Chia Ko in



In August 1921, the Yellow River broke through the north dike at Kung Chia Banear Li Ching, Shantung—Winter scene, flooded area



Excavating New Channel 6,000-ft. long, 14-ft. deep, 500-ft. wide on bottom and 900-ft. on top



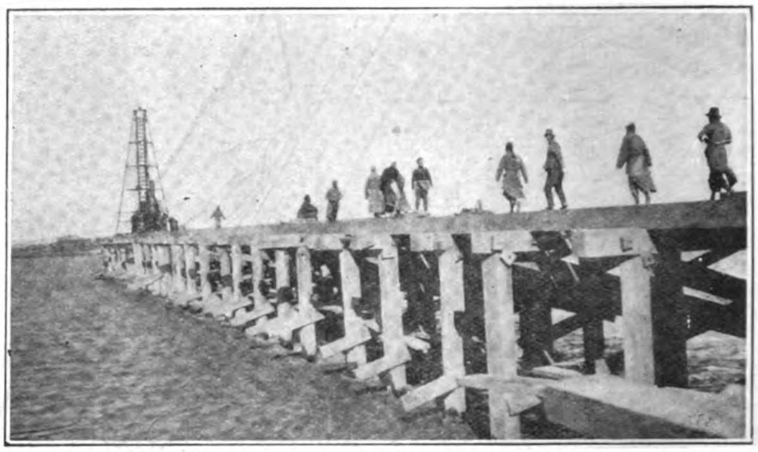

December 1922 the company re-surfaced the top of the dike from this road to the construction camp, a distance of about 37 miles. It was also necessary to re-surface the road which had become badly rutted by carts; in fact it was necessary to continuously employ road maintenance gangs. Although a dirt road, it was thus possible to keep it in fair condition and with the Dodge car the trip of 77 miles from the railway at Chowtsun to the camp was frequently made in three hours and sometimes less. On the road transport service a Dodge, a Ford car and a Ford combination bus and truck were used. The company had agreed to guarantee its work at Kung Chia Ko during the 1923 flood season. Inasmuch as the motor road will become impossible during the rainy season a high-powered speed boat will be put in service on the Yellow River for communication purposes between Tsinanfu and Kung Chia Ko.

The "human" engineering was perhaps the most difficult. The recruiting, feeding and handling of up to 23,500 coolies presented numerous problems. In this connection two innovations of interest proved successful. In order to speed up the earth work a bonus and prize system was put into effect. The workmen responded to this better than was anticipated. A cash prize, first, second and third was offered for the gang (30 men) which moved the most dirt in a week. The winning gangs were given appropriate flags which they had the right to fly over their section until it was lost to another gang. A gang won a first prize by working all night before the day that measurements were to be taken. The other innovation was that of calling in the Y. M. C. A. workers.

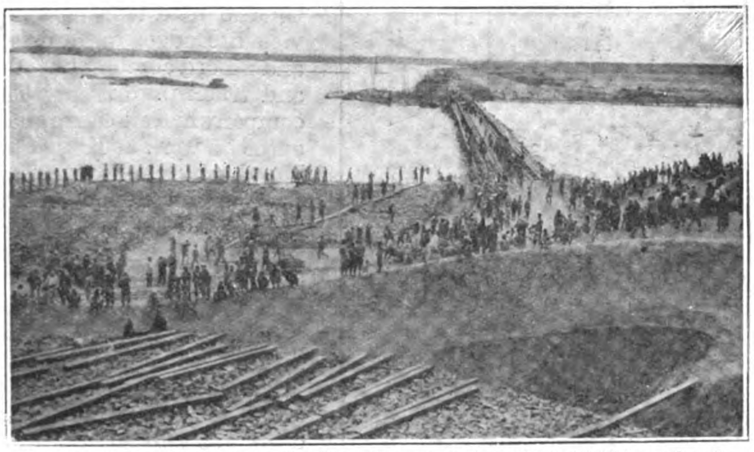
The national committee of the Y. M. C. A. placed trained workers at the camp who performed a service similar to that done for the Chinese labor corps in France; in fact some of the workers had served in France. The results were beneficial all around and contributed much to the contentment of the work-

*(Continued on page 475)*

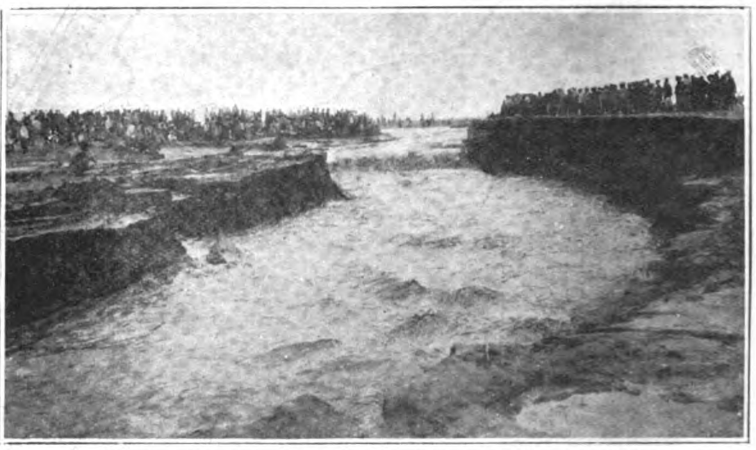
Worthington pumps draining excavation sumps.



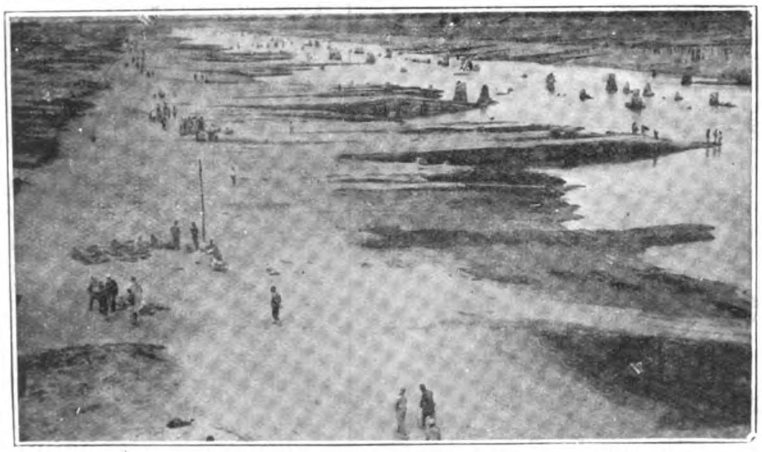
A timber trestle or temporary bridge 800 feet in length was built across the river to aid in constructing dam.



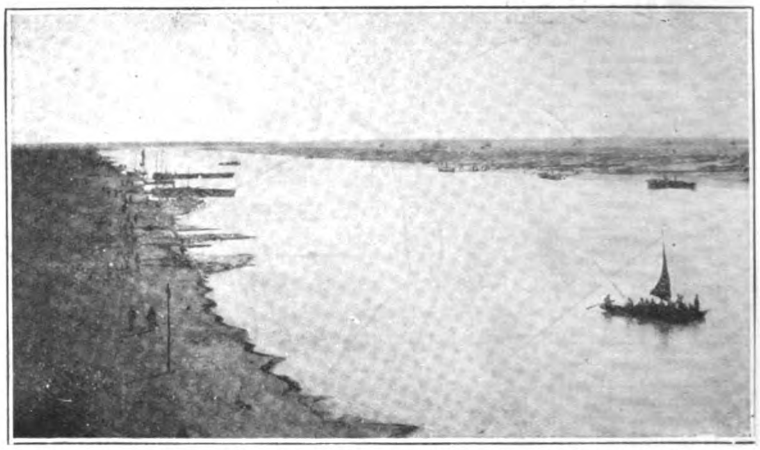
Light railway tracks were laid on the trestle by which 40,000 yards of rock were dumped into the river forming the core of the dam.



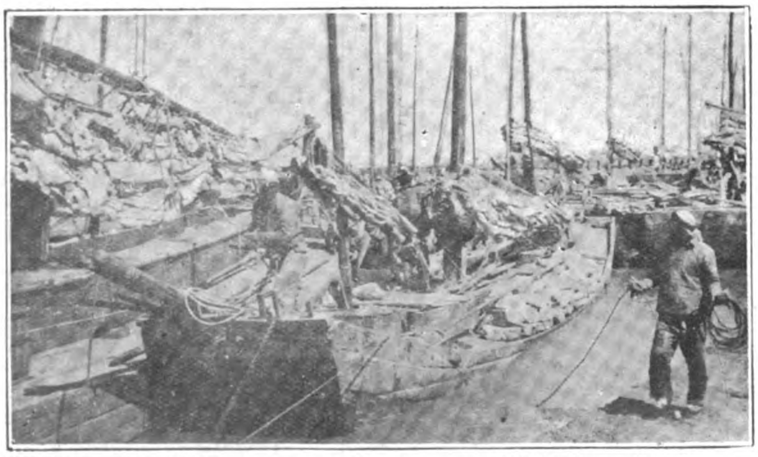
Letting the water into the New Channel May 15, 1923.



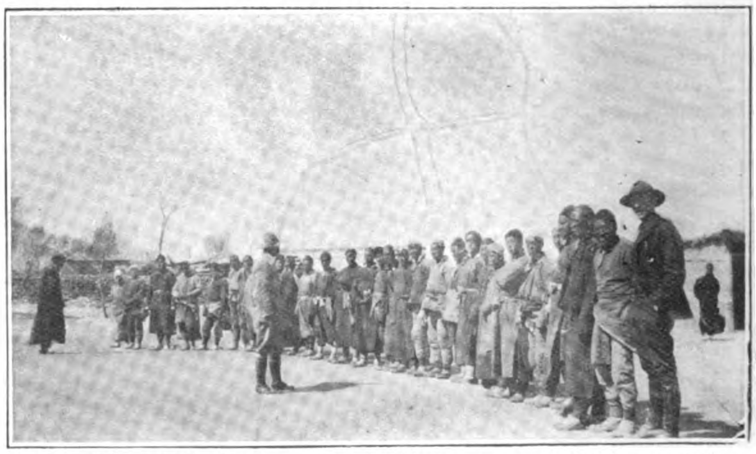
New Channel a few hours after the water was turned into it.



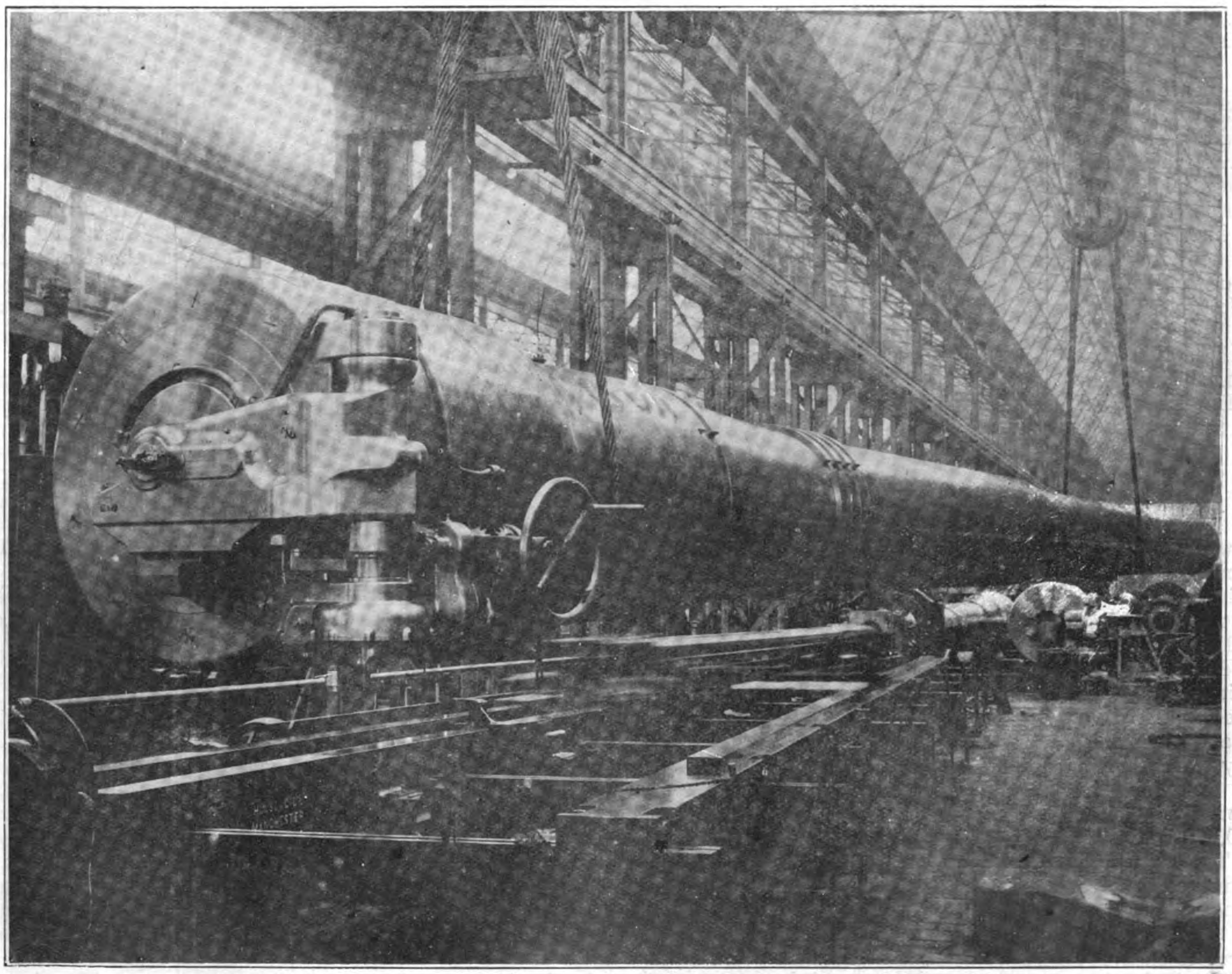
The next morning May 16, the Yellow River flowed through what 24 hours before was a dry channel and found its way to the sea through the course occupied prior to August 1921.



More than 400 boats were used to transport 14,000 fang of rock from 100 miles up river to the dam.



A newly recruited pai or gang of 30 laborers, a unit in the army of 23,000 workmen, employed on the job.



14-inch Gun Manufactured by the Japan Steel Works : Hulse & Co., Ltd., Boring Mill

# Japan's Iron and Steel Industry

## The Japan Steel Works, Ltd.

IN the March number of THE FAR EASTERN REVIEW the great Japanese government steel works at Yamata were fully described. Next in importance are the Japanese Steel Works at Mororan in the Hokkaido, established in order to supplement the government arsenals in the manufacture ot war material at a time when the Anglo-Japanese alliance made necessary some effort on the part of Japan to more better fulfill her share of the obligations imposed by the pact. Up to that time all war material for Japan had been manufactured in the government arsenals but with the stimulus of the alliance and the tendency on the part of other powers to recognize the necessity for private enterprise to assist in maintaining national independence in the supply of munitions in case of war and at the same time meet the trade demands of other nations, Japan also modified her policy in this respect.

The establishment of the Japan Steel Works was the result of the government purchase in 1907 of the whole length of railway under the control of the Hokkaido Colliery & Steamsdip Co. This company, wishing to invest the funds thus received, applied for government permission to establish an iron works. The government was in no position to afford assistance, and the proposal was deferred. At this time Armstrong & Co., and Viekers, Son & Maxim, Ltd., were supplying the country with warships and ordnance, and had frequent consultations with the government with regard to their inventions. These companies combined with the Hokkaido Colliery & Steamship Co. to gain government permission to establish an iron works. As at this time the Anglo-Japanese alliance was concluded, the government gave its consent to the starting of the enterprise upon a co-operative basis, considering that the co-operation of English and Japanese investors would realize effectually the objects of the alliance. Thereupon the representatives of the two companies met in Tokyo on March 7, 1908, and drew up a provisional contract, which was formally concluded in Lon-

Map of Southern Hokkaido

don on July 30 of that year, and on November 1 the first general meeting was held.

Although the details of this contract were never made public, its essential features were disclosed at the time by Mr. Kakugoro Inouye, managing director of the Hokkaido Tanko Kisen Kabushiki Kaisha, and one of the active promoters of the arrangement. He is alleged to have stated :—

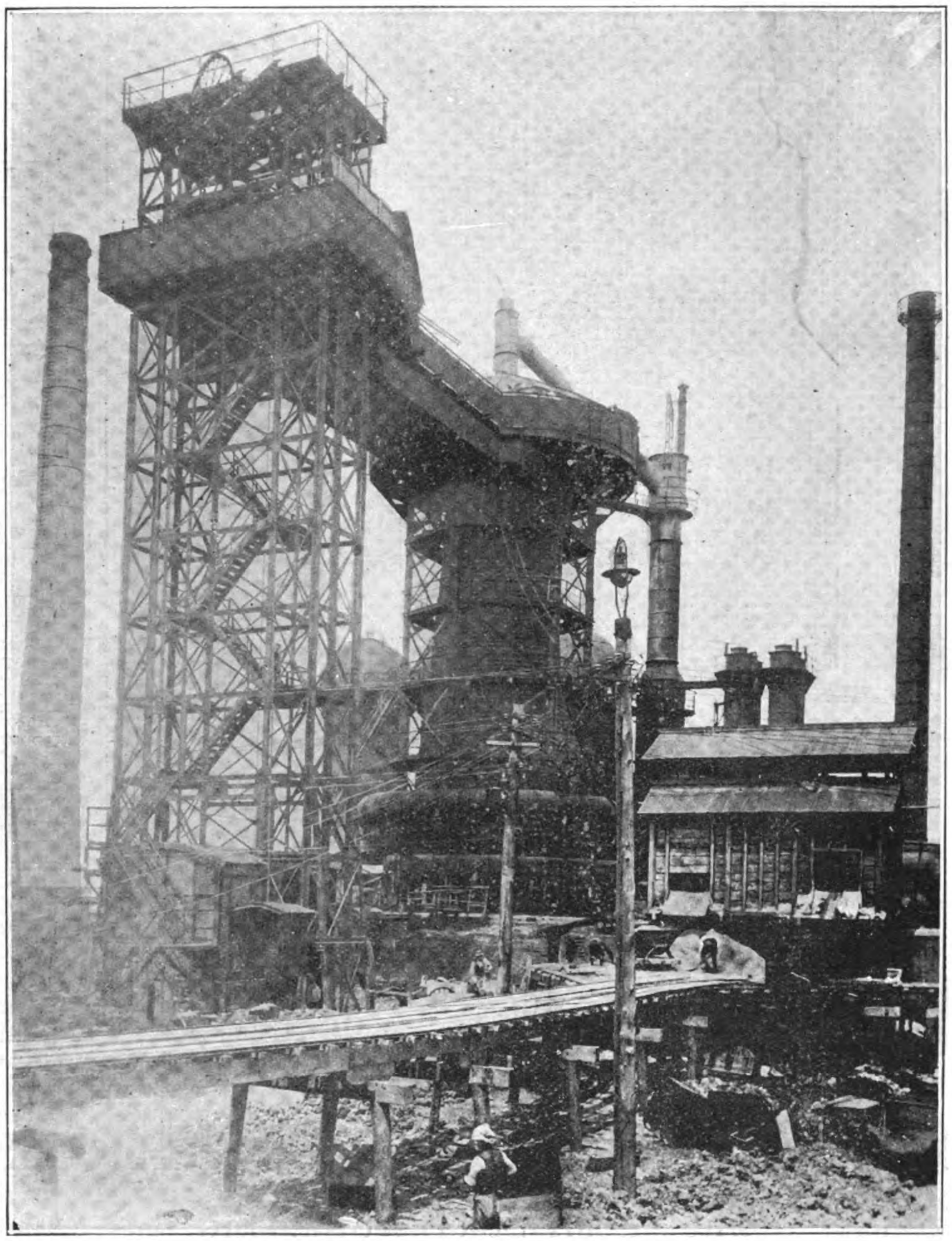
The contract the Hokkaido Colliery and Steamship Company has concluded with the representatives of the Armstrong and Vickers Companies in Tokyo is as follows :—

(1) The Armstrong and Vickers Companies, in co-operation with the Hokkaido Colliery and Steamship Company, wiil establish a steel foundry in Japan with a capital of 10,000,000 yen.

(2) The Japanese and English companies to produce a half of the capital each, and four directors each.

(3) The Hokkaido Colliery to supply coal and the Armstrong and Vickers to supply iron material and engineers.

(4) Neither party to establish a similar foundry in the Far East.



No. 1 Blast Furnace of the Japan Steel Works

The following supplementary contracts concluded in London provided :—

(1) The new concern to engage in the manufacture of ammunition, and construction of merchantmen ond warships in addition to the making of steel.

(2) For the purpose Armstrong and Vickers to issue debentures to the extent of Y.10,000,000.

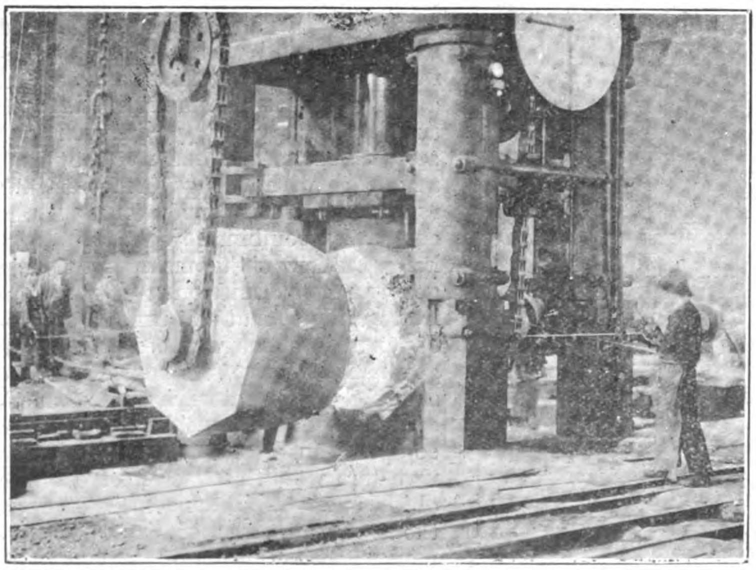
(3) Armstrong and Vickers to abolish their sale agents in the Far East and to transfer the sale business to the steel foundry, paying to it a commission of 2 5 per cent.

(4) The Japanese Steel Foundry to give preference to the above English companies, in case the foundry is about to purchase goods by tender and prices offered are equal.

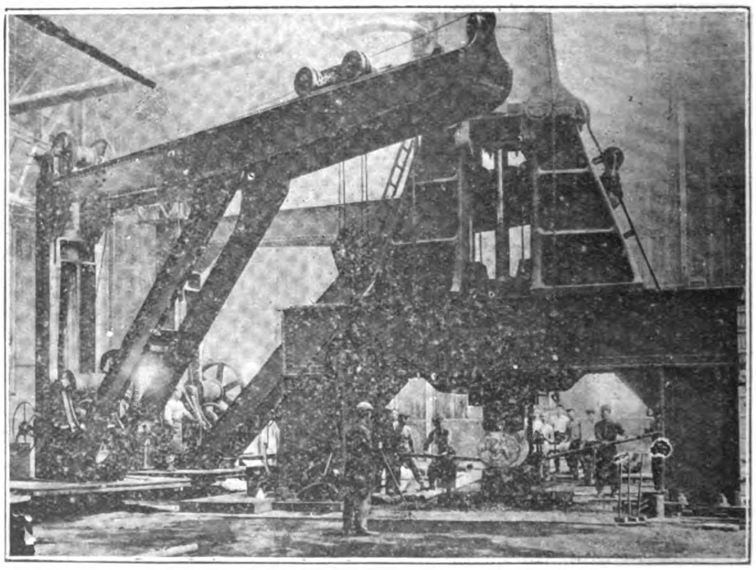
(5) Mr. Kakugoro Inouye to be president and Mr. Sukemune Kondo to be a director in addition to eight directors mentioned above.

(6) Armstrong and Vickers to assign gratis their technical privileges, secrets, etc., to the steel foundry, and the Hokkaido Colliery and Steamship Company to cede to the concern the building lot at Muroran at cost price.

The foundry was established at Muroran, Hokkaido, for three reasons: First, this site belongs to the Hokkaido Colliery & Steamship Co. Second, it is accessible to coal mines. Third, there are ample facilities to accommodate the company and to lease the space for the navy and army departments. It was proposed to work on the sand ore that lies in such immense profusion around the large, adjacent,



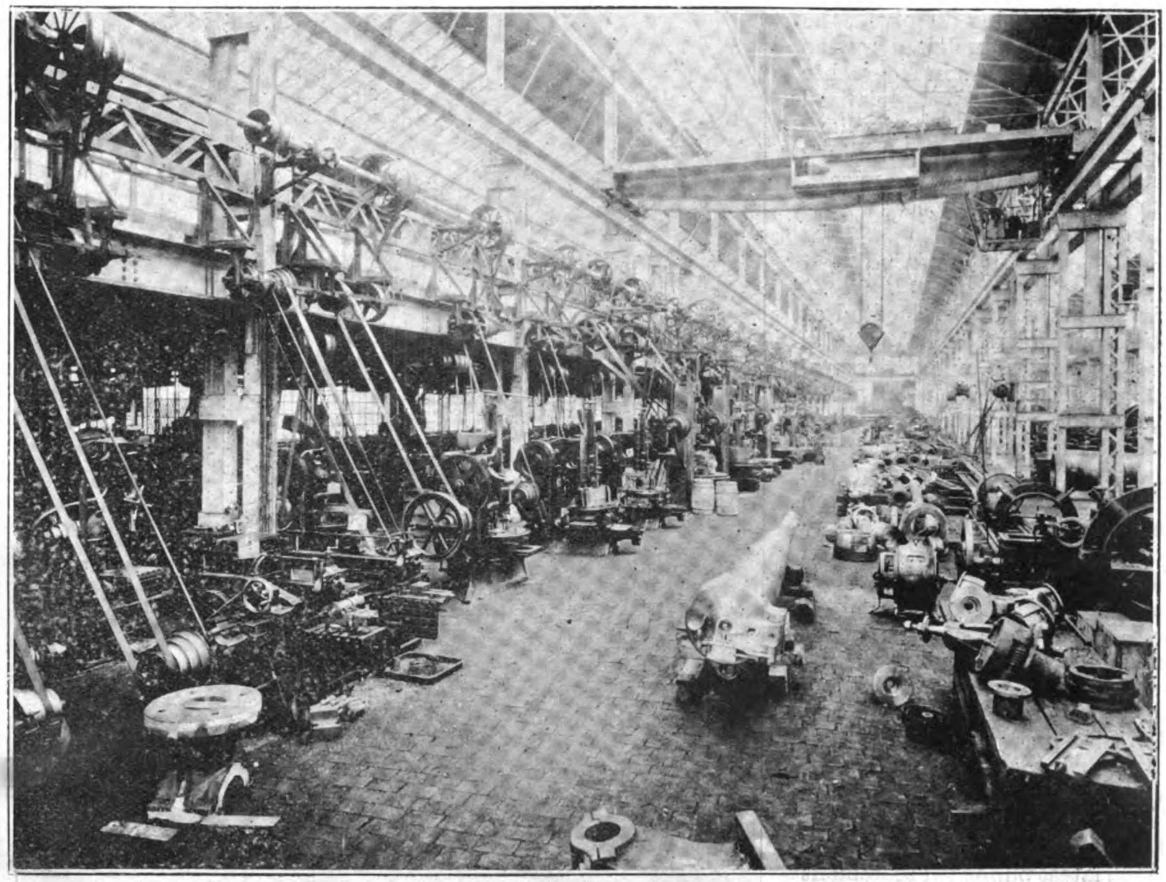
4,000-Ton Hydraulic Forging Press



12-Ton Steam Hammer (Thwaites Brothers, Ltd.)

Volcano Bay. Muroran and Hakodate lie at the two points of the Bay, at the head of which is the volcanic mountain that causes the name. The volcano itself is known as Komagatake.

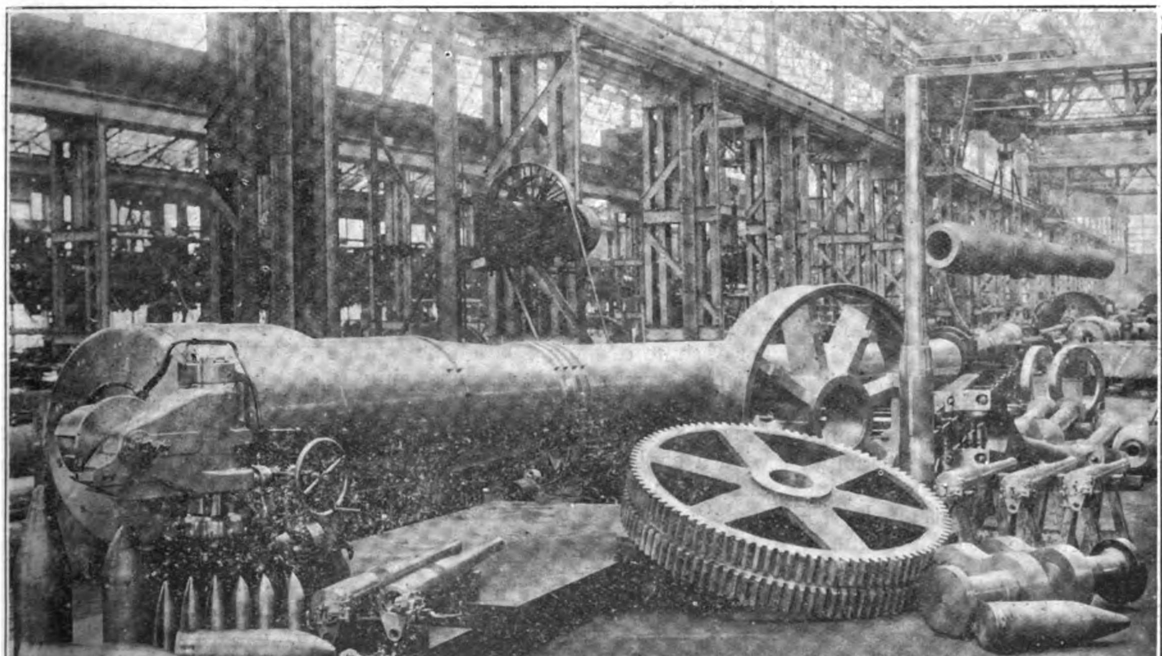
The greater part of the plant was erected towards the end of 1910 when a domestic bond issue of Y.10,000,000 was floated that enabled the new enterprise to engage in active business in the following January, having been appointed approved Lloyd's makers and sole agents in Japan for Sir W. G. Armstrong, Whitworth & Company, Ltd., Vickers Limited and Hulse & Co., Ltd. The works sprang at once into prominence as the foremost manufacturers of steel products in Asia and aside from its specialty in munitions, it took the lead in steel castings of all sizes and shapes especially for steamship construction. The Muroran works have since turned out naval and military guns of all calibers and descriptions, gun mountings, shells of all kinds, shell-hoists, torpedo air-vessels and ends, aero-motors, etc. Steel castings of all shapes and dimensions, up to 100 tons in weight are cast. The works have supplied the various ship-yards of Japan with stern frames; steam frames; rudder frames; shaft brackets; gun-mountings; turbine castings; engine bedplates; parts for engines; flywheels; generator yokes; motor yokes; anchors; parts for mining and metallurgical machinery; rolls; wheels; etc. etc.



Machine Shop of the Japan Steel Works

Steel forgings of all shapes and dimensions, up to 100 tons:—Engine shafts; pistons; engine parts; turbine forgings; materials for marine purposes; etc. etc.

Iron castings of all shapes and dimensions, up to 100 tons in cast weight: steam cylinders; steam-engine parts: flywheels; rope-pulleys; ingot-cases; machine beds; pipes for waterworks and gas-works; rolls; wheels; etc. etc.



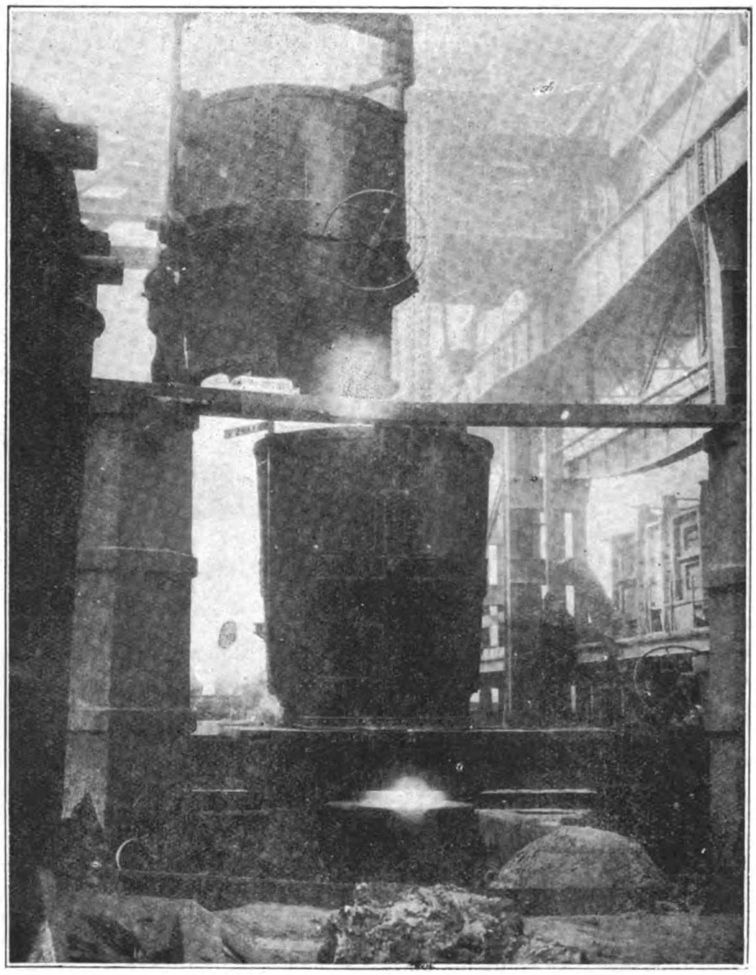
Machine Shop of Japan Steel Works

Bronze and brass products of all descriptions, shapes and dimensions, up to 30 tons: Parts and fittings for marine purposes; propellers; valves and cocks; condensers; bearings; submerged torpedo-tubes; phosphor bronze castings for torpedoes; materials for gun-mountings; fuse materials; etc. etc.

Ingots; foundry pigs; basic pigs; otder kinds of pig irons for steel making; managanese iron; Spiegel eisen; etc. etc. Slag-bricks; slag-cement; slag-cotton.

In December 1919, the Japan Steel Works acquired through amalgamation the properties of the Hokkaido Seitetsu Kabushiki Kaisha (Hokkaido Iron Works, Ltd.) capitalized at Y.15,000,000 fully paid up. These works, located at Muroran produce pig iron and control several mines. The capital of the Japan Steel Works was then increased to Y.30,000,000 fully paid, and in 1920 a further domestic bond issue of Y.10,000,000 was floated. The Kabushiki Kwaisha Hiroshima Seisakusho (The Hiroshima Works, Ltd.) located at Kaida-Ichi near Hiroshima with a capital of

Y.1,500,000 being dissolved, the property was purchased by the Japan Steel Works in November 1920. This company specialized in the manufacture of auxiliary machines for naval and military purposes and other miscellaneous tools largely used by the government.



Casting 100-Ton Ingot : Japan Steel Works

### The Muroran Works

The main works, located at Muroran, Hokkaido, have a total area of 1 square mile, 345 acres, 795 yards of which 39 acres, 1,024 sq, yards are covered with buildings. The water for the works is drawn from the Washibetsu River about seven miles distant. The company owns its own loading pier on Muroran Bay, being 1,300 feet long, 60 feet wide and is equipped with a 100-ton wharf crane for loading and unloading heavy castings. In addition the works are served by 34 miles of standard and narrow guage railways belonging to the company connecting with the pier and the government railway system. The works equipment according to the latest published statement of the company consists of following plant :—

Four blast furnaces (three 120-ton and one 80-ton furnaces), 12 hot stoves, 7 blowers, casting beds, lifts, etc. etc.

Three D.C. generators, 1,000 K.W. and less, and 22 boilers.

Annual productive capacity of pig iron : 160,000 tons.

The Coal Washing and Coke Making Plants.—Three coal washing plants provided with 826 coke-ovens. Annual productive power : 130,000 tons.

The Smith-Shop.—Total area occupied: 1 acre 99 sq. yds. Steam hammers, 12 tons and less, and reheating furnaces for hammering small forgings, and 1 rolling mill for making bars.

The Pattern-Shop.—Total area occupied: 1,068 sq. yds. All kinds of wood-working machines of the latest design for making wooden patterns for moulds.

The Foundry.—Total area occupied: 4 acres 12 sq. yds. Melting furnaces, 50 tons; two six 25-ton, two 10 tons and two five-ton furnaces all of the Siemens type, the larger being served by two traveling Wellman machines. Besides there are four 6-ton cupolas for iron casting and 20 crucible furnaces for casting brass, gun-metals and other alloys. In the foundry are 5 casting pits, 3 annealing furnaces, 7 drying chambers, etc., that are capable of taking in castings of large sizes ; and of the machines and apparatus installed here, the following may be mentioned as the principal ones :—A wheel-centre cutting and turning lathe, circular sawing machines, bandsawing machines, sand mills, a sand blast, an electric welding apparatus, electric capstans, electric elevators, pneumatic tools for chipping purpose, etc.

Overhead traveling electric cranes in this shop are numerous, their respective capacity being 120, 80, 40, 30, 15 and 5 tons, besides two scrap yard cranes running outside of the shop for transportation of foundry materials, products, and so forth. 120-ton cranes and those of less capacity, ingot-parting machines, etc. etc.

Annual productive capacity of steel : 130,000 tons.

Principal Products.—Ingots for gun forgings and other general purposes, iron castings, cast-steel products of all kinds, and brass, gunmetal and other alloy castings.

The Gas Producer Plant.—40 sets of gas producers of the latest design, supplying gas to furnaces in the foundry, forging shop and tempering and shrinking shop. Coal consumption per day of 24 hours : 250 tons.

The Forging Shop.—Total area occupied: 2 acres 3,760 sq. yds. The interior of the building is divided into three bays ; and the shop has three hydraulic forging presses of 4,000, 2,000 and 1,000 tons, respectively, and they each are served by two overhead hydraulic cranes and for reheating furnaces, the cranes provided being of 100-, 50- and 25-ton capacity each for 4,000-, 2,000- and 1,000-ton presses, respectively. These presses are forging gun steels and shaftings and for turning out other forgings, not exceeding 100-ft. in length and 11-ft. in breadth.

There are also in the shop one 650-mm. cogging mill and another 450-mm. rolling mill (they being served by one 10-ton overhead electric crane, one shearing machine, one hot-sawing machine, for straightening machines and three heating furnaces), that are four rolling shell steels for field guns and ordinary round steel bars of 3-in. diameter or less.

An overhead traveling crane, 60 tons in capacity and electrically driven, is also provided for facility in general transportation of materials and manufactures.

Besides the above, here we have one vertical 250-ton hydraulic shell p[illegible]ing press, another horizon[illegible]e of the same capacity, and six punching and drawing mac[illegible]s for field-gun shells, and they are employed for punching and drawing out shells for 6-in. or smaller diameter and other steel manufactures of small sizes.

Working: Forgings for guns, shells, shafts, etc., and steel bars.

The Tempering and Shrinking Shop.—Total area occupied: 3,005 sq. yds. 1 oil-tank, 80 feet deep ; 1 pit, 80-ft. deep ; annealing, hardening and shrinking furnaces; one 80-ton hydraulic crane, etc, etc.

Working.—Heat-treatment of gun tubes, shafts and other forgings, and building up of gun tubes.

The Power Station and the Boiler House Attached :—Total area occupied: 3,756 sq. yds. Three 440-volt 1,000-K.W.D.C. Lancashire Dynamo and Motor Co'.s direct coupled with Bellis & Moreom triple-expansion engines and one 200 k.w. W. D. C. generator of same design ; 20 high-pressure B. & W. water-tube boilers with automatic stokers, producing 10,000 h.p. steam. Two sets of economisers are provided for heating feed-water, and four fans to regulate ventilation. The boiler-house is complete with a coal and ash conveyer for coal charging and ash removal, automatic weighers and other necessary apparatus ; and it is replete with all devices for labor saving and economy in fuel consumption.

Working.—Production of electricity for motive power for cranes, machines and machine-tools and for lighting purpose.

The Machine-Shop.—Total area occupied : 6 acres 613 sq. yd.

This is the largest building in the Works and divided into the two sections, the rough machining and the finish machining section ; and machining operations for guns, armaments of all other kinds and others are carried on here.

Equipment.—Machines of more than 500 in total number including ingot trepanning machines, gun boring machines, gun rifling machines, profiling machines, lathes drilling, milling, slotting and surfacing, grinding machines, sawing machines, gun wire winding machines, standard gauges and measuring machines of fine accuracy, cranes for various purposes, 80 tons and less capacity, etc. etc.

Hand finishing for filing work is also performed here.

Other shops : Drawing office : laboratory : slag-brick making shop : fire-brick making shop ; stock main store.

The auxiliary buildings of the Japan Steel Works consist of a hospital, officers' residences, a school and kindergarten. The hospital covers an area of 689 *tsubo*, with acommodation for 80 patients. The general public as well as the Works' officers and workmen can get medical advice and treatment at the hospital.

The five hundred salaried employees and four thousand workmen are housed in 1,200 residences, and provided with complete sanitary and fire-preventive arrangement. The children of the officers and workmen are educated at the school and kindergarten attached to the Works, and a society is established for giving lessons in manual works and moral training to the families of the workmen. Special class rooms and dormitories are provided for apprentice workmen. A club house provided with all amusements and a theatre, with a seating capacity for 1,500 men, cater to the enjoyment of the officers and workmen, as do also green house, a large garden, and a sanitorium erected at the Noboribetsu hotspring, 15 miles from Muroran.

## II. The Hiroshima Workshop

This is situated at Kaida-Ichi, near the city of Hiroshima, Hiroshima prefecture, covering 196 acres 285 sq. yds., of which 4 acres 1,633 sq. yds. is occupied by buildings, and over which railways are laid for facility in transportation of products, materials, etc. At the landing ground along the eastern coast a 35-ton floating crane is installed.

The Hiroshima Workshop specializes in the manufacture of shells, 6-in. or less calibre, of all descriptions ; breech-mechanisms ; sighting gears ; gunpowder-cans ; torpedo-tubes ; hydraulic pumping engines ; refrigerating and cooling plants of the Hall's system ; steam cylinders ; ingot-cases ; machines and tools of all kinds.

Steel castings of all shapes and dimensions, ½ ton or less in weight.

Iron castings of all shapes and dimensions, up to 10 tons in weight.

Alloy castings of all shapes and dimensions, up to 3½ tons in weight.

The general arrangement of the workshop is as follows :

The Machine-Shop.—Total area occupied : 1 acre 300 sq. yds.

The shop consists of two blocks and is divided into the shell finishing, the small machining, the large machining and the erecting section.

Equipment.—Shell finishing machines, lathes and other machines, more than 200 in total number, overhead traveling cranes, etc. etc.

Working.—Erection and finishing of shells, 6-in. and under, various machineries.

The Steam Testing Station.—A water-tube boiler of Yarrow type with the working pressure of 300-lbs. per sq. in. is installed here for conducting steam tests of machineries before leaving premises.

The Tool Making Shop.—Total area occupied : 791 sq. yds.

Equipment : Three salt baths, one electric furnace, tempering furnaces and tool-making machines of various kinds, numbering more than 30 in all.

Products.—Twist drills, reamers, cutters, taps, etc. etc.

The Pattern-Shop.—Equipment : Wood-working machines for making patterns for casting purposes.

The Foundry.—Total area occupied : 3,163 sq. yds.

Divided into the two departments, the Iron Foundry and the Alloy Foundry.

Equipment.—Cupolas, 5 tons and less, crucible furnaces, drying ovens, overhead traveling cranes, etc. etc.

The Smith-Shop.—Total area occupied : 791 sq. yds.

Equipment.—Steam hammers, hearths, hardening and annealing apparatus, etc., for turning out small forgings.

The Boiler-Shop.—Equipment : Plate shearing machines, punching machines, gas welding apparatus.

Products.—Boilers, tanks, etc. etc.

The Copper-Smith.—Total area occupied : 3,954 sq. yds.

Equipment.—Copper-working apparatus, pneumatic tools, lathes, etc., numbering more than 40 in total, of all kinds necessary for copper smithy.

Products—Gunpowder cans, sighting gears, etc. etc

## III. Ore Mines

The total acreage of all mine-lots owned by our Company is 136 sq. miles 206 acres 1,684 sq. yds., of which three mines in Hokkaido and one in Chosen (formerly called Corea) are being operated.

There is also the Mejiro laboratory for ferro-titanium.

The company is now capitalized at Y.30,000,000 having its head office at 5 Hon Kawaya Machi, Nihonbashi-ku, Tokyo, with a branch at 112 Dojima hama dori, in Osaka, with Armstrong, Whitworth & Company, Ltd. in England as their agents. The directors of the company are Dr. Takuma Dan of the Mitsui firm, Messrs. T. Mizutani, A. Kabayama, M. Kawabe, T. Isomura, M. Tanaka, D. Awata, S. Eto, T. Makita, N. Ikegami with Douglas Vickers and John Henry Brunel representing the British interests. The auditors are Counts Terashima, N. Ariga and Mr. Saxton William Armstrong.

# REPAIRING YELLOW RIVER BREAK

(*Continued from page 469*)

men. A field hut was erected by the Y. M. C. A. Amusements of various kinds were provided including moving pictures, phonographic concerts and lectures. Much was done for the welfare and health of the laborers, the Y. M. C. A. co-operating with the medical and hospital services provided by the company. A sanitary squad was organized and a most thorough daily inspection of the workmen's camps instituted. The results justified the effort. Only three deaths occurred which is noteworthy when it is known that for a period of seven months an average of 10,000 laborers were employed, the maximum number at one time reaching the 23,500 mark.

The foreign staff which varied from 8 to 20 men was housed in comfortable quarters built much like officers army cantonment buildings, an electric light plant was installed. A steam boiler provided boiled water which was run into tanks and filtered ; also it supplied hot water for the baths. During the winter large quantity of river ice was stored. The use of refrigeration boxes enabled keeping meats and vegetables during the hot weather as well as the furnishing of cold drinks.

Much credit is due to His Excellency, Hsiung Ping-chih, civil governor of Shantung, for the manner in which he co-operated with and assisted the company also for the reason that he met all payments promptly on due dates. $1,140,000 was paid by the civil governor and the international famine relief committee assisted by contributing $360,000.

Mr. Paul Page Whitham is president and general manager of the Asia Development Co., which did the work. Mr. L. Fred. Patstone as chief engineer had direct charge of the work and was ably assisted by assistant chief engineer, Irving B. Bush, and the staff of Chinese and foreign engineers and supervisors.

The diversion of the river took place May 15, since which time the dikes have all been completed. The water flowed freely and within a few days the river scoured a deep channel within the old course by which it now reaches the sea, as before the break in 1921.

# THE NEW PLANT OF THE E. W. BLISS CO.

(*Continued from page 476*)

Again crossing 1st avenue on this block are housed various activities including blacksmith and drop forging shops, pipe shop, lathe department, machine shop, coppersmith shop and various other general machine working departments. In the foreground is shown the steam power plant and high-pressure air equipment, also a sale water pumping station which gets its supply from New York Bay from a 36-in. main. Salt water is used for condensing purposes and flushing and cooling throughout the plant. This station also includes one 1,000-gallon electrical and one gallon steam fire pump which is connected to the sprinkler systems throughout the entire plant. For fire supply the pumping capacity is equivalent to 5,000 gallons per minute, the fire system is further provided with two four-way Siamese connections on the pier bulkhead for connections with fire boats.

The rectangular tower at the top of the seven story building contains one 50,000-gallon sprinkler tank and one 25,000-gallon mill supply tank.

# The New Plant of the E. W. Bliss Co.

THE E. W. Bliss Company of Brooklyn, N. Y., have recently moved their sales and executive offices to their south Brooklyn plant, located at the foot of 53rd street, on the east shore of Upper New York Bay. This plant comprises a group of seventeen buildings covering a ground area of eighteen acres and has a total floor area of twenty-one acres. It has a water frontage of 390 feet at which there are two piers, one being 200 feet long and 80 feet wide and the other 575 feet long and 60 feet wide. There is ample water to accommodate the average size steamship.

During the war many large additions were made to this plant to meet war requirements until it reached its present large proportions. At the termination of hostilities there was available a considerable amount of space and equipment. The Bliss Company determined that the consolidation of their two Brooklyn plants had decided advantages and accordingly have moved practically all the machine equipment from the Adams St. plant to the south Brooklyn plant, using the space made available by the dismantling of the special machinery which was necessary for war requirements.

This plant is reached by the Brooklyn rapid transit fourth avenue subway, a station being located at 53rd st. and fourth avenue (Brooklyn), also by the brooklyn rapid transit fifth avenue elevated, the terminal of which is the New York side of the old Brooklyn bridge. On this line the nearest station to the plant is what is known as the 52nd street station (Brooklyn). The offices which are located on the corner of 53rd street and 2nd avenue are but a few minutes walk from either the subway or elevated station.

The accompanying aeroplane view gives a very good idea of the size of the plant which is 5 feet less than one-half mile long. Beginning at the second avenue end of the plant which is shown on the foreground of the picture there is a three story machine shop, 320 feet by 200 feet, constructed in the form of a hollow rectangle, the court of which is 200 feet by 80 feet and is used as an erecting shop while the balance of the building is used as a machine shop. The erecting shop is served by a number of electric traveling cranes and auxiliary hoists. On either side of the building are five-ton steel cranes to serve the planers and lathes.

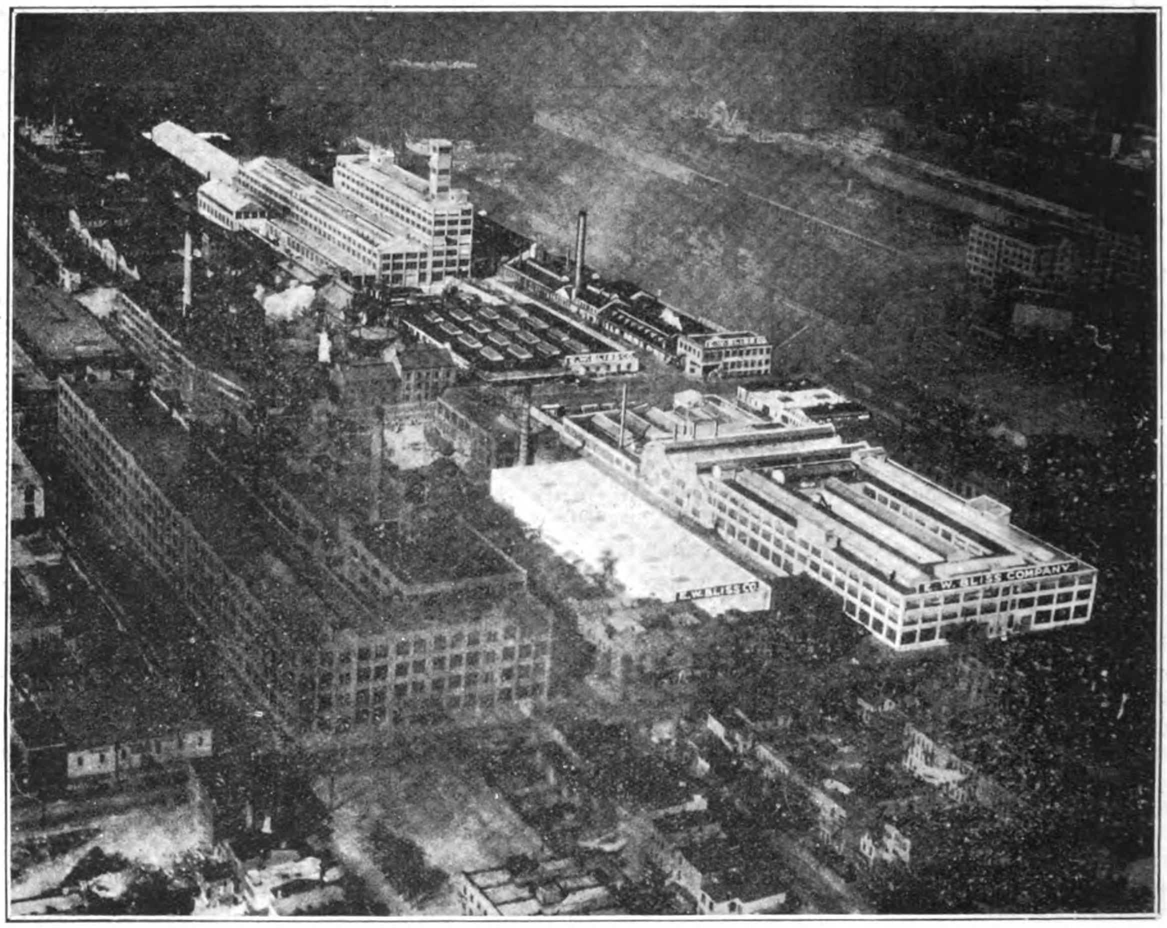
Next in the picture is the hydraulic forge shop which is a one story building 125 feet long and 200 feet wide and is served with two 10-ton and one 30-ton overhead electric traveling cranes. The equipment in this shop consists of furnaces, steam hydraulic forging hammers and forging presses ranging from 200 to 1,000 tons pressure. The water supply and pressure is obtained by eight hydraulic pumps each being driven directly by one 350 h.p. general electric motor which in turn supplies two 16-in. 200-ton accumulators. The pumping equipment is controlled by an automatic switchboard which is operated by the position of the accumulators.

Next in order is the automobile die department, a one story concrete building 200-ft. by 180-ft., and the last shown in this block in the picture. A storage yard having a railroad siding completes the space in the block between 2nd and 1st avenues. This yard is used chiefly for loading and unloading of cars serving the group of buildings above described, a 5-ton locomotive crane being used to accomplish the purpose.

On the far side of 1st avenue is a one story brick and steel building 320-ft. by 200-ft. This building is fitted with numerous skylights which give an ideal lighting condition within. Between this and the seven story building at the centre of the picture are various minor buildings such as plating, pickling, grinding, and small tool houses, also two 100,000 gallon fuel oil storage tanks. This is the primary supply of oil for the boilers and furnaces used throughout the plant and is fed by a main line running from the pier to these tanks so that they may be filled directly from the barges.

Prominent in the rear of the picture is the seven story machine shop and the erecting shop. The machine shop itself is a brick and steel building 380-ft. by 60-ft. The first two floors are served by five ton overhead electric travellers, both the lower stories having been made sufficiently high to accommodate these tools. The entire building is used for manufacturing purposes.

Immediately to the left and adjoining this building is the main erecting shop, having an 80-ft. span and being 380-ft. in length with clear overhead distance of 50-ft. and in which are houses all of the large planers up to and including those having 12-ft. capacity and 26-ft. stroke. The main erecting floor and the machine tools are served by four overhead electric travelers, two of which are 50-ton capacity and two of which are 30-ton capacity, each equipped with auxiliary hoists.




The New Plant of the E. W. Bliss Company at South Brooklyn, N.Y., U.S.A.

Beyond this building and up to the bulkhead line is the main foundry which is 240 ft. long and 180-ft. wide. The foundry obtains its iron from two 84-in. and one 54-in. diameter cupolas. The equipment includes three core ovens 20-ft. wide, 30-ft. deep and 10-ft. high (oil fired), sand miners, jolt ramming machines and four-ton wall travelers. In the centre of the foundry there is a pit properly water proofed, 60-ft. long, 14-ft. wide and 10-ft. deep, which is used for making deep castings. This foundry being built at tide water level it was necessary to construct such a pit to exclude water from the moulds.

The half block line if buildings on the right of the picture begins about half-way between 2nd and 1st avenues with various minor shop buildings, including a garage having an area of 10,000 square feet.

(Continued on page 475)

# Shanghai Municipal Electric Plant

## 20,000 k.w. Metropolitan-Vickers Turbo-Alternator

THE local government of Shanghai is in the hands of the municipal council which is international in character and in the matter of electric supply has conducted the affairs of this town in a very progressive manner. The council purchased the undertaking from a private company in 1893. In 1896 a new station was built at Fearon Road. The total capacity of this station in 1901 was 550 k.w. but this was gradually developed by Mr. T. H. U. Aldridge, M.I.E.E., M.I.MECH. E., FEL. A.I.E.E., who was appointed engineer-in-chief and manager at this time, until the station contained altogether about 5,600 k.w. of plant.

By 1910 the load had grown to a maximum of 3,240 k.w. with an annual output of 6,530,643 units sold, and it was decided to build a new station on the Whangpoo River at Riverside. The original station at Fearon Road generated direct current for street arc lighting, and single-phase alternating current, 2,200 volts 100 cycles for ordinary supply. In 1904 the system was changed to 50 cycles. The first two 1,000 k.w. single-phase turbo-generators installed in 1906 and 1907 were subsequently re-wound for two-phase operation 2,000/2,000 volts. The remainder of the single-phase generating plant was operated in proportion on each of the two phases. In order to meet the growing demand for electric power, it was necessary to start three-phase distribution, and this was effected by means of Scott connected transformers.

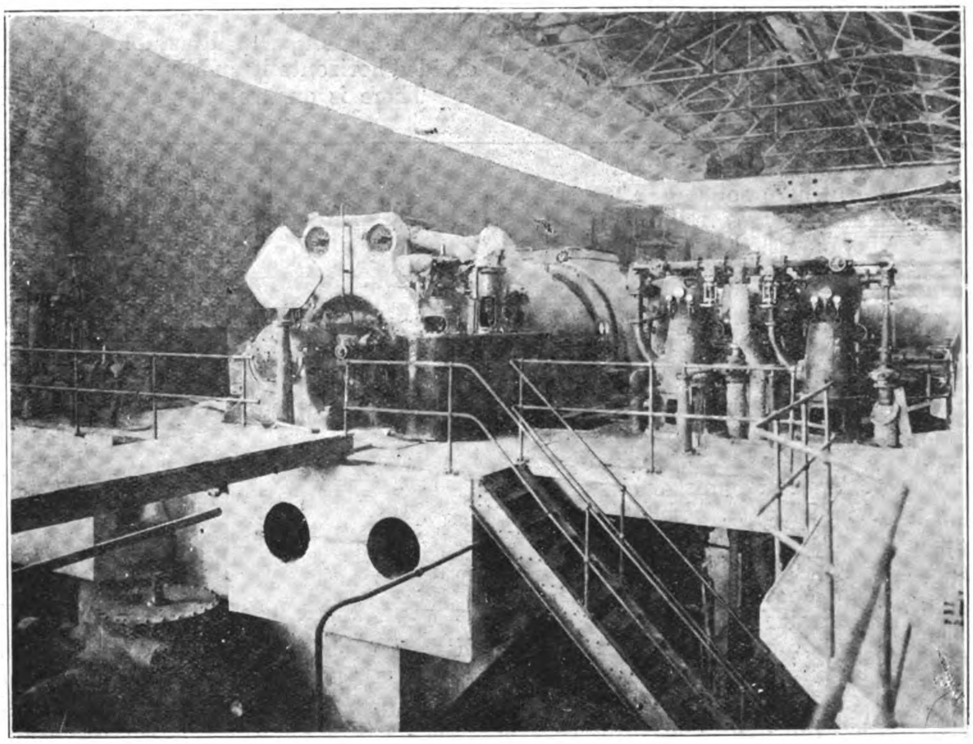
All the plant at the Riverside station generates at 6,600 volts, three phase and 50 cycles, but the additional generators supplied in 1916, and those supplied under the present extension are directly connected to "Step up" transformers working at a trunk distribution pressure of 22,000 volts. The first section of the new station at Riverside contained at the end of 1914 14,000 k.w. of steam turbine plant, and as the output in 1915 amounted to 49,787,397 units sold with a maximum load on feeders of 13,909 k.w. further plant was required, and three turbines of an aggregate capacity of 25,000 k.w. were ordered for this extension, known as the 1916 extension. The first set was running in October 1917 and the constant increase in load during that year amounting to 79,000,000 units caused the management considerable difficulty as the manufacturing countries were engaged in the great war, and there were many obstacles in the way of getting a new plant.

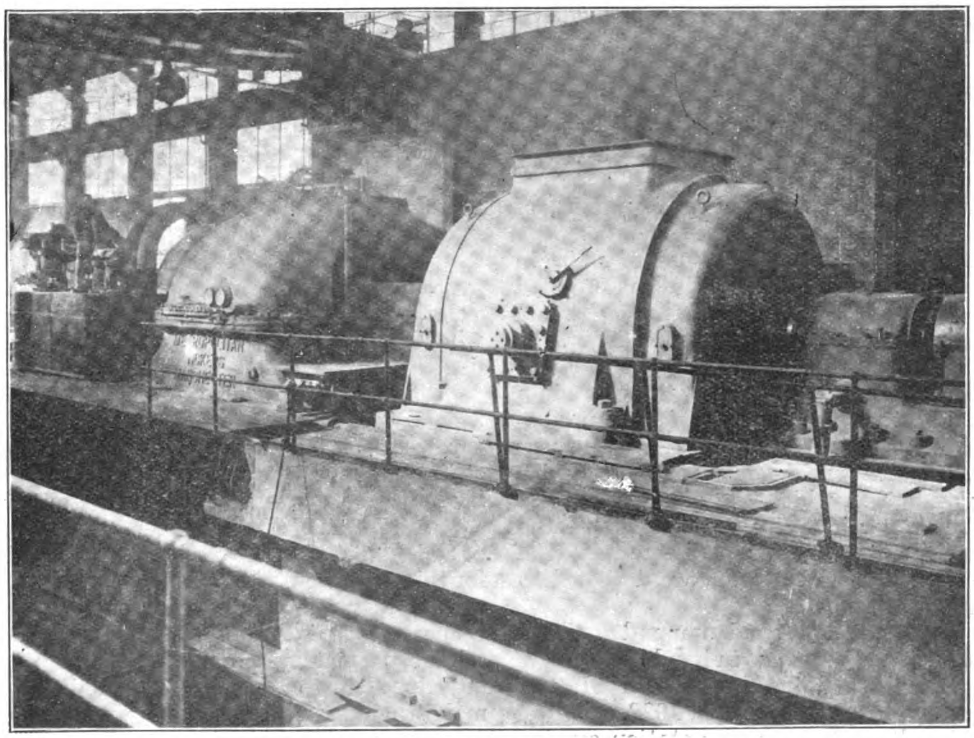
Orders were placed in 1917 and 1918 for plant with a capacity of 36,000 k.w. and in 1919-20 a further 40,000 k.w. of generating plant was ordered. The output of the station which was 49,789,397 units in 1915 had risen to 102,338,137 units in 1919.

The extensions ordered in 1917 and 1918 were supplied by the General Electric Company of America, and consisted of two 18,000 k.w. turbo-generator sets but capable of developing 20,000 continuously at slightly lower efficiency. When these orders were placed British manufacturers were unable to offer any definite time of delivery as their works were under the direct control of the ministry of munitions.

During the war considerable trouble was experienced with the two 5,000 k.w. units of German manufacture which were set to work in 1914, and it was decided to replace them by a 10,000 k.w. set by the General Electric Company of America, ordered in March, 1920. By this time English firms were in a better position for dealing with such a contract, and the 1920 extensions consisting of two 20,000 k.w. turbo-alternators with condensing plant and two 3,000 k.w. house service turbo-alternators with condensing plants, and also three 750 k.w. rotary convertors were ordered in England.

One of the large alternators was placed with Messrs. C. A.





Two Views of the New 20,000 k.w. Metropolitan-Vickers Turbo-Generator for the Shanghai Municipal Electric Plant. Top, Steam End

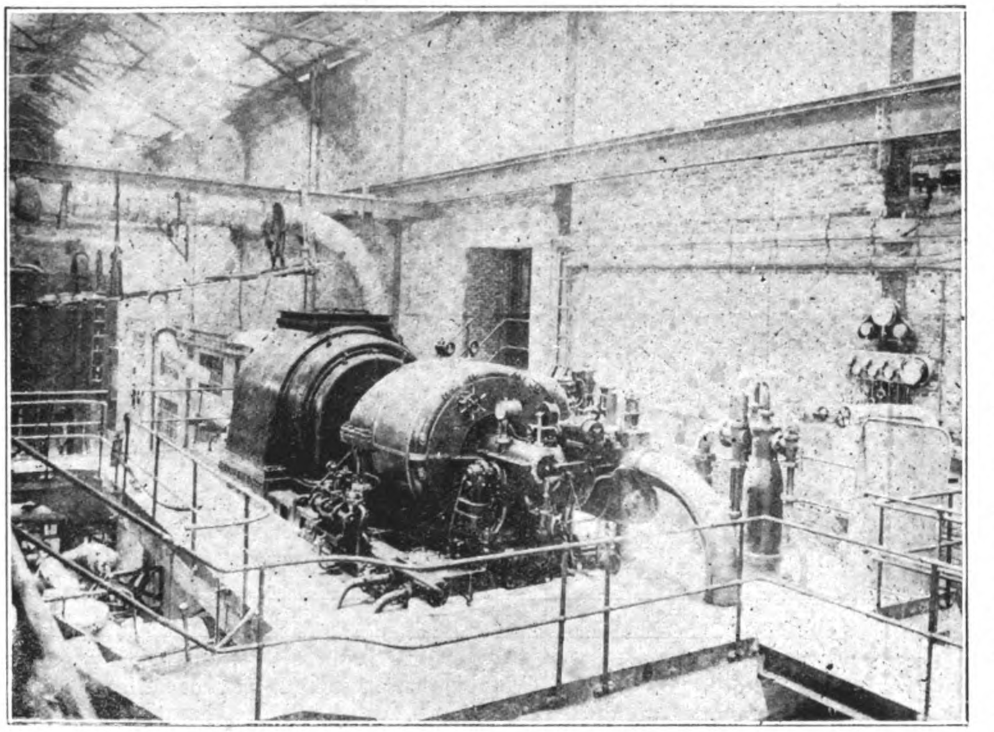
Parsons & Company with condensing plant by Messrs. Hick Hargreaves & Company, and the second 20,000 k.w. set and condensing plant and two 3,000 k.w. house sets were placed with the Metropolitan-Vickers Electrical Co., Ltd.

The 20,000 k.w. turbine supplied by the Metropolitan-Vickers Electrical Company runs at 1,500 r.p.m. and has 14 Rateau stages. Steam is supplied at 180-lbs. pressure at the stop-valve and superheated to a total temperature of 572 deg. F. The turbine is designed for a vacuum of 28.75 inches. The set is capable of developing an overload of 25 per cent., i.e., 25,000 k.w. for two hours.

The nozzle boxes and parts subjected to full steam pressure and superheat are of cast steel. The main cylinder is of cast iron proportioned and stiffened to minimize the effects of unequal expansion. One end is fixed to the bed plate and the other free to expand along guides. The moving blades are of nickel steel machined out of the solid. They are fixed to the wheels by straddling and double rivetting. The fixed blades are of mild steel. Lubrication is effected by means of a main oil pump driven from the main shaft, capable of delivering 100 gallons per minute with an oil pressure of 7-10-lbs. per square inch. An auxiliary steam-driven pump is supplied to flush the bearings on starting. There are four main bearings of the adjustable self-alignment type with adjustable pads on the top, sides and bottom. Each bearing consists of a cast iron shell divided horizontally and lined with white metal.

The turbine is provided with a main control centrifugal governor which can be adjusted by hand or electrically from a distance and in addition the turbine is provided with emergency governors which come automatically into operation and operate valves to shut off steam completely if the speed of the turbine rises 10 per cent. above the normal. These valves can also be operated by hand from the engine room floor or from the switchboard control room by means of a solenoid.

The condenser has an area of tube surface of 40,000 square feet, and 40,000 gallons of cooling water per minute are required. Each set of air and condensate pumps, of which there are two, require 40 h.p.



**One of the two 3,000 k.w. Metropolitan-Vickers House Turbo-Generators for the Shanghai Municipal Electric Plant**

The condenser is capable of maintaining a vacuum of 28-in. in the turbine exhaust when the turbine is under continuous full load when the temperature of the inlet water does not exceed 80°F. and 28¾-in. of vacuum when the inlet water does not exceed 65° F. the barometer standing at 30-in. in each case.

The turbo-generator has a stator built of steel stampings in a cast iron frame. It has a solid rotor and the radius of clearance between the stator and the rotor is ⅞-in. The collecting rings are of steel with 20 brushes per ring. The turbo-generator is fitted with an enclosed air circulating system in which the air cooler has a capacity of 60,000 cubic feet per minute. The capacity of the direct coupled exciter is approximately 60 k.w. at 180 volts. The coupling bolts between the generator and turbine are designed to shear in the event of a dead short circuit.

The weight of the complete set without condenser snd auxiliaries is approximately 232 tons. The set was put in hand in October, 1920, the condenser being despatched in November 1921, the turbine in January 1922 and the alternator in June, 1922.

The two 3,000 k.w. turbo-alternators are for station service and give their output at 80 per cent. power factor at 6,600 volts, 50 periods and 3,000 r.p.m. They are, however, to be connected to the 22,000 volt system through a floating transformer so that if the house turbines are not running the auxiliaries can be run from the main alternators. Normally, however, the auxiliary supply is derived from the house turbines and the floating transformer merely used for the transfer of load from the house turbines to main busses or *vice versâ*, the principal object being the attainment of a correct heat balance on the house turbine plant condensers functioning as feed water heaters. The steam pressure at the stop valve is 180-lbs. the steam is super-heated to a total temperature of 572 deg. F. The highest efficiency is obtained when exhausting into a condenser maintaining a back pressure of 7-lbs. per square inch absolute. The condensate from the main sets is used as circulating water in these condensers and its temperature thus raised to approximately 170° F. The condensers for the service sets thus act as feed water heaters and great economy is effected in this way as much of the heat which would normally be carried off in the circulating water is returned to the boilers.

The nozzle boxes and parts subjected to high steam pressure are of cast steel and the cylinders of cast iron. The bearings are standard and self-aligning with adjustable pads in the tops, sides and bottoms, divided horizontally and lined with white metal keyed into position.

There is one velocity stage followed by five Rateau stages. The lubrication is maintained by oil pumps capable of delivering 25 gallons per minute at a pressure of 7-10-lbs. per square inch.

The generators have solid rotors and the clearance between the rotor and stator is ¾-in. Both sets are fitted with ventilation fans and air coolers. The capacity of the air cooler in each case is 14,000 cubic feet per minute. The direct coupled exciter on each set has an output of approximately 25 k.w. Thermo couples are fitted for measuring the temperature in the stator. The complete weight of each trubo-alternator is 44 tons.

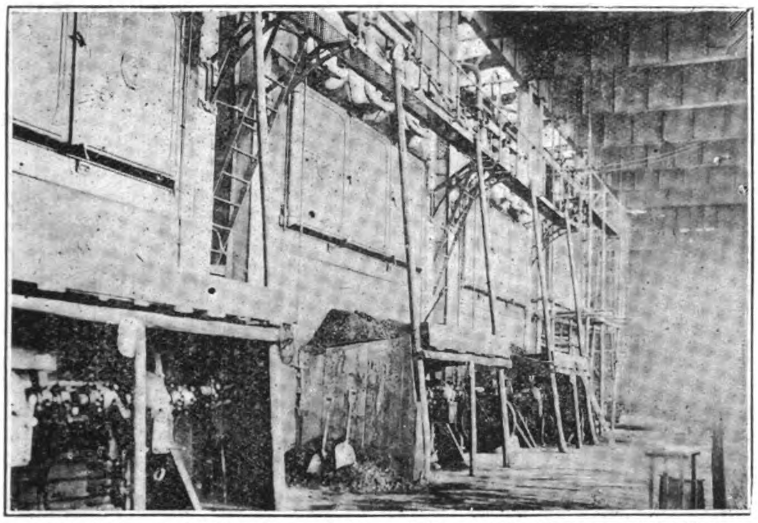
The three 750 k.w. rotary converters are of the self-synchronising type 6-phase, 50-period, running at 750 r.p.m. and giving 440/450 volts on the D.C. side. Each rotary converter is fitted with a starting motor and speed limiting devices.

Three 825 KVA transformers, of the oil insulated self-cooled type in boiler iron tanks with rollers, transform from 6,600 to 316 volts 3-6 phase. The temperature rise does not exceed 80 deg. F. when measured by thermometer in the hottest part of the oil or 90 deg. F. when measured by resistance.

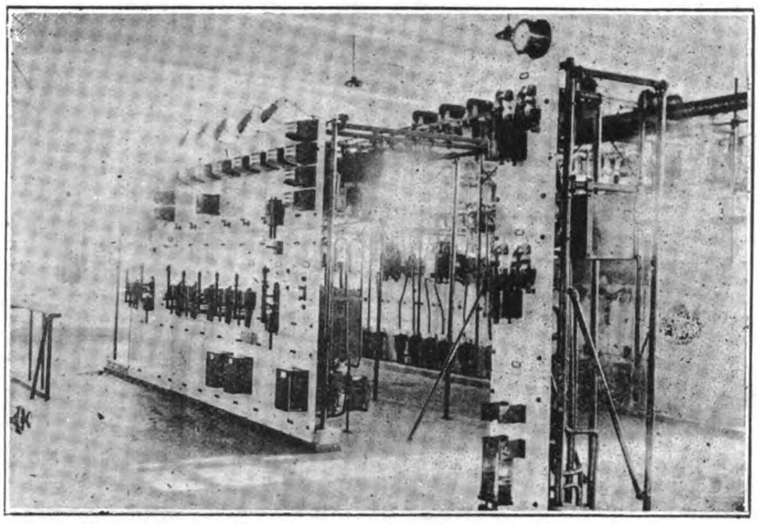
The starting panels are of enamelled slate and contain one 3-pole single-throw switch for the main circuit, one 3-pole double-throw switch for the starting motor, one single-pole field discharge switch and resistance, one moving coil voltmeter marked as a polarity indicator, one push button switch and one set of indicating lamps.

A battery of 10 new boilers, each having a normal evaporation of 80,000-lbs. of water per hour, has been installed to provide steam for this extension. They have superposed steel economisers and the steam pressure is 200-lbs. per sq. in. The coal consumed is either Chinese or a mixture of Japanese and Manchurian dust containing a large percentage of ash and moisture. Modifications have been introduced in the design of the boilers and mechanical stokers to make them suitable for this low-grade fuel.

The whole of the layout of the extensions was designed by Mr. Aldridge and his staff in Shanghai, upon whom rests the entire responsibility.



Boiler Room; 4 Babcock and Wilcox Water Tube Boilers with Westinghouse Stokers



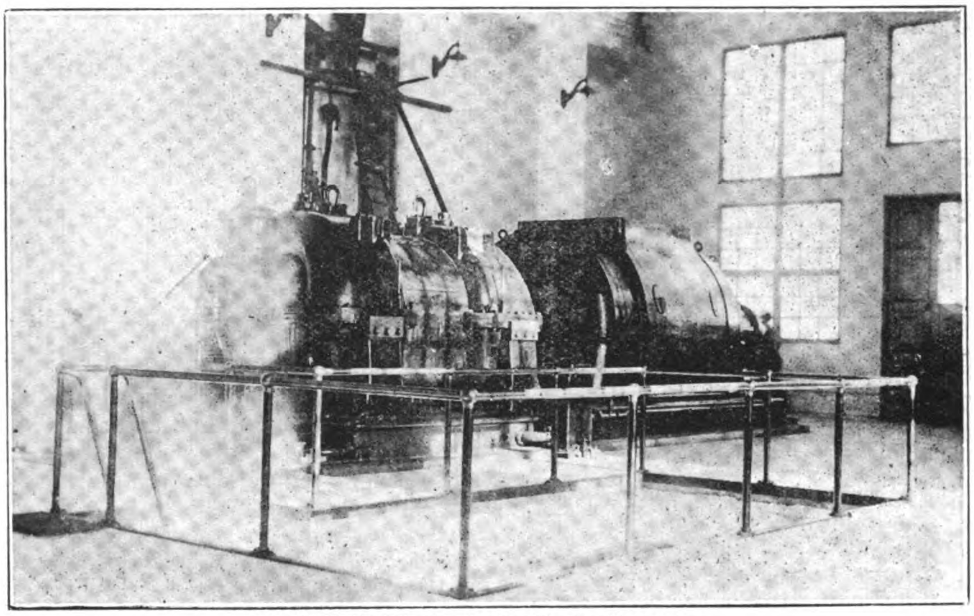
Switchboard Bay : All appliances made by the Shibaura Engineering Works

# The New Amanogawa Power Plant at Dairen

## Operated by the Electricity Department of the South Manchuria Railway Company

ON the main road from Dairen to Hoshigaura and near the water-works is located the new Amanogawa power station designed and built of reinforced concrete and steel to house a plant of 30,000 kilowatts. This building was commenced in June, 1919, and in November of 1922 the test runs were made for the first unit. The building itself is one of the best examples of reinforced concrete and steel structures to be found in the Far East, designed on the most approved lines of power house construction, in which provision has been made for the installation of all modern coal handling and saving appliances, which, however, are not to be installed until the second or third unit is in place.

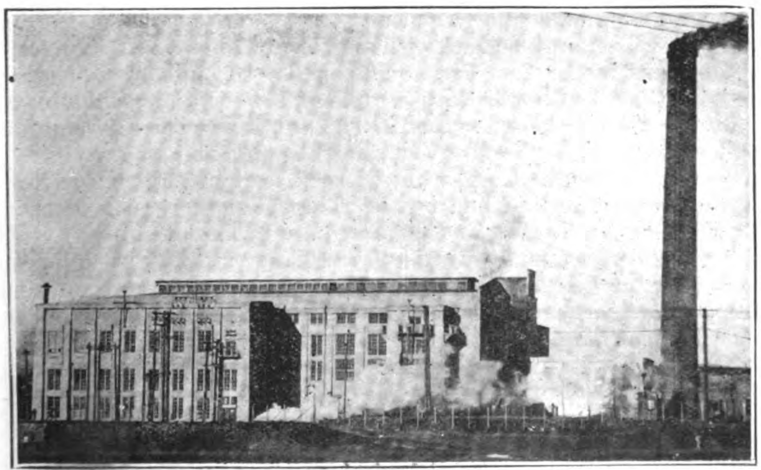
Adjoining the generating room is the boiler-house designed for about 8,000 horse-power. The initial installation consists of four Babcock and Wilcox water-tube boilers of which three are of 7,135 and the other of 8,282 square feet of heating surface, with 144 and 168 sq. feet of grate surface respectively, and equipped with Westinghouse stokers. The boiler feed is supplied by two vertical Weir pumps with closed type heaters, while forced draft is supplied by two turbo-condidal fans from the Buffalo Forge Company driven by Westinghouse motors.



5,000 K.W. Westinghouse Turbo-Alternator

For the present coal is handled by coolies as being most economical, but with the installation of further units conveyors will carry the coal to overhead bunkers with gravity discharge into weighing lorries and feed shutes.

In the generating room, floored with white glazed tiles, is found the first of the four units for which the building has been designed. The one in place is a Westinghouse turbo-alternating set of 6,250 K.V.A., 11,000 volts, 50 cycles, operating at 3,000 r.p.m. with direct connected exciter of 45 kilowatts, 125 volts. A second unit of the same size is to be installed and as fast as consumption of power and light warrants, the other two sets will be added. The switchboard bay is equipped throughout with instruments, switches, transformers and other appliances manufactured by the Shibaura EngineeringWorksofTokyo.



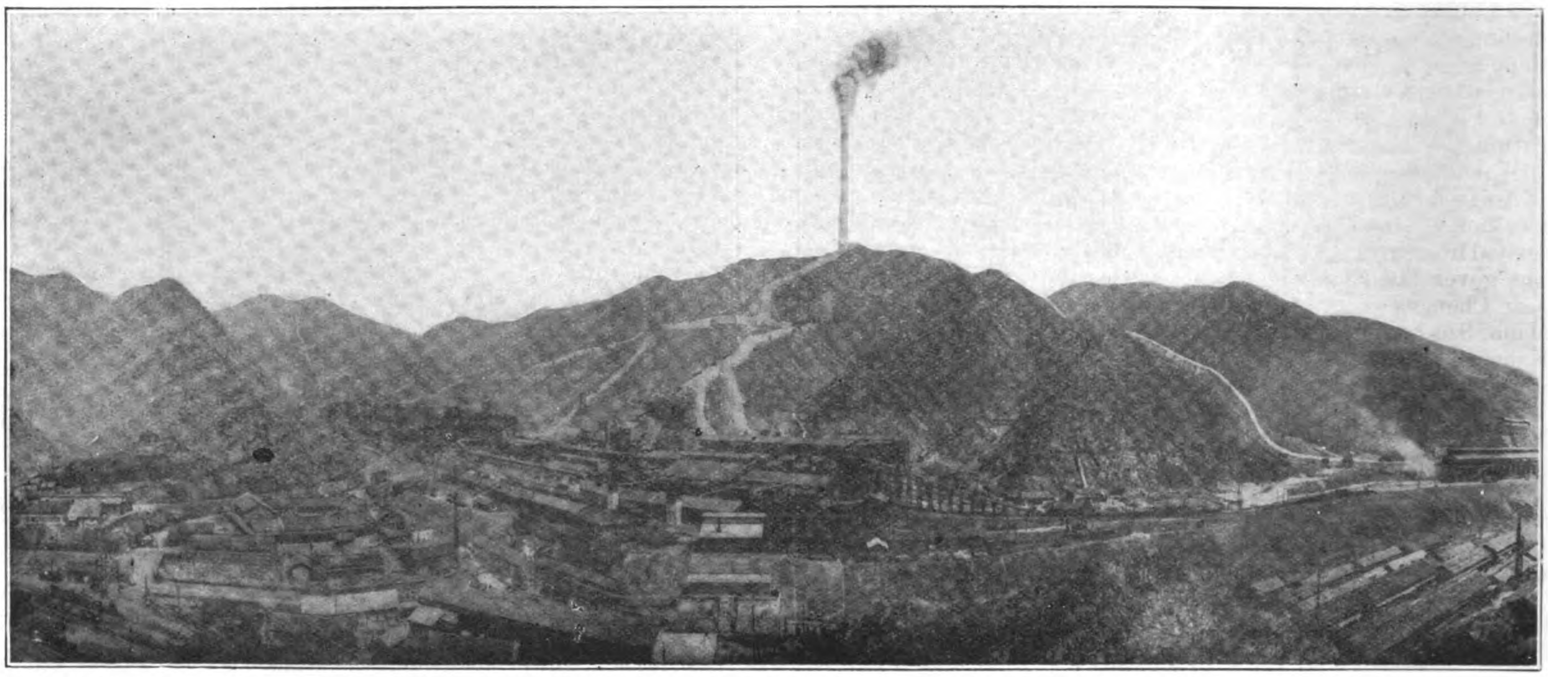
General View of the Amanogawa Power Station

## First Telephone Co. Toll Cables in Japan

*(Continued from page 487)*

This cable, with the necessary loading coils, is now being manufactured at the Hawthorne Works of the Western Electric Company at Chicago. It will be of the quadded type and consist of 54 pairs of No. 16 A.W.G. conductors and 130 guaranteed pairs of No. 19 A.W.G. conductors. All of the No. 19 gauge circuits will be suitably arranged for 4-wire operation, the No. 16 gauge conductors being used for 2-wire operation only.

Japanese telephone engineers have shown great interest and a keen insight in the recent advances which have been made in the art of long distance telephone cable transmission. The decision of the government to undertake construction work of this nature will materially assist in the creation of an adequate toll line plant and will place Japan among the foremost countries of the world in the development and operation of long distance telephony.



The Hidachi Copper Mine of the Kuhara Mining Company, one of the four largest producers in Japan, situated near Sukegawa, Ibariki Prefecture

# Copper Ores in East Asia

## Extracted from a Monograph on Copper Ores by Robert Allen, M.A. (Cantab.), B.Sc. (Lond.), M. Inst. M.M. of the Imperial Institute. Published by John Murray, London

### China

THE mining of copper in China has always been strictiy controlled by the government, as copper is an important medium of currency. The metal is imported as production is insufficient to supply the needs of the country.

According to V. K. Ting, director of the geological survey of China, there are many deposits of copper in China, but not many are of value. The deposits occur as (1) *magmatic segregations*, (2) *contact deposits*, (3) *replacement deposits* and *fissure veins*, (4) *impregnations*, and (5) *sedimentary deposits*.

The first are seen in the Permian basalt of Yunnan, which covers great areas. All are small and irregular. Similar deposits occur in the Teriary porphyries of North Chihli. The contact deposits, always associated with iron ore, are due to contact action of diorites. They are found in South Hupeh, in the districts of Shing Kuo and Yangshing, and are of small economic importance. The government is working a contact deposit at Pangshih in Kirin, which contains 10 per cent. ore, but is small. Important replacements, occurring as stockworks in limestone, and as fissure veins in shale, are found in the famous Tungchuanfu mine, Yunnan, where the ore contains over 8 per cent. copper, and in the Hueili district of Szechuan.

Low-grade impregnations are found in the pre-Cambrian crystalline rocks of South Shansi and N.W. Hupeh. The government is working a similar deposit at Penghsien, near Chengtu (Szechuan), where the ore-bodies consist of large lenses in crystalline schists and limestones, and contain about 5 per cent. copper.

The sedimentary deposits in Yunnan and in Kweichow are of interest: the lower Triassic sandstone overlying the Permo-Triassic coal measures, always contains some copper, principally as malachite.

According to Chas. H. Hansen great mineral wealth lies within the border of the province of Kansu, but prospecting is very difficult, as the rocks are covered by a capping of fine sandy loam (*loess*), up to 200-ft. in thickness, supposed to have been blown over from the Gobi Desert. At one place he erected a copper smelting furnace, with a capacity of 50 tons per day, there being good fluxes and coal near by. Access is difficult as the roads are of the worst possible type.

According to H. W. L. Way, there are extensive aboriginal workings on th Ko-Lo-Lo copper mine, four miles north of Maha, Szechuan, and there are a number of derelict stone blast furnaces in the valley below, but the mine has not been worked within the memory of man. Copper-bearing veins occur at Lo-Ko-Ti, about 12 miles N. W. of Maha ; and at Hui-Lung-Chang, 30 miles N. E. of the same place, 90 smelters worked very prosperously until 15 years ago, when the Chinese were driven out by the Lolos.

The copper mines of the province of Yunnan have been described by J. Coggin Brown. In N. E. Yunnan the Lou Pou mines in Carboniferous prophyry yield a small production, and, near the village of Ta-Me-Ti, are several copper deposits, the most interesting of which is Lao-Sin-Chang. It is a kind of stockwork in cracked and brecciated limestone, and the primary chalcopyrite has been altered to carbonate with concretions of barytes. The ore from Lao-Sin-Chang was almost entirely chalcopyrite, and that from Pe-Si-La was mainly bornite with a little covellite. In E. Yunnan, the deposits at the Tien-Pao mine, near Pe-Tchen, consist of three interstratified ore-bands with a sandstone floor and a shale roof. Only one seam is being worked. The ore, in the form of balls, is chalcopyrite. The Wei Tou Chan mine is on a thin vein following an irregular fissure in an eruptive rock, carrying quartz rich in bornite, chalcopyrite and pyrite. The Yung Pei Ting district, N. N. E. of Ta Li Fu, was inspected by J. Coggin Brown. He believes the veins were in very irregular fissures, very varied in size and shape, crossing shales, sandstones and limestone, and entering the eruptive rocks in contact with them. The output is at present small. The San Chia Chang copper mine, S. W. of Yunnan Fu, in the upper valley of the eastern head waters of the Red River of Tongking, was also visited by J. Coggin Brown. The ore is chalcopyrite, with small amounts of enriched sulphides, in limestone, which is much broken near its contact with slates.

Copper mining was formerly of importance in Yunnan. The decline in the last 50 years is due to depletion of rich surface ore, to political troubles, to lack of charcoal fuel due to the destruction of forests, and to transport difficulties. There are government mines in the Tungchuanfu region, already referred to, which yield an output of about 1,000 tons per annum. One of the mines dates from 1697, and the output from five groups of mines formerly amounted to from 4,500 to 9,000 tons per annum. The Mohammedan rebellion in 1858 stopped all mining in Yunnan. There was a revival from 1874, and the mines reverted to the government in 1907. The government also has copper mines in the Penghsien district, near Chengtu, Red Basin, and in Huilichow, 115 miles south of Maha, Szechuan ; at Ch'ang Pailing, Kiangsi, and works at Yaokai, Kansu. The Ching Hua Mining Co. is working in the Nanchang district, Hupeh, with a modern foreign equipment.

Copper also occurs in the provinces of Shantung, Hunan, Anhui, Kweichow and Kwangtung.

In Manchuria copper is found, but apparently not worked, at Tunghwasien and at Maoerhshan near the Korean border east of Moukden ; also at Pensihu, at Tienpaoshan, at Chaimachi and at Shisuitze. According to Rockhill, copper is found and slightly worked in S. E. Tibet.

The difficulties of mining for foreigners in China are described by W. F. Collins, E. Gilmour Brown and J. A. T. Robertson. If foreigners desire to engage in mining they can do so by forming joint companies with the Chinese, half of the shares being held by Chinese. In some places, such as the province of Hunan, the presence of foreigners is not desired. In some parts large portions of the mineral wealth are locked up in concessions. The important mineral province of Yunnan is under French control.

The yearly output of copper in China is about 2,000 tons at present, one-half of this coming from Yunnan, the balance, from Kirin, Kansu and Turkestan.

Recent imports of unmanufactured copper are as follows :

| | 1914. | 1915. | 1916. | 1917. | 1918. | 1919. | 1920. | 1921. |
|---|---|---|---|---|---|---|---|---|
| Metric tons | 19,853 | 3,089 | 1,575 | 1,672 | 7,339 | 19,210 | 25,190 | 28,925 |

## Dutch East Indies

*Celebes.*—Copper ore has been found near Gorontalo, and is being worked by natives.

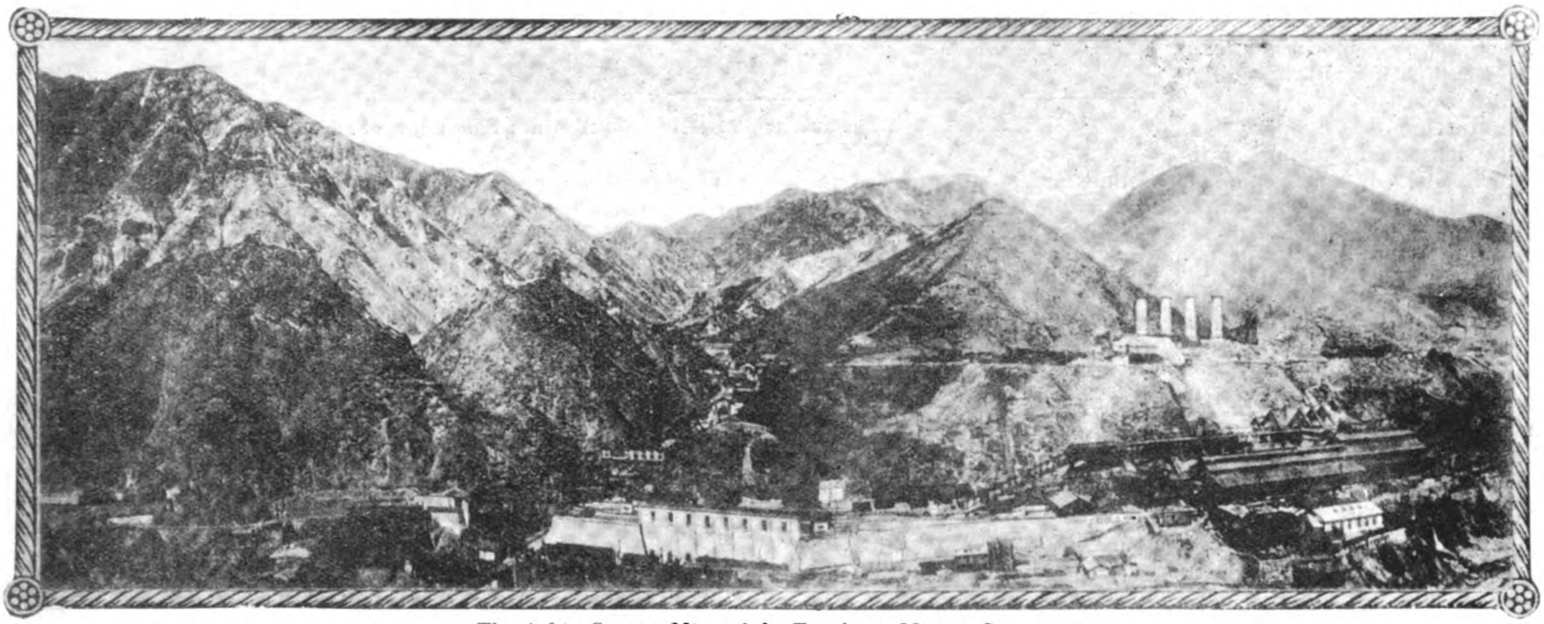
*Dutch Borneo.*—Ores of copper are fairly uniformly distributed near Mandor, Montrado and Budok, West Borneo. Copper ore is found occasionally disseminated in gold and pyritic quartz veins in slate and granite, and small veins containing pyrite and chalcopyrite occur in argillaceous sandstones. In the Tampi Mts. there is a zone of weathered clay-slate 40-ft. wide, impregnated with pyrite and chalcopyrite, and traversed by several small ore-bearing veins, which, however, die out at small depths. In the same mountains native copper has been found in auriferous drifts. The Chinese and native gold-washers have long known that native copper is sometimes associated with gold sand ; indeed, copper ore is said to have been, at one time, a by-product in gold-washing. Near Salothong, copper ore is found in granite for a width of 16-ft., either in small veins or scattered through it in nests and impregnations. At greater depth the quantity of ore diminishes. Near Skanah, granite is traversed by veins of chlorite nearly 2-ft. in thickness, containing chalcopyrite and blende. In the deserted gold mines of Man Fo Pie and Ko Pie Then, veins impregnated with chalcopyrite are scattered over a clay-slate district. Some of the veins consist almost entirely of chalcopyrite.

*Dutch New Guinea.*—The presence of copper has been reported near Biri River in the north-east of Dutch New Guinea.

*Dutch Timor.*—A rich copper deposit has recently been found near Taninj, about 20 miles from Tjamplong, Dutch Timor, the ore being reported to be worth from £25 to £40 per ton at the then existing rate of exchange.

*Java.*—It is believed that copper ore exists in large quantities in Java. It is found at Madiun and at various places in the Preanger Highlands, but has been mined nowhere scientifically.

*Sumatra.*—Copper ore is said to be plentiful in the Paningahan Valley, west coast of Sumatra, but has not been worked. It is found also on Nias Island off the same coast.



**The Ashio Copper Mine of the Furukawa Mining Company**

## French Indo-China

Louis de Saugy has described the copper ore occurrences at Van Say, on the Song-bo (Black R.) a tributary of the Song-kio (Red R.), Tongking. Five nearly vertical veins, striking N. N. W. to S. S. E., occur on the right bank of the river. The veins, covered by a shallow gossan, vary from 1½ to 5-ft. in thickness, and contain carbonate ore followed by unaltered sulphides. To the north on the left bank of the river is the outcrop of a similar vein, 1½-ft. in thickness, and rich in copper. Copper ore outcrops to the south at various places on the left bank, both oxidized and sulphide ores being present in gangues of ochreous schist, quartz (often auriferous), chlorite and dolomite. Quartzose ores assayed 12 to 27 per cent. copper ; schistose, 18 to 31 per cent.; and dolomitic ore, 6 per cent. The average content was about 16 per cent. copper. The gold contents varied from a trace to 27 dwt. per ton ; the silver, up to 4 dwt. per ton. Saugy thinks the exploitation of these deposits should be remunerative. Copper ores have been found by natives at several places in the province of Tranninh, Tongking, but the deposits have never been exploited.

Copper mines are worked by natives in the province of Kwangnam, Annam. Copper ores have been found near Vien-Tiane and at Savanakhet, Laos, and in the lateral valleys of the Mekong River.

In 1919 there were nine copper mineral concessions in Indo-China.

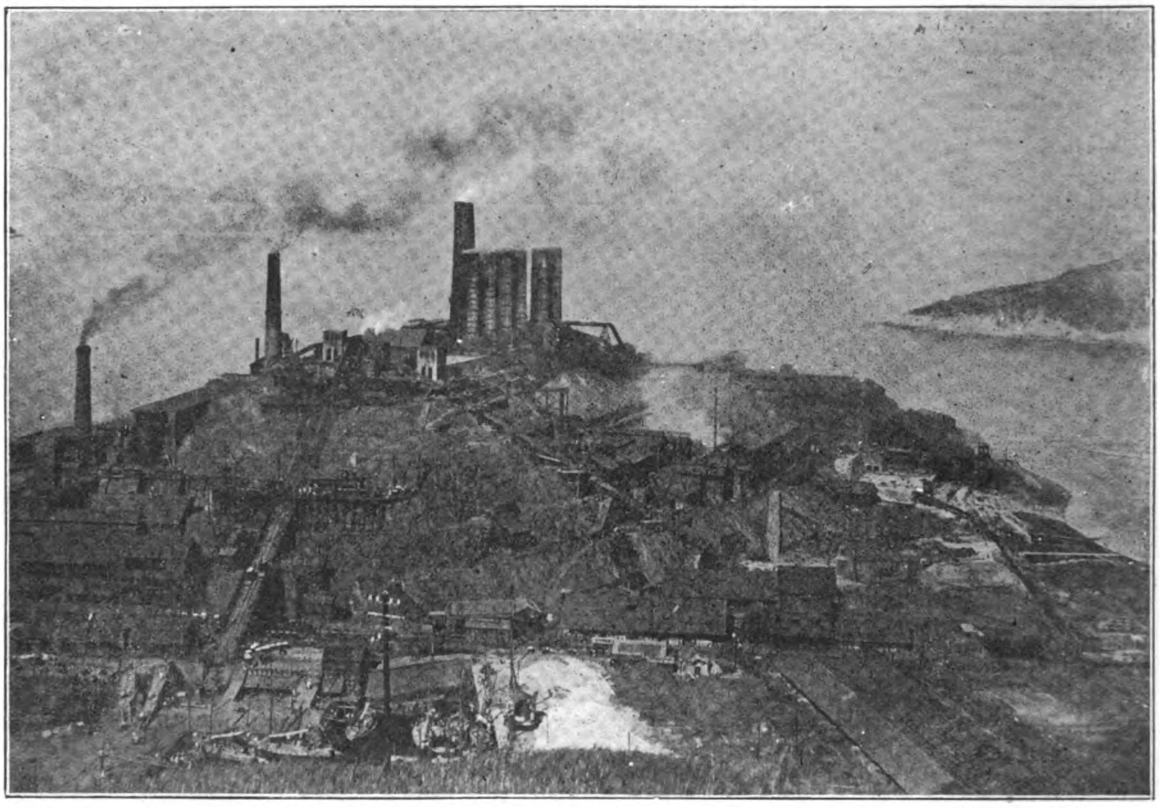
Recent exports of copper ore from Haiphong, Tonking, are as follow :

| | 1910. | 1911. | 1912. | 1915. |
|---|---|---|---|---|
| Metric tons | 32 | 29 | 55 | 67 |

## Japan and Formosa

*Japan.*—Copper mining in Japan dates from the year 708, when copper was found in the province of Mushashi. The copper produced was used to a small extent for minting purposes, but mainly for casting bells and images for the temples. Early in the fifteenth century a considerable amount of copper for that time was exported to China, one shipping invoice, dated 1456, showing 92 tons of copper in one cargo. The Dutch did much trading for copper with Japan till the year 1858.

Modern smelting methods were introduced into Japan in 1890 by the late William Gowland, and more recently Japanese engineers have adopted the latest American practices in handling low-grade ores.



**The Sumitomo Besshi Copper Mine: Shisakajima Smelter**

Production of copper has steadily increased during late years. In 1912 Japan became the second largest producer of the world. The copper industry in the country is next in importance to that of petroleum.

Owing to stimulation by the high prices ruling during the war, old mines were reopened. In 1917 owing to the fixing of the price of copper by the allied governments, at which Japan could not produce, her production decreased considerably. After the signing of the Armistice the price of copper seriously dropped, and it became cheaper for the Japanese to buy in the United States than to produce. During the war Japan started extensive manufactured copper and brass industries, which she will want to maintain, so she is likely to be a buyer of copper for some time to come.

Copper deposits are found in all parts of Japan, and about 40 mines were in operation till recently. The deposits of the Ashio mines (Furukawa Co.) are at Ashio in the province of Shimotsuki, and are fissure veins, the largest of which is 3,000-ft. long, 2-ft. wide, and 3,000-ft. deep, occuring in liparite intrusive through Palæozoic slate, sandstone and quartzite. The ores are chalcopyrite and pyrite in a siliceous gangue, but are complex. The Ashio mine is the largest in the Far East, has 190 miles of drives and has been worked in depth to 3,700-ft. It is operated from a remarkable 10,000 h.p. hydro-electric plant. The mine yielded 15,460 metric tons in 1919, the largest output in Japan.

In the Besshi mine (Sumitomo Co.), on the island of Shikoku, Iyo province, bedded pyritic deposits occur in crystalline schists or Palæozoic rocks, such as chloritic or graphitic schists. The ores, pyrite and chalcopyrite, contain about 3½ per cent. copper. The largest ore-body is 5,000-ft. long, 4-ft. wide, and 3,000-ft. deep, and dips at 49°. The mine has been in the hands of the Sumitomo family since 1691. Production in 1919 was 10,610 metric tons of copper.

Complex sulphide deposits, which contain about 2 per cent. copper with blende, pyrite, galena, gold and silver, and which are replacements in Tertiary sedimentary and in volcanic rocks, are found in the Kosaka mines (Fujita Co.), in the extreme north of Hondo Island ; they were originally worked for silver. The ore-bodies are largely mined by open-cut methods. One is 1,600-ft. long, 400-ft. in maximum width, and 400-ft. deep. In 1919 the Kosaka mines produced 9,022 metric tons of copper.

Contact deposits of great irregularity as to form and size and confined to the margins between Palæozoic clay-slates and limestones, and intrusive granites and diorites, are found in the Kamaishi mines, also in the north of Hondo Island.

Ores from fissure veins and contact deposits are concentrated, the concentrate being smelted in blast furnaces with semi-pyritic smelting, the coke charge being from 8 to 16 per cent. Ores from the bedded and replacement deposits are treated usually by pyritic smelting.

Considerable amounts of gold and siver are recovered as by-products from the copper ores of Japan, most of the silver produced coming from copper ores.

The Hitachi mine S E of Ashio, in the province of Hitachi, is owned by the Kuhara Mining Co. It yielded 12,346 metric tons of copper in 1919.

The four mines, Ashio, Hitachi, Besshi and Kosaka, together, produce over one-half of Japan's output.

Production of copper and the copper trade of Japan for recent years are as follow :

*Production of Copper and Copper Trade of Japan.*
(Long tons)

| | London price (electro). £ s. d. | Production 3 | Imports. | Exports. | Consumption. | Stocks. |
|---|---|---|---|---|---|---|
| 1914 | 62 5 6 | 78,700 | nil | 43,305 | 32,045 | 1,500 |
| 1915 | 84 2 7 | 83,017 | 324 | 56,528 | 27,723 | 4,873 |
| 1916 | 138 0 10 | 111,562 | 2,325 | 58,432 | 59,690 | 536 |
| 1917 | 136 8 10 | 122,379 | 14,109 | 71,052 | 63,309 | 2,227 |
| 1918 | 128 5 10 | 95,455 | 1,068 | 31,553 | 65,397 | 2,250 |
| 1919 | 100 15 1 | 81,855 | 27,570[2] | 19,132 | 67,188 | 26,800 |
| 1920[1] | 110 12 10 | 65,000 | 22,600[2] | 5,000 | 83,000 | 25,000 |

1 Estimated.

2 Sudden increase due to home development of water-power undertakings and to increased demand from China for copper for coinage.

The increase of consumption in 1916-18 was owing to the war ; the increase in 1919-20, to the consumption of copper wire for transmission purposes by new hydro-electric power schemes.

Recent costs of producing copper in Japan, calculated at 1 yen=$24\frac{9}{16}$ pence, are as follow :

*Costs of Producing Copper in Japan*
(Per long ton)

| | £ s. d. | | £ s. d. |
|---|---|---|---|
| 1914 | 48 10 0 | 1918 | 78 0 0 |
| 1915 | 43 6 0 | 1919 | 88 8 0 |
| 1916 | 53 15 0 | 1920 | 107 10 0 |
| 1917 | 62 8 0 | | |

The distribution of Japanese exports of copper for recent years is as follows :

*Exports of Copper from Japan*

(Long tons)

| Destination. | 1914. | 1915. | 1916. | 1917. | 1918. | 1919. | 1920.[1] |
|---|---|---|---|---|---|---|---|
| China .. .. | 14,083 | 1,432 | 1,490 | 4,929 | 7,420 | 13,692 | 3,500 |
| British India .. | 2,444 | 1,221 | 86 | 3,991 | 2,437 | 1,375 | 350 |
| Asiatic Russia .. | 5,061 | 29,536 | 35,244 | 10,767 | 139 | — | — |
| Great Britain .. | 6,813 | 12,251 | 14,352 | 24,587 | 5,417 | 452 | 600 |
| France .. .. | 3,487 | 3,958 | 4,175 | 17,977 | 8,510 | 141 | 100 |
| Italy .. .. | 200 | — | — | 4,225 | 4,374 | 1,859 | — |
| United States .. | 4,701 | 7,833 | 2,920 | 2,617 | 37 | — | — |
| Other countries .. | 6,516 | 297 | 164 | 1,957 | 3,219 | 1,613 | 450 |
| | 43,305 | 56,528 | 58,432 | 71,052 | 31,553 | 19,132 | 5,000[2] |

1 Estimated.

2 Not including copper re-exported from bonded warehouses, estimated at 12,000 tons.

*Formosa.*—Copper ore is mined in the north of Formosa (Taiwan) principally in the Kinkaseki mine, and also in the Dobunian mine in Karenko province, and in the Futa mine in Giran province. The two latter mines were opened recently.

Recent productions of copper in Formosa are as follow :

| | 1914. | 1915. | 1916. | 1917. | 1918. | 1919. |
|---|---|---|---|---|---|---|
| Metric tons .. | 1,875 | 1,482 | 1,151 | 1,008 | 610 | 877 |

### Korea (Chosen)

Copper is found in abundance in different parts of Korea but development of the deposits has been delayed largely owing to absence of transport facilities.

The Suan concession, granted in 1905, is in Hwang Hai province, Central Korea ; in 1908 it was taken over by the Seoul Mining Co. of Denver, Colorado.

The ore deposits of the concession are of the contact-metamorphic type, occurring in limestone around the edges of a granitic batholith, elliptical in shape and roughly six miles by five miles in its main dimensions. The periphery, known as the Collbran contact, is about 23 miles in circumference. The intrusion of the granite has uplifted and shattered the surrounding sedimentary rocks, producing intense contact metamorphism. Around the edges of the contact ore-bodies occur irregularly in the gangue, which is a highly siliceous crystalline limestone, altered by contact action, containing a considerable amount of magnesia and alumina. The ore is invariably associated with faults that have served as passages for hot mineralizing solutions. The valuable metals of the ore, which consists mainly of chalcopyrite with some bornite and tetrahedrite (rare), are mainly gold and copper ; bismuth (as bismuthinite) silver and tungsten (as scheelite) also occur in economic quantities ; galena, blende and molybdenite, only in small amounts.

As a general rule the gold-copper ores occur close to the contact, whilst those of lead and zinc are farther from it. D. F. Higgins states that there is very little secondary concentration at the Suan mine, and J. M. Maclaren, who examined the property in 1915, came to the conclusion that the ore-bodies represent primary sulphide deposits, the upper portions of which have been eroded away. The Suan mine, 650-ft. in depth, is almost worked out.

The Tul Mi Chung is now the principal mine of the Seoul Co. The majority of the ore-bodies are either formed close to a tongue of quartz-diorite, which divides the mine into two portions, or at the flatly-dipping boundary of limestone with overlying schist. The ore-bodies, on the whole, lie near the walls of quartz-diorite and, in all probability the ore was deposited in the limestone by metalliferous solutions that followed in the track of the intrusion (Maclaren). The Soctarie ore-bodies near-by consist of a flatly-dipping band of siliceous limestone, in places altered to a quartzite. The average thickness of this band is about 30-ft. It could be quarried and operated in 1916 at a profit, when the reserves were estimated at 2,300,000 tons containing ½ dwt. gold per ton, 0.95 per cent. copper and 0.25 per cent. tungstic acid.

In the Suan mill (capacity 8,000 tons per month), after the introduction of flotation in 1913, the gold and copper extraction amounted to about 90 per cent., and that of the bismuth to 60 per cent. The average grade of the mill-ore to the end of 1918 was gold, dwt., silver, 0.6 oz. per ton ; copper, 0.92 per cent. and bismuth 0.08 per cent. The ore treated at the Tul Mi Chung mill (capacity 14,000 tons per month) to end of 1918 averaged gold, 6 dwt.; silver, 0.5 oz. per ton ; and copper, 0.98 per cent. The flotation concentrate; contains gold, 25 dwt., silver, 9 oz. per ton, and copper, 26 per cent. The copper extraction during 1918 averaged 90.34 per cent., and the gold extraction about 60 per cent.

In 1916 the reserves, not including those of the Soctarie deposits, were estimated at 1,221,000 tons valued at $13,460,000.

There has recently been great development at the Kapsan copper mines, which were bought in 1916 by a Japanese company from its English owners for £300,000. During 1917, 2,000 tons of roughly refined copper were sent to Japan. The mine is in the South Kankyo province and is equipped with a smelter of 200 tons per day capacity. The Kosho mine is in the Huchang district, in the extreme north of Korea, within a short distance of the Yalu River. Important copper deposits have been discovered in the South Chusa province in Southern Korea, and a refinery is being erected.

Tsingtau has become the centre of a big Japanese export trade since 1915. The exports of ore in 1916 were 34,000 tons.

### New Caledonia

Deposits of copper ore, some auriierous, are in New Caledonia principally in the north, in the Diahot Valley and Pam districts. The principal mine is the Pilou, but formerly the Edison mine at Pouembout was the most important. Copper is also mined in association with nickel. Outputs of copper in the colony in metric tons for the period 1908-1912 according to the *Statistiquss de l'Industrie Minère dans les Colonies Françaises* (annual) were :

| | 1908. | 1909. | 1910. | 1911. | 1912. |
|---|---|---|---|---|---|
| From copper ore .. | 108 | 1,337 | 1,126 | 266 | -- |
| From nickel ore .. | 7,501 | 1 | 9,630 | 1 | 11,116 |

1 Not reported

### Philippine Islands

A number of copper deposits are to be found on the islands Luzon, Malolos, Mindanao, Marinduque, Mindoro, Panay, Masbate of the Philippines, but all are awaiting development with the exception of the Mancayan deposit in Northern Luzon. Prospecting on the islands has practically ceased. In the island of Luzon are to be found veins of enargite and *famatinite*[1] ($Cu_3 SbS_4$) with selenium compounds of silver and copper in association with the usual secondary minerals. Obstacles to mining and smelting copper ore on the islands are numerous and great. There has been no production of copper since the American occupation.

### Timor (Portuguese)

Chalcopyrite is found at Mt. Birogue, west of Baucau in Portuguese Timor. Other copper deposits occur, but all are unexploited for want of capital.

# China Electric Company

Seven new telephone exchanges have recently been completed at Nanking, Shanghai, Soochow, Wusih and Peking. A toll line is now under consideration between Shanghai, Nanking, Hankow, Tientsin and Peking. This expansion of China's telephone system has made necessary a factory at Shanghai for the manufacture of the apparatus. The China Electric Company was organized by the International Western Electric Company and the Chinese ministry of communications in 1917. In 1919 work was started in the new plant at Shanghai, which now employs 450 Chinese workers.

Here are manufactured telegraph instruments, telephone sets, special telephones and switchboards for military purposes and central office switchboards and other apparatus. While this work is of a technical nature, the Chinese are very adaptable to such work, being not only deft, but extremely patient and easily contented. Such a thing as a labor problem is rare in China.

The largest contract completed by this Chinese factory was the Hatamen street exchange in Peking. It is a 3,000 line equipment of the central battery type, and has a capacity of 10,000 lines. It employs 38 operators. The China Electrical Company is also setting up small lighting plants for use in foreign compounds in the interior, schools and similar places. These plants are run by engines which are started by gasoline and operated by kerosene.

# Java's Volatile Oil Industry

By *K. R. F. Blokzeyl*

THE oil derived from citronella grass (Andropogon Nardus) is certainly one of the best known "Aromatic Grass Oils," which designation may be conveniently used to group together the several essential oils obtained from members of the genera Andropogon, Cymbogon and Vetiveria, belonging to the grass order (N. O. Graminaceae). The group includes a number of volatile oils of very considerable commercial importance, which, although finding much use in a medicinal way, have their greatest value to the perfumer and manufacturer of scented soaps, not only on account of their natural perfume, but because they contain large percentages of prime materials used in the preparation of certain types of synthetic perfumes, such as "otto of rose," etc.

The distillation of citronella oil in Java is an industry which has assumed large proportions during the last decade, its rapid growth in recent years being due in part to the opening up of remunerative lines of work by pioneering scientific workers, and in part to the greater demand for this product by manufacturers in the United Kingdom, the United States, Japan, France, and other countries.

According to the customhouse statistics, the exports of the oil from Java rose from 75,200 kilos in the year 1913, to a record of 528,500 kilos in 1910, whilst during the last two years, 273,200 and 434,700 kilos, respectively, have been shipped from the island.

Throughout Java, but more especially in the western districts, there are scattered a number of large distilleries under European management, and dozens of smaller, which for the greater part are situated at the bases of hilly ridges, where cold water for condensation purposes is to be had plentifully.

Weighing Bundles of Citronella Grass on Arrival at the Distillery.

The cultivation of the grass is very simple. Clumps of well-grown uncut plants are divided into "slips" or "shoots" and planted 2 to 3 feet apart. The planting is done in wet weather, and most of the slips throw out roots and set.

The gardens are, as a rule, laid out on open hillslopes, as the plants like full sun-heat, although they thrive fairly well under large trees, f.i. rubber trees, where they are sometimes cultivated as a secondary crop, but under such conditions a smaller quantity of leaves is obtained.

A long and pronounced drought is unfavorable to their development, the best results being obtained in districts where a damp climate and regular rainfall throughout the year are prevailing.

Under normal conditions the grass grown rapidly and form "stools," about three feet in height and twelve inches in diameter in from six to seven months. It can be cut from five to six months after planting, and three times in each succeeding year. The stools require replanting at intervals of about four years if the industry is to be a profitable one.

Formation of seeds is prevented by regular harvests, as otherwise the tufts of grass become too dense and spoil. Weeding is rarely necessary after the planting period. On some estates the ground is forked after the grass has been cut.

When the grass is used for fuel, after the extraction of the oil, the ashes are sometimes scattered over the ground for manure. This manuring process, however, is usually left off since it has been found that the plants, though growing up luxuriously and producing a larger amount of leaves, are decreasing in their oil content.

Recently published returns show a number of estates producing volatile grass oils in Java amounting to 35, with a total planted area of more than 15,000 acres, an acre yielding, on an average, from 50 to 60-lbs. of oil in a year.

The grass is always distilled in the fresh state, i.e., as soon as it has been carted in from the gardens. Sometimes the larger bundles are cut into smaller pieces before being steamed.

The distillation is carried on by direct steam only, no water being first added to the grass in the still. The principles of this method depend upon the property of the steam as it passes through the charged apparatus to carry with it the volatile portion of the plant in the form of vapors, which are condensed, together with the excess of watery vapor, and deposited in the receiving vessel. Thus the three steps in the process are (1) the distilling, (2) the condensing of the vapors, and (3) the collecting of the oil.

The distilling plant consists of a more or less modern steam boiler provided with safety valve and water gauge, resting on a concrete foundation. The steam is passed into one or more separate stills, which, in the larger distilleries, are erected in batteries. A still is a cylindrical vessel made of cast-iron and resting on a solid brickwork. It is, as a rule, about 3-ft. to 4-ft. in diameter, and 6-ft. to 7-ft. high, closed at the top with a flat lid fastened down with thumb screws. Near the top of the still is a pipe communicating with the condenser, which consists of an iron tank through which cold water is kept running. The condensing worm passes through this tank and issues from the side where it is received by a Florentine flask (mostly made of metal) to collect the distillate.

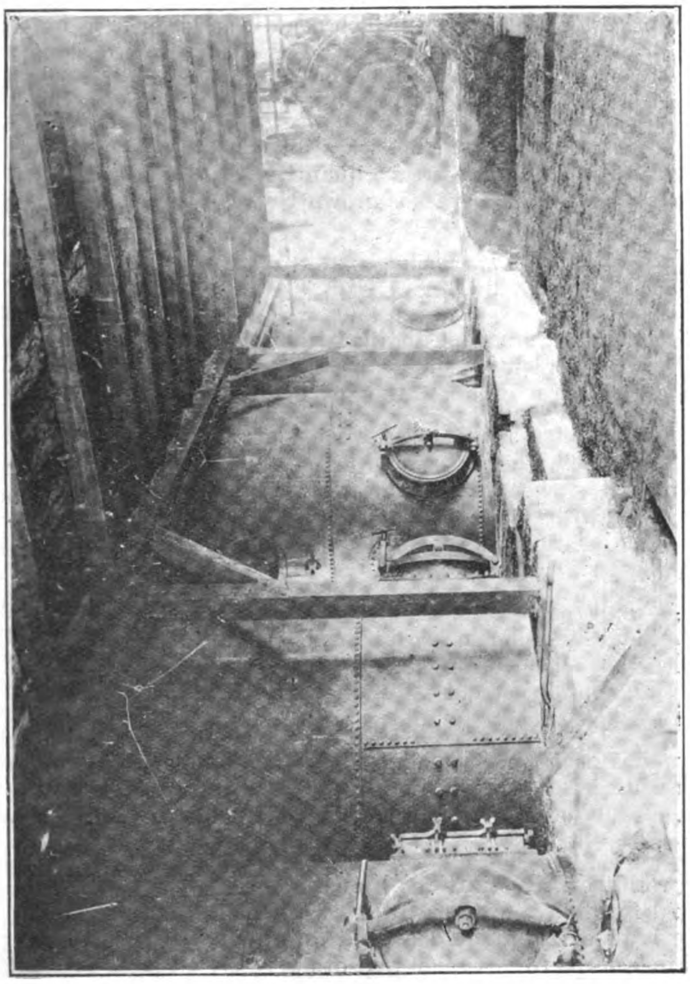
Economy in the process is practised even to the extent of using the water of the condensing vessel when it gets hot to feed the boiler with, so as to economize in fuel.

The space of time, necessary for the distillation process is not the same at all distilleries, as this depends on may factors. Usually, however, a distillation is completed in from one and one-half to two and one-half hours.

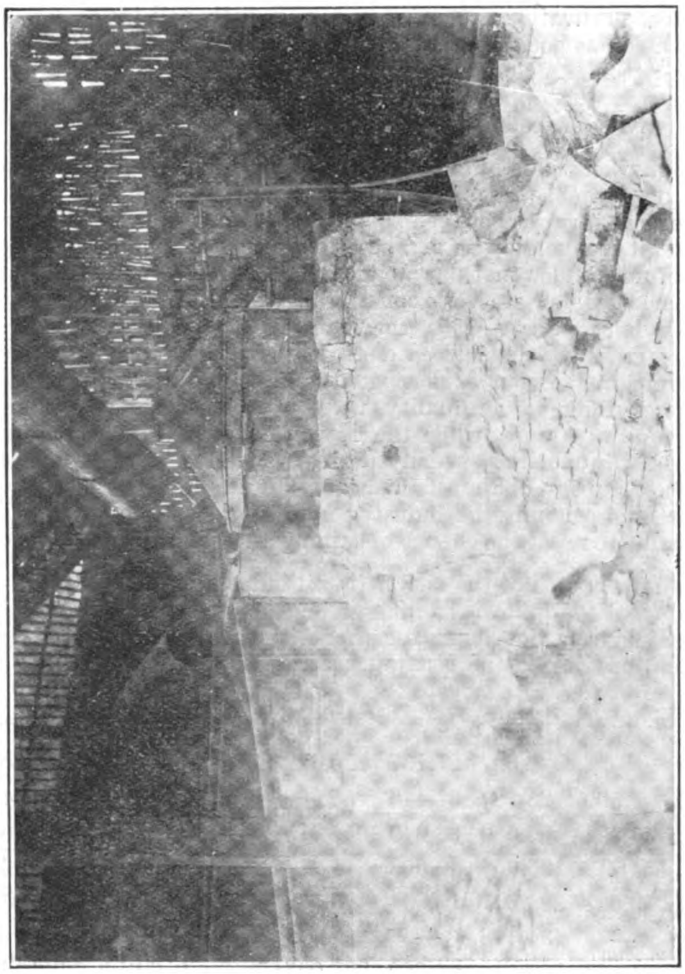
The yield of oil is much influenced by such factors as soil, dryness, moisture, altitude, sunshine, age of the harvested leaves, and distilling efficiency. As a result of this, it varies in Java from 0.6 to 1.1 per cent. of the fresh material.

To separate the oil from the aqueous distillate in the receiving vessel, the portion which has not been separated by means of the stop cock on the side of the receiver is poured into a separating

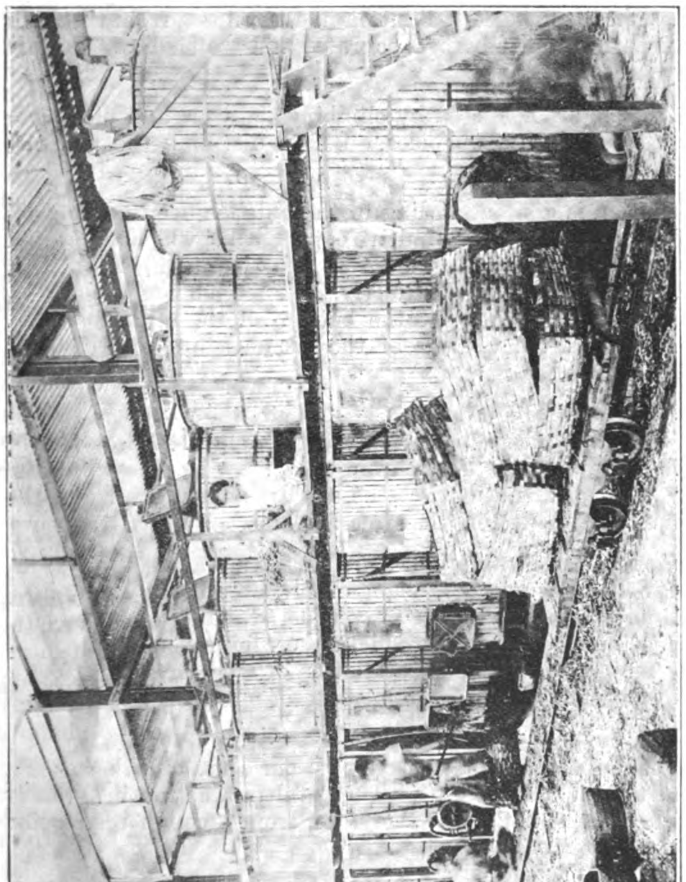
# VOLATILE OIL DISTILLERIES IN JAVA



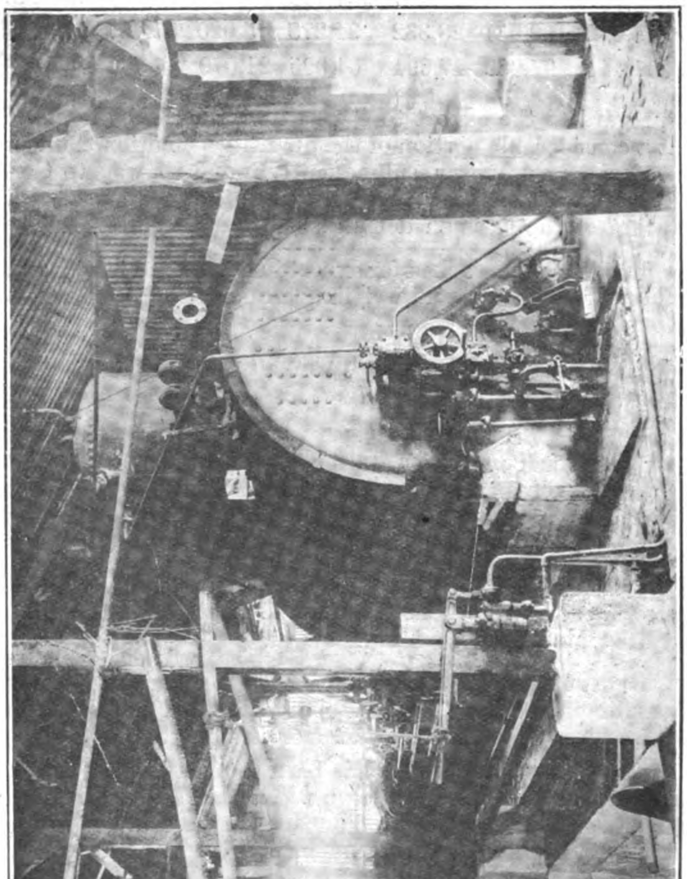
View in a Java Citronella Oil Distillery, showing battery of four stills and locomobile boiler producing steam for distillation



Simple type of stills (containing material suspended in water and applying direct heat) used by Chinese distillers of Cananga oil in Java



Battery of 9 stills in a Java Citronella Oil Distillery. The iron stills are covered with split bamboo rods for steam economy



Marine boiler installed in the oldest Citronella Oil Distillery in Java; in use since 1909

funnel of glass and the heavier liquid drawn off. The oils resulting from different stills are then united and subjected to filtration, which process tends to separate any solid particles or emulsion of oil and water. Filtration is effected by pouring the oil into a glass funnel which has been fitted with a filtering medium, such as filter paper or cotton. A clear and transparant oil finally results, bearing in every way the appearance of a marketable oil and having a specific gravity of 0.885 to 0.901 at a temperature of 15° C.

The market value of citronella oil depends chiefly on the percentage of geraniol present. This percentage, as far as the Java oil is concerned, varies between 80 and 90 per cent., whereas for the Ceylon oil it is much lower, viz.: 60 to 65 per cent. only, and it is, therefore, no wonder that Java citronella oil fetches prices on the world market which are very considerably higher than those paid for the Ceylon product. It is true that Java oil is distilled from a species of grass which yields a distinctly superior oil to that obtained from the Ceylon Anderpogon grass, but quite apart from this natural difference in quality, there is the fact that the Java product is always pure, while the Ceylon oil—with the exception only of small quantities, usually designed "Estate oil," which is really pure oil too—is almost invariably adulterated by the Singhalese in whose hands the industry is, owing to these producers being unable to resist the change of gaining an illicit profit.

The importance of the citronella oil industry in Java may be gathered from the following table, giving the quantities of exports of this article from the island, together with the principal countries of destination, during the last ten years:—

| Year | Gr. Britain Kilos | U.S.A. Kilos | France Kilos | Holland Kilos | Germany Kilos | Japan Kilos | Totals, incl. other destinat. |
|---|---|---|---|---|---|---|---|
| 1913 .. | — | 6,637 | 21,137 | 20,422 | 23,824 | — | 75,230 |
| 1914 .. | 1,500 | 25,787 | 31,446 | 55,666 | 17,164 | 5,091 | 136,654 |
| 1915 .. | 60,394 | 63,560 | 38,049 | 55,713 | — | 12,377 | 233,326 |
| 1916 .. | 151,719 | 196,065 | 40,653 | 14,278 | — | 19,416 | 428,743 |
| 1917 .. | 213,631 | 204,807 | 15,654 | 5,565 | — | 50,437 | 515,763 |
| 1918 .. | — | 84,478 | — | — | — | 80,867 | 228,124 |
| 1919 .. | 91,264 | 85,619 | 69,360 | 233,095 | — | 6,912 | 528,534 |
| 1920 .. | 75,230 | 46,921 | 80,767 | 124,496 | — | 18,590 | 434,445 |
| 1921 .. | 13,052 | 100,931 | 28,332 | 34,278 | 5,020 | 67,487 | 273,140 |
| 1922 .. | 137,944 | 97,960 | 47,694 | 64,095 | 21,070 | 47,852 | 434,708 |

With regard to the export to Germany, it should be borne in mind that a considerable portion of the quantities mentioned under Holland before and post-war, subsequently found its way to Germany. For this reason the above figures do not give a correct representation of the German demand.

Java citronella oil is packed for export in galvanized iron drums containing about 300 litres and weighing a quarter of a ton or 560-lbs.

Having dealt with citronella oil, we will now turn to another volatile grass oil, distilled in Java, viz.:

*Lemongrass oil*, which is derived from the leaves of a grass, bearing the botanical name of Andropogon Citratus. The most interesting feature of the oil is the large percentage of citral that it contains. This has been variously stated at 70 to 80 per cent. and in inferior or adulterated samples at 40 to 50 per cent.

The oil is employed in the manufacture of artificial perfumes, such as the violet known as ionone, and, like all the aromatic grass oils, is utilized mainly in perfuming soaps.

Cultivation of the grass and distillation of the oil are done in the same way as for citronella, but the grass is smaller and yields a much less amount. The price of the oil, however, is higher.

As a result of experiments, it has been found that 496-lbs. of fresh grass yielded 1-lb. of crude oil (0.2 per cent.), the estimated yield per acre, per year, being about 20 to 25-lbs. of crude oil. The yield of refined oil, however, is much less than this.

As long as British India—where lemongrass is mainly grown—supplied only moderate quantities of the oil to the world market, resulting in prices reaching an exceptional high level, Java could easily compete with the product of other origin. However, as soon as shipments from India increased, and also other colonies like Indo-China and Reunion started the production on a commercial scale, prices of the Java oil, which contains a lower percentage of citral, dropped to such a level that the industry was no longer remunerative, and since then nearly all distilleries in the island were compelled to close down.

In recent years, Java lemongrass oil can only be produced profitably and in fairly important quantities by the government rubber estates, where the grass is grown between the rubber trees as a secondary crop.

Export figures are not available, as the oil is not separately mentioned in the customhouse statistics.

*Vetivert oil* is a grass oil distilled from the roots of Vetiveria zizanioides. This plant is indigenous to India and Ceylon, and introduced into Java, Reunion, the Seychelles, and elsewhere.

The dried roots of the grass, which yield from 0.4 to 0.9 per cent. of volatile oil, are exported from Java in considerable quantities to Europe, where the material is distilled for essential oil, used for "heavy" types of odors, and which has a very great fixative value as well. The powdered roots are also in use as a sachet powder.

On a small scale, vetivert oil has also been distilled in Java for export, and by doing so freight was saved and loss of essential oil avoided, but since its preparation has been found a matter of some difficulty, producers of the roots prefer to ship this material only cleaned and dried.

There has been considerable over-production of vetivert roots and oil in Reunion in the past, but it is stated that production has been much reduced lately, owing to the unremunerative character of the industry.

The result of investigations by experts have shown that the oil derived from Java vetivert roots, when distilled by European methods, is of excellent quality and quite equal to the best oil distilled in Europe from Indian and other vetivert roots.

*Cananga Oil.*—This perfume oil is chiefly prepared by natives and Chinese in the district of Bantam in West Java, from the fresh flowers of a tree, the Cananga odorata, and which bears flowers twice a year.

The flowers are collected by climbing the tree, and picking is done by means of bamboo poles. Before distilling the material is slightly bruised.

Distillation is done according to the old-fashioned method by means of water and in most primitive copper stills, which are heated by an open fire. This has the great disadvantage in the fact that the heat, being applied directly, has a tendency to char or burn the material adjacent to the bottom of the still, and thus appreciably affect the quality of the aromatic product distilled over.

Besides in the Bantam district, where the cananga tree is cultivated for the industry on a small scale, some oil is also made in the district of Cheribon, Java, from wild growing trees, but the Bantam oil is considered better, the smell being intenser and the product contains less esters and free alcohols.

In odor and general properties the Java cananga oil is inferior to the well-known ylang-ylang oil prepared in the Philippines and in Reunion, which product is considered standard by buyers. But, with a more general introduction of improved methods of collecting the flowers and the installation of modern apparatus for the extraction of the oil, a large increase in foreign sales might be expected.

The yield of oil is at present only 0.1 per cent., and the specific gravity of the oil 0.93 to 0.94. The total production in Java is only small, and the article is, therefore, from a commercial point of view, not of much interest.

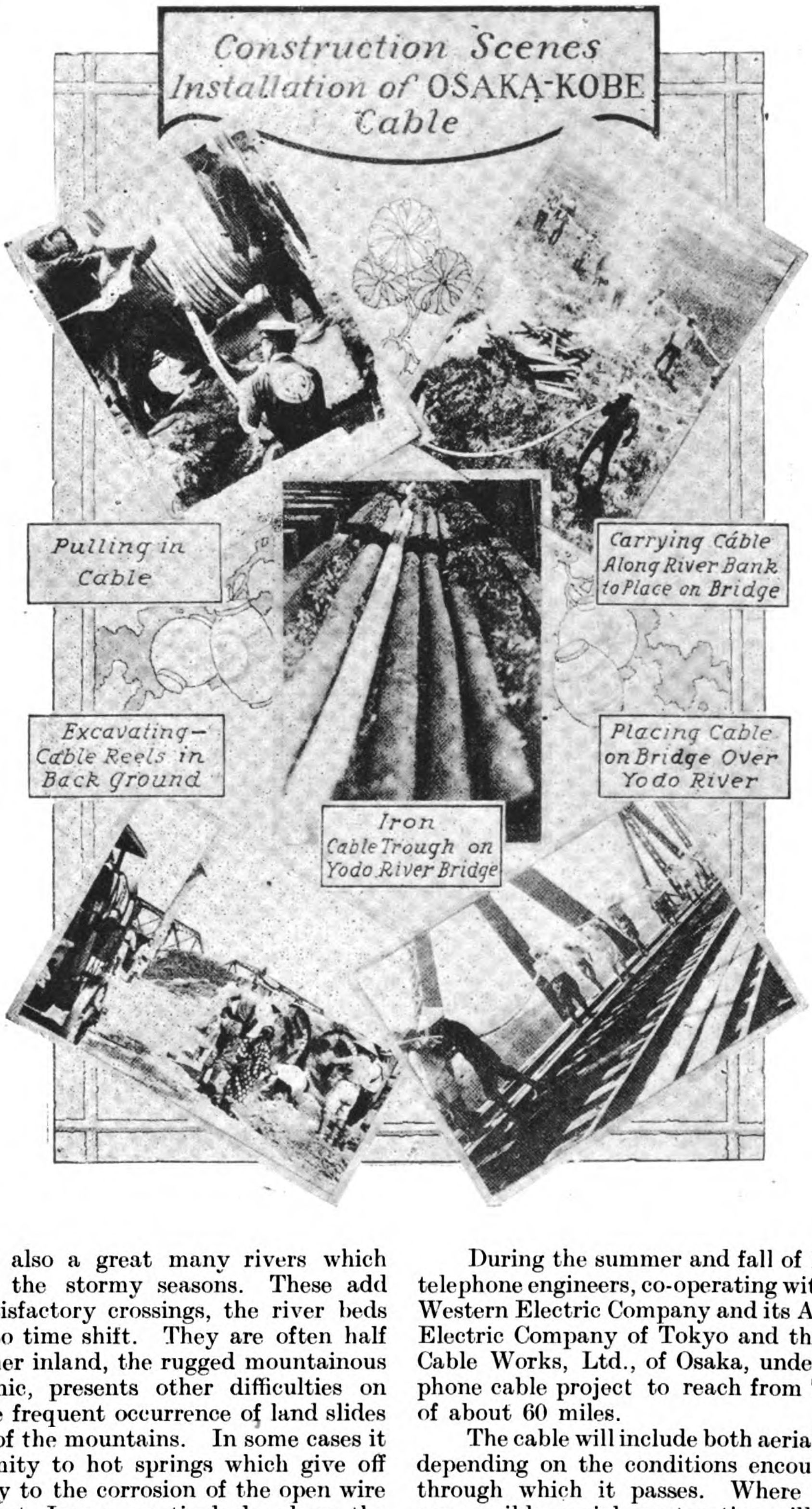
*Other essential oils*, such as Chenopodium, Champaca, Palmarosa, etc., are prepared in Java on a very limited scale only, and are not always obtainable for export.

# Installation of the First Telephone Toll Cables in Japan

*By R. P. Ashbaugh, Engineering Department, Western Electric Company*

OWING to the mountainous nature of the central portion of the main island of Japan, the population of the country has concentrated on the coasts. The development of the Pacific coast cities, lying as they do at the gateway to the Orient, has been most rapid by reason of their location. Telephone toll service, inaugurated between Tokyo and Yokohama in 1890, has been steadily extended; Tokyo and Osaka, distant 350 miles, being connected in 1897, and telephone circuits at present extend from Sapporo, on the island of Hokkaido, to Nagasaki, on the island of Kiushiu, a distance of about 1,500 miles. All of this service has until recently been supplied over open wire lines.

The demand for power in the industrial centres led to an early consideration of methods for utilizing the very extensive water power of the country and the growth in hydro-electric installations has been rapid, involving a considerable extension of the high-tension electric power distribution networks. As the topography of the country limits the number of possible routes which may be utilized for pole line construction, these routes must be shared by both signal and power circuits. The signal circuits are subjected to the possibility of inductive interference and hazard from crosses inasmuch as the width of the roads and streets, particularly in the villages, prohibits adequate separation.




The natural conditions in the country have made it particularly difficult to maintain the open wire lines in a satisfactory condition and to insure continuity of service. Japan is situated in the typhoon area. During the summer months it is often visited by devastating storms which do great damage and in many cases have destroyed large sections of telephone lines. There are also a great many rivers which are subject to floods during the stormy seasons. These add to the difficulty of making satisfactory crossings, the river beds being unstable and from time to time shift. They are often half a mile or more in width. Further inland, the rugged mountainous country which is often volcanic, presents other difficulties on account of steep grades and the frequent occurrence of land slides due to the rather rapid erosion of the mountains. In some cases it is not possible to avoid proximity to hot springs which give off sulphurous fumes adding greatly to the corrosion of the open wire lines. The humidity throughout Japan, particularly along the coast, is very high and makes it difficult to maintain a satisfactory insulation.

In order to overcome these difficulties and relieve the serious congestion in toll traffic which existed between Osaka and Kobe, and also between Tokyo and Yokohama, the Japanese government placed orders with the Nippon Electric Company, Limited, an Affiliated Company of the International Western Electric Company, for loaded duplex toll cables, to be installed between these cities. Both cables are of the same size and type and of approximately the same length, 22 miles. Each cable consists of 52 quads (4 quads of No. 13 A.W.G. conductors, 14 quads of No. 16 A.W.G. conductors and 34 quads of No. 19 A. W. G. conductors). The cables are loaded throughout with medium heavy loading on 6,000-ft. spacing, the inductance of the side circuit coils being approximately 0.175 henry and of the phantom circuit coils 0.107 henry. The equivalents of these circuits in miles of standard cable (one mile equals an attenuation of 0.109 at 800 cycles per second) range from approximately two miles to about 6½ miles, depending on the gauge of the circuit.

Both the cables and loading coils were manufactured at the Hawthorne Works of the Western Electric Company at Chicago and shipped the latter part of 1921. The installation of the Osaka-Kobe section was completed in the fall of 1922, and installation is in progress on the Tokyo-Yokohama section. The Osaka-Kobe section is almost entirely underground, the only exception being a small amount of aerial construction at two river crossings and another where the cable crosses a river on a railroad bridge.

The underground conduit is about one-half concrete block and one-half iron pipe. Manholes in Kobe and Osaka and in the larger villages and at all loading points between are similar to the types standard in America. In the remainder of the line where concrete block conduit is used, the manholes comprise small rectangular concrete boxes placed just beneath the roadway. Where the iron pipe conduit is used no manholes are provided, but after the joint in the cable is made, a larger section of iron pipe is slipped over it and then the earth filled in over the joint. Throughout all this part of the line the roadway is dirt with some admixture of sand and gravel, so that it is not difficult to dig down to the splice whenever necessary. Some interesting features of the construction work are shown in the group photographs.

During the summer and fall of 1922, the Japanese government telephone engineers, co-operating with engineers of the International Western Electric Company and its Affiliated Companies, the Nippon Electric Company of Tokyo and the Sumitomo Electric Wire and Cable Works, Ltd., of Osaka, undertook a survey for a toll telephone cable project to reach from Tokyo to Odawara, a distance of about 60 miles.

The cable will include both aerial and underground construction depending on the conditions encountered in the various localities through which it passes. Where routes through open country are possible, aerial construction will be used. Through the usually narrow and congested streets of the more populous villages and through the cities, the cable will be laid underground. This is an important measure toward avoiding possible interruptions to the service as a result of fires in the villages and towns.

*(Continued on page 479)*

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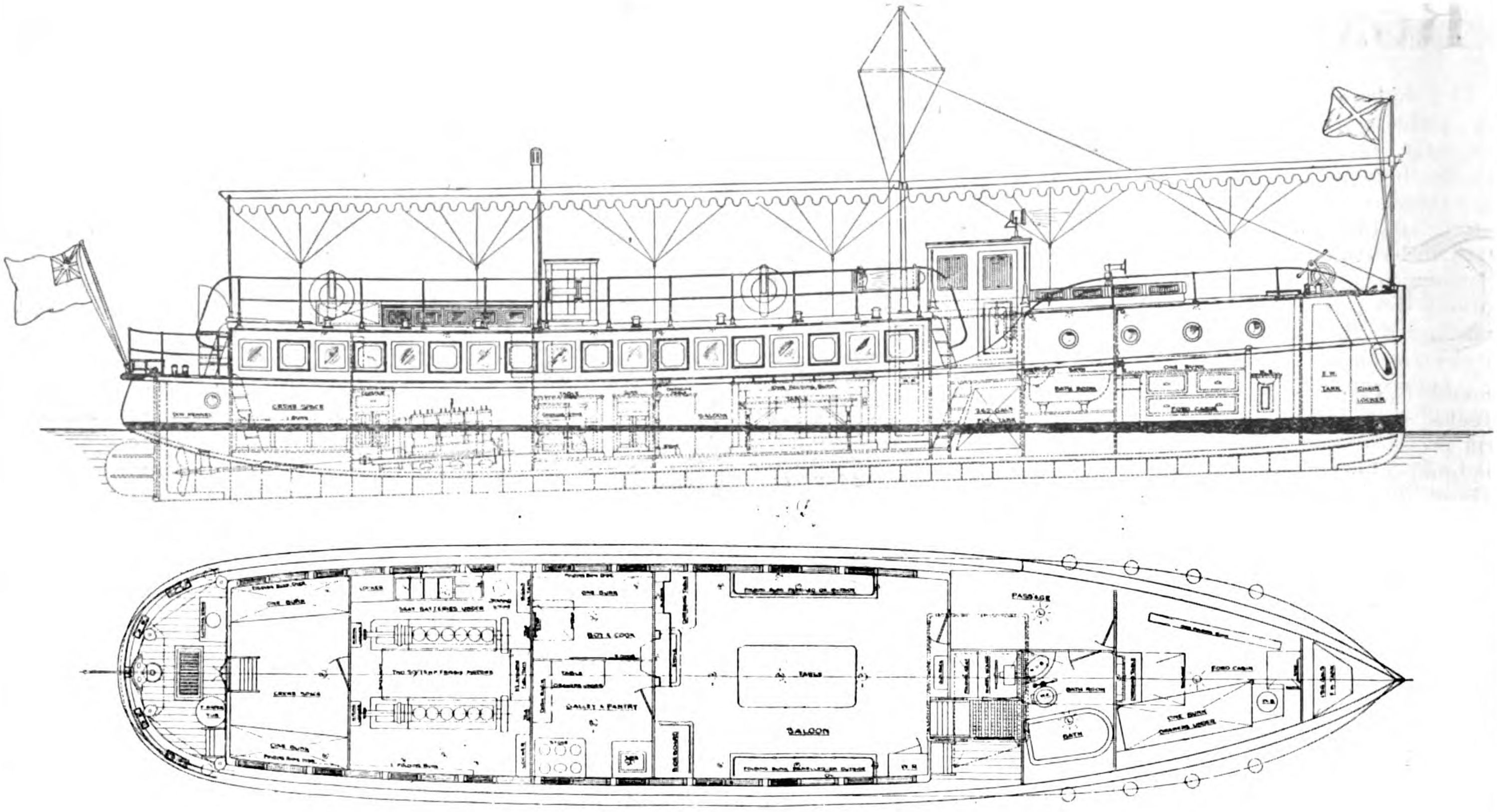

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MOTORING - AERONAUTICS - MOTOR BOATING

# Roads, Bridges and Transportation in the Antung District

*By J. Murrihy*

THE climatic conditions prevalent in Manchuria in winter turn rivers into roads, the waters of the Yalu and its tributaries are frozen into ice strong enough to support the heaviest traffic, and usually from the end of November to the beginning of March, vehicles of many kinds may be seen hauling farm produce and passenger traffic over the ice. The hauling animals are generally shod with frost nails which enable them to get a sure foothold.

The public roads of this locality are abominable, except those in the Japanese town. Sledges are in common use both for passengers and goods; a large amount of timber logs and other produce are pushed down on sledges in winter, by what is locally known as "Rice Power," i.e., coolies who wear shoes with spikes to enable them to get footholds in the ice. Along the banks of the Yalu the country is intersected with rivers, cross-canals and creeks, which when frozen, are good roads, but cart-traffic in this locality is impossible in summer, and without the aid of birdges, traffic is retarded in warm weather.

**The Fine Roads of the Japanese Settlement of Antung**

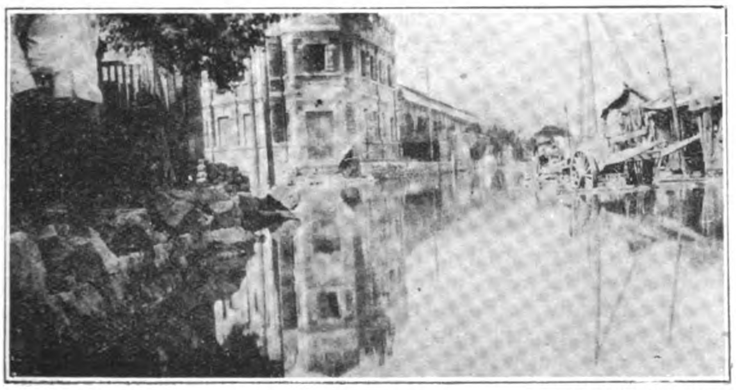
Manchuria is ice-bound for at least four months of the year, and during that period water-borne traffic ceases, the ground is frozen hard, and where it is level, roads are not necessary at all; traffic may be hauled over paddy ground, if the load is too heavy, extra animals may be hitched on with ropes, and off they go over the plains anywhere.

This cart-trade from the interior of Manchuria is immense, large quantities of cocoons, and farm produce are hauled down, and it might be supposed that some care would be taken to keep the roads over which it has been transported in order. The absence of bridges causes animals to partly swim and wade over streams with their burdens. The roads are often worn below the surface of the surrounding land and during the rainy season become rivers. Instances of animals being drowned on the roads are not unknown.

These roads with their deep ruts are permitted to freeze hard without any repair, heavily-laden carts are hauled along by tired animals which are whipped at frequent intervals.

Heavy cargo-carts, made to suit these bad roads of Manchuria, are made of stout Korean elm capable of withstanding the bumping and jolting to which they are constantly subjected. The heavy iron-studded wheels revolve with the axle, these wheels have only three spokes, one strong beam and two smaller ones at right angles which are spliced together with large iron rivets and the fellies encircled with heavy iron tires.

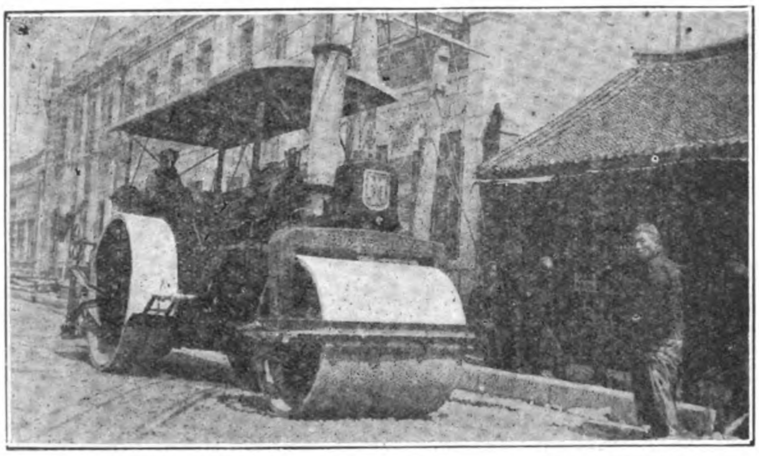
These carts will carry a couple of tons or more over the worst roads for years, or until they break down, which usually happens in some narrow pass where only one cart can enter, then the whole traffic is stopped for hours and there is general pandemonium, whipping and shouting which can be heard far off.



CONTRASTS IN GOOD GOVERNMENT

**Chinese City of Antung: The "Vegetable Market" Street, like a River in Rainy Weather**

**Animal Drowned in the Streets of the Chinese City of Antung**



**Road Making in the Chinese City of Antung**

**A German Road Roller at Work**

**Portable Track and Tipping Wagons**

The passenger cart is lighter than the above and resembles a miniature box-car or a large saratoga trunk, covered with blue cotton cloth and sometimes lined inside with goat skins, there is room inside for two passengers, or three small people. The entrance to the cart is in front, covered with a heavy cloth door with a pane of glass in the middle ; there are no springs and the bumping and jolting over hard uneven bean-fields can better be imagined than described.

When the natives of Manchuria travel in winter they go in pairs, if possible, and usually lie close together for the sake of warmth, the heat of one body keeps the other warm and *vice versâ ;* moustaches are not at all necessary in these journeys, as the process of thawing lumps of ice which cling to them is very painful. Those intending to travel in Manchuria during winter ought to cut off their moustaches, otherwise they will be compelled to carry extra weight in the shape of icicles suspended from their upper lips.

In damp roads, the frost penetrates three or four feet deep, this is warmed by the rays of the sun in May, and forced to doze out by the heat, and the roads which were in good condition in March are sometimes like india rubber in June. When the roads begin to soften in the spring, the carters unload part of their cargo before they arrive at Antung, the great trade mart of Southern Manchuria, where the goods are stored until the ice breaks up and the Yalu opens to navigation.

The roads of this locality are not straight but meander through bean-fields and streams ; on high ground they are pounded hard by years of traffic.

The above gives a fair idea of the roads and the means of transport for conveying passengers and traffic from the interior of Manchuria to Antung.

Within the limits of Antung some of the roads in the Japanese settlement are as good as can be found anywhere. Three Ruston Proctor steam-rollers are constantly at work in the Japanese settlement. The only drawback is that these good roads are not long enough, as, after a few miles ride one comes to the end, and must turn back. Although the roads of the Japanese settlement have a level surface, the place has not yet been supplied with sidewalks for foot passengers.

The roads of the Chinese town are the opposite of those described above and these may be classified as bas as can be found anywhere. During the rainy season of 1922, the roads of the Chinese town were like streams or a succession of ponds, through which the weary animals could only struggle forward at a snail's pace, with the wheels of the carriages submerged beyond the hubs. Ricshaws cannot negotiate the puddle at all. It is said that at one time the streets of Peking were also in bad shape, and a foreign official who got stuck in the mud of legation street said "If all expenses for me were paid I to Peking no more will go." He ought to have been sent to Antung.

Antung being built on the delta of the Yalu, when the river overflows, there will always be trouble with the roads, as the excess water will interfere with the sewage on such a dead level unfavorable for drainage. The Chinese are, at last, trying to emulate the Japanese in road making. A Danish consulting engineer named Mr. Gernow, employed at a salary of $500 per month by the Chinese chamber of commerce, is engaged in road making in the Chinese town, and since his arrival some improvements have been made. Mr. Gernow is insisting on proper drainage and has had some difficulty to make the native officials accede to his views until he refused to continue work until the subsoil was properly drained.

Sewage pipes have now been laid on some of the large streets. When the ditches were first dug, the Chinese used them as receptacles for refuse, and orders had to be issued to prevent them from dumping their rubbish into the pipes. Wooden boxes are now provided for refuse which is removed occasionally under the supervision of the police.

A steam-roller imported from Germany is now at work in the native town, the cost of it is said to be $12,000.

We shall now say a few words about the bridges of Antung, for without the bridges, the roads would not be very important.

Antung, situated on the right bank of the Yalu river about thirty miles from its mouth, chiefly owes its prosperity to the Yalu Bridge ; over which Japan is enabled to get her raw materials from Manchuria and import her commercial commodities. Built in 1910 at a cost of 3,000,000 yen ; the bridge is 3,096-ft. long, with twelve steel spans, six large ones on the Manchurian side, and six small ones on the Korean side, supported by solid stone piers. The material was supplied by the United States Steel Products Company and its construction supervised by the late Mr. H. Okamura and Mr. Whitmore.

There is a swing span in the centre to permit boats with tall masts to pass. The bridge is opened four times daily during the following hours : from 4.30 a.m. to 5.30 a.m., 8.30 a.m. to 9.30 a.m., 0.30 p.m. to 1.30 p.m., and from 4.30 p.m. to 5.30 p.m.

Chin-An Bridge, known by the Chinese as the Chin-An-Ch'iao, is the next largest bridge in Antung, situated at the northern end of the Chinese city spanning the Ta-Sha-Ho (big sandy river) a tributary of the Yalu). It is called after the old name of Antung which was Chin-Kou and was afterwards known as Sha-Ho-Tze (Sandy river). When the port was opened by commercial treaty with the United States in 1903 this place was called An-Tung-Hsien (Eastern Peace District).

The Chin-An-Ch'iao, built in 1920, is of reinforced concrete and stone it, costing $22,000. It was built under the supervision of the Chinese chamber of commerce, and connects Antung city with the district known as Pei-Kan-tze (the northern slope). Until this bridge was built the traffic over the Sandy River was almost impossible in summer, because the water was too shallow for boats, and the bottom of the river not solid enough for vehicles.

## Boundary Bridge

This bridge, now under construction, spans the creek of Ch'i-Tao-Kou (7th creek) which separates the Chinese city of Antung from the Japanese settlement. It was originally agreed that half the cost would be paid by the Chinese ; but they were slow, as usual, in coming forward with the money, and the original plan was abandoned. After years of fruitless negotiation between the South Manchurian Railway Company and the Chinese authorities and repeated repairs to the old wooden bridge, which at last became dangerous, the South Manchurian Railway Company and the customs agreed to put up a new bridge according to the following

*(Continued on page 496)*

# A Good Name

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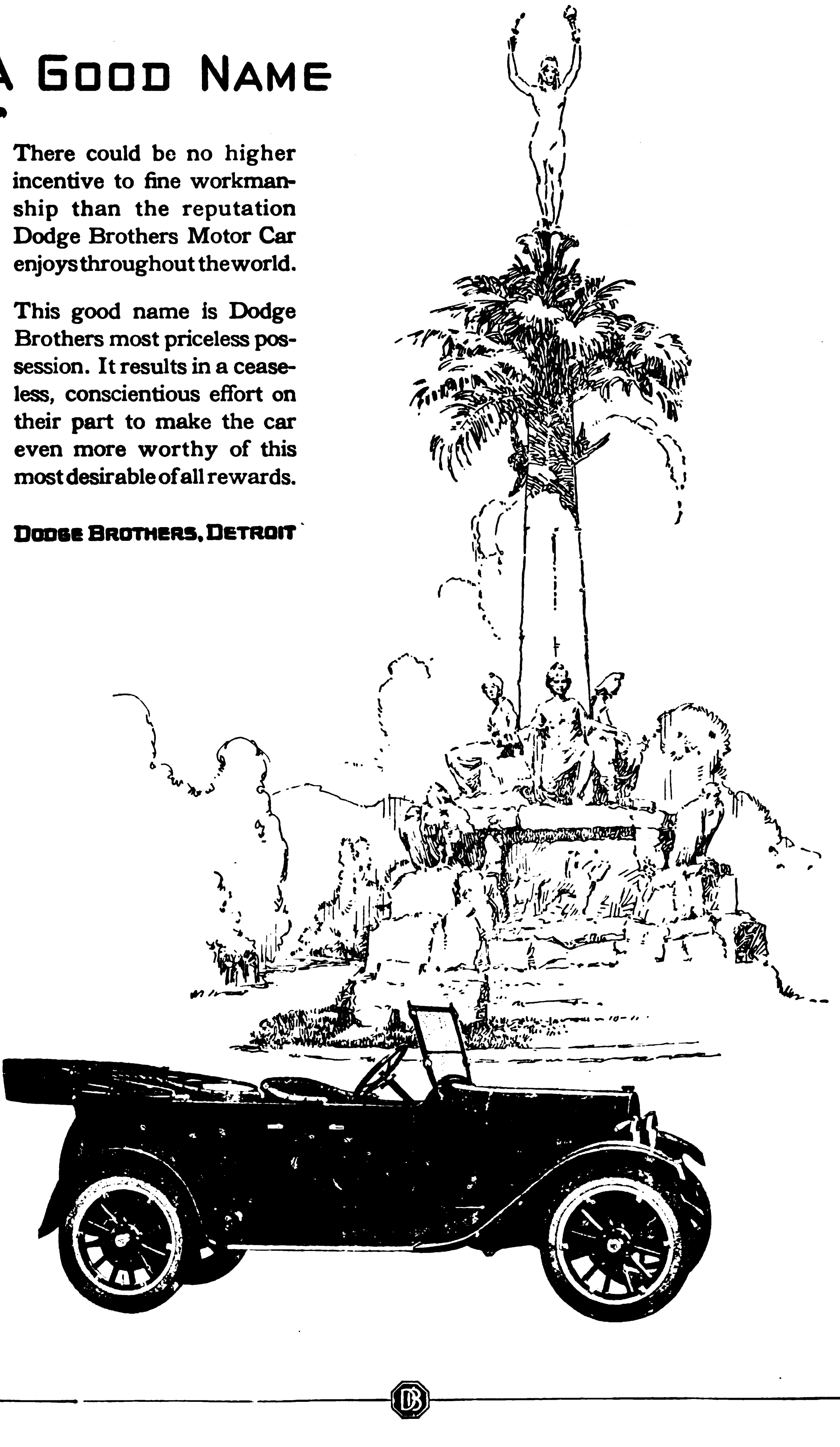


A Triumph of Road Building: Lugard Road, around the Peak at Hongkong, a Wonderful Scenic Highway.

# Road Making in Hongkong

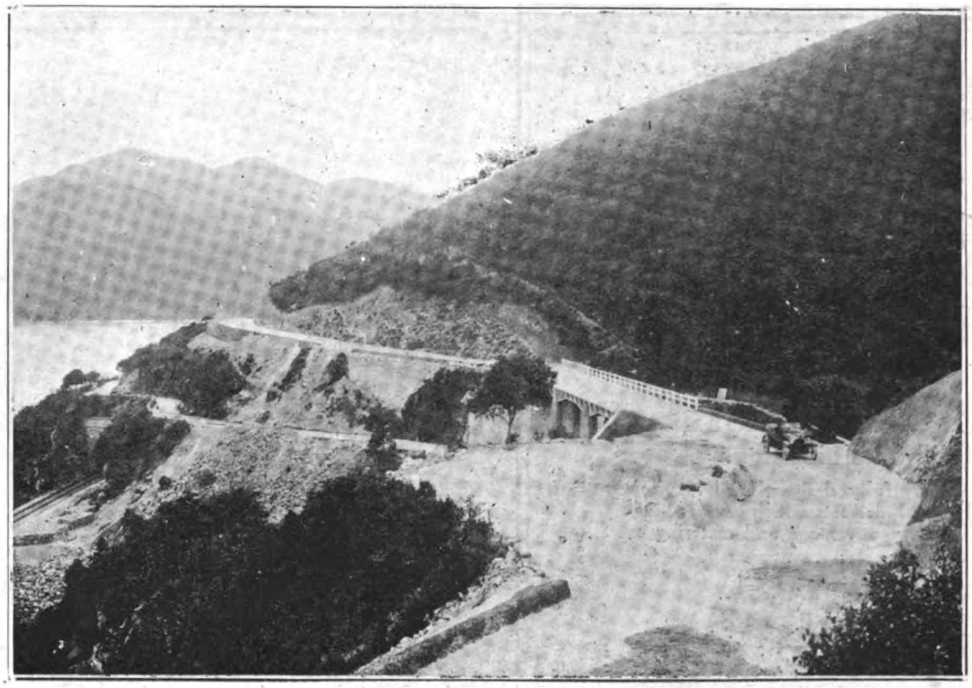
## Developments Which Will Make Hongkong the Queen City of the Orient

HONGKONG is stirring itself to make the best of its natural advantages, not only as an industrial and manufacturing centre but as a place of residence and tourist resort. The Hongkong Hotel Company has taken the lead in many improvements which will make the colony more attractive to the traveling public. In addition to the beautiful resort at Repulse Bay, one of the most charming rest places in the whole of Eastern Asia, this enterprising company is now building a three-million dollar hotel at Kowloon, which will be opened in the winter of 1924; another up-to-date hotel is to be erected on the Shameen at Canton, the Peak Hotel is to be remodeled and new bus services put in operation. Kowloon is being developed into a delightful suburb for residences and industries, and one or two projects are well under way for the building of model groups of houses that in one instance will rise to the dignity of a new town. As a result of the investigations of an industrial committee many new enterprises are projected, amongst which is the establishment of a large iron and steel works, and the development of a great machinery manufacturing centre in the colony. Much of this future prosperity, however, depends upon closer relations and a better understanding with the neighboring province of Kwangtung, from whence the bulk of the raw materials must be drawn, and, as we pointed out in the April number of THE FAR EASTERN REVIEW, the recognition of this dependence upon

Reinforced Concrete Details of the Lugard Road Construction.

the mainland for its growth and prosperity, lies at the bottom of the recent agreement entered into between the Hongkong authorities and Dr. Sun Yat-sen. Hongkong's future is, therefore, much brighter at this time than any other part of China, and from all indications, the authorities are losing no time in preparing the colony for what lies before it.

The basis of Hongkong's growth lies in the excellent public works program, which in opening up territory with new roads has made possible the erection of many new and handsome buildings, and permitted the development of tracts in Kowloon for residential purposes. These splendid roads have transformed the island of Victoria into one of the scenic wonders of the Far East, rivalling in the beauty of the panoramas unfolded to the motorist, some of the more widely advertised scenic highways of other lands.


**The Scenic Road Round Hongkong: View near Tytam Reservoir.**

There are now 215 miles of road, of which 137 are used for mechanical transport. The material used for the construction is granite setts on concrete, 2-in. asphaltum sand carpeting of concrete, 2-in. asphaltum sand carpeting on macadam, macadam painted with asphaltum, and ordinary macadam. The roads are kept in good condition, and the average cost per mile of building is $70,000 for 20-ft. width. That for maintenance in connexion with all roads is $1,000. Granite sett or asphaltic mixture surfaces cost about 5c. per super yard. The minimum width of the main roads is 20-ft., the maximum gradient 1 in 7 (for a short distance only), but there are slopes of 1 in 20 three miles long. The colony is generally hilly, there being only a few flat gradent roads, but the ruling gradient for roads open to mechanical transport may be taken as being 1 in 20. The streams are all bridged, the structures are capable of carrying ten-ton loads, the minimum width, generally speaking, is 20-ft., and they are kept in good repair. In the city the maximum speed desirable for cars and lorries is fifteen and twelve miles an hour, and outside twenty to twenty-five and fifteen miles per hour.

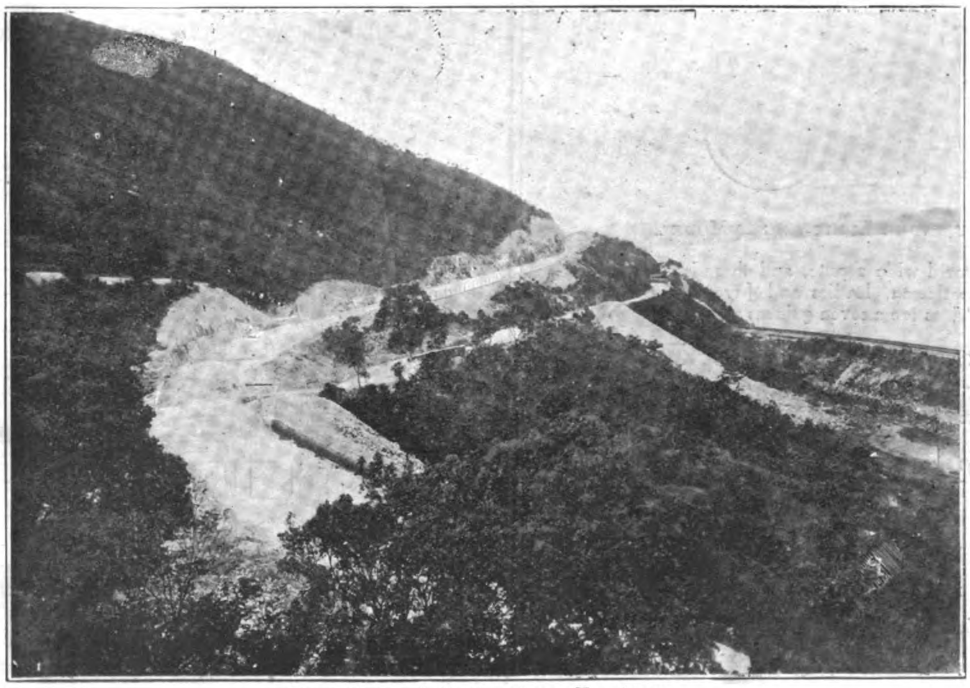
The number of touring cars and commercial vehicles is about 551 and fourteen respectively. The government own one four-ton steam lorry of Aveling and Porter make, and two two-ton Dennis lorries; the former is run on coal and the latter on petrol, while the vehicles are used mainly for the conveyance of road-making materials. The steam wagon has been working since 1916, and has proved satisfactory, except for the smoke nuisance, due to the burning of Japanese coal. The Dennis lorries have been running since 1921, and have also proved successful. The price of steam coal per ton delivered is $19.50; coke is obtainable in small quantities at $32 per ton. Petroleum costs $5.22 for eight imperial gallons, and petrol, $8.55 for eight imperial gallons.

Individual enterprise follows closely on the heels of the pioneer work of the public works department. The building boom carries with it new transportation schemes, and within the past month, two new autobus companies have commenced operations. The Hongkong and Kowloon Taxi-cab Company, Limited has been organized with a capital of $500,000 and will place in operation eighty Citroen Landaulette taxis by the end of the year. The first batch of thirty have been ordered and will be placed in operation sometime in June. These will serve not only the city of Hongkong but the suburban districts of Kowloon. In addition, the Kai Tack Motor Bus Company, Limited (a subsidiary of the Kai Tack Land Investment Company, Ltd.) has opened a service of six buses between Tsim-sha-tsui and Kowloon city.

In describing the road work of the public works department, the *South China Morning Post* says that it was the opening of the Shaukiwan quarry that made it possible to proceed with projected public works with much greater rapidity than would otherwise have been possible.

Shortly before the war it was found that contractors were not able to meet the heavy demand for road-making materials, forcing the officials to consider the possibility of supplying their own requirements from the splendid supplies of granite existing in the island, with the result that the quarry on the Shaukiwan road was started in 1914.

The increase in demand since that date has outgrown the capacity of the quarry, while the new 100 feet Shaukiwan road cuts through a large portion of the present site, necessitating the transfer of operations to a point further east which will have additional plant to increase the output. The new plant will include three crushers, two rotary drivers, two spiral mixers and an electric crane. There will also be a moulding shed capable of producing 940 granite paving slabs, workshop and garage for no fewer than six lorries, smithy, workshop for telephonic and electrical repairs; machine, furniture and carpenter's workshops, stores of various kinds, workmen's quarters, office and laboratory for testing road materials. The quarry has a productive capacity which should meet all needs for 30 years ahead.


**Road Around the Kowloon Territory.**

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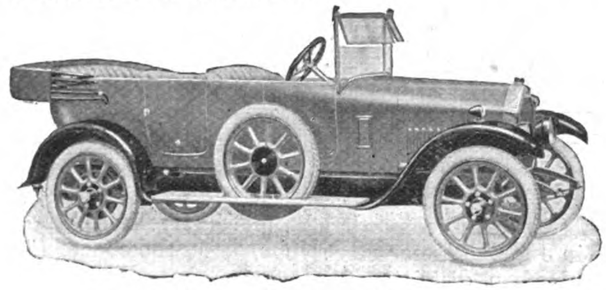

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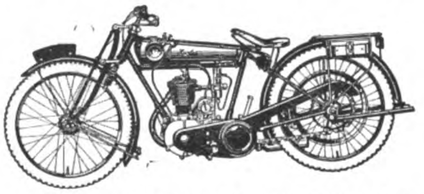

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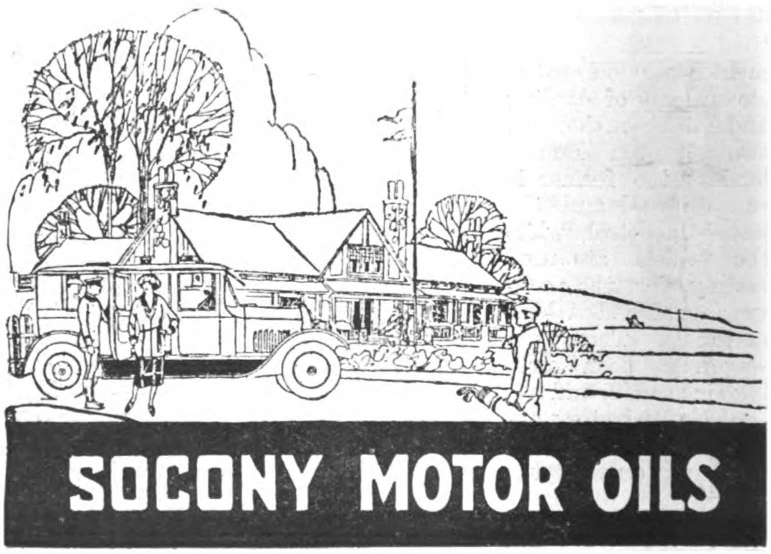
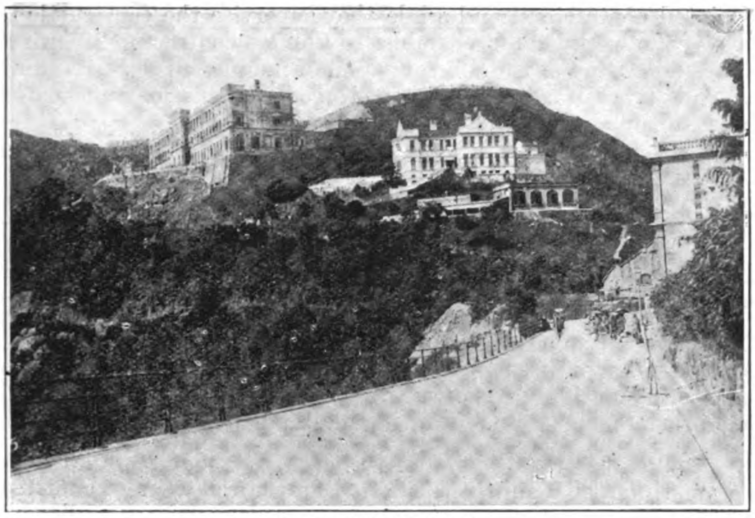
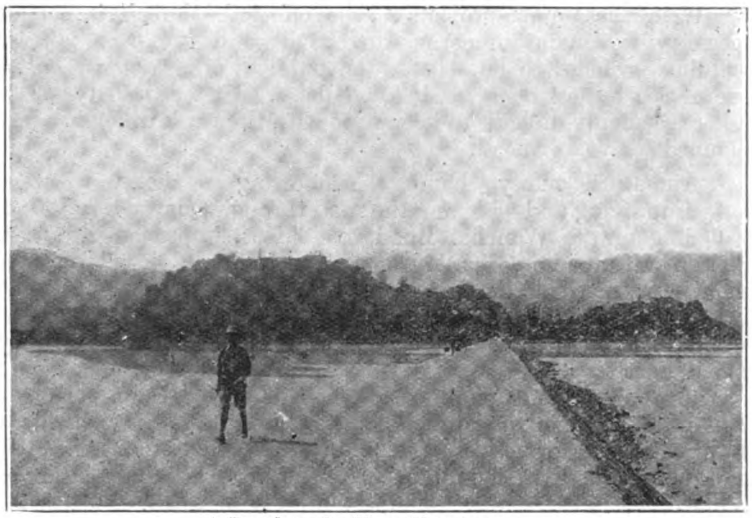




A Road to the Peak.



A Road in the New Territory.

To produce the material fast enough to supply the growing needs the three new crushers will have to work continuously. The electric crane will eliminate unnecessary handling. This crane, by means of a projecting gib, will raise the trucks of granite from the face of the quarry to a level about 40 feet higher, where they will be placed on a track and run by gravity to the crushers, after which they will proceed, still by gravity, to their original position at the quarry face.

At the present time all drilling is done by hand but in the new quarry six Ingersoll-Rand compressed air drills have been installed. Each drill can bore six inches a minute and can perform as much work in two hours as nine men can do in one day under the old method.

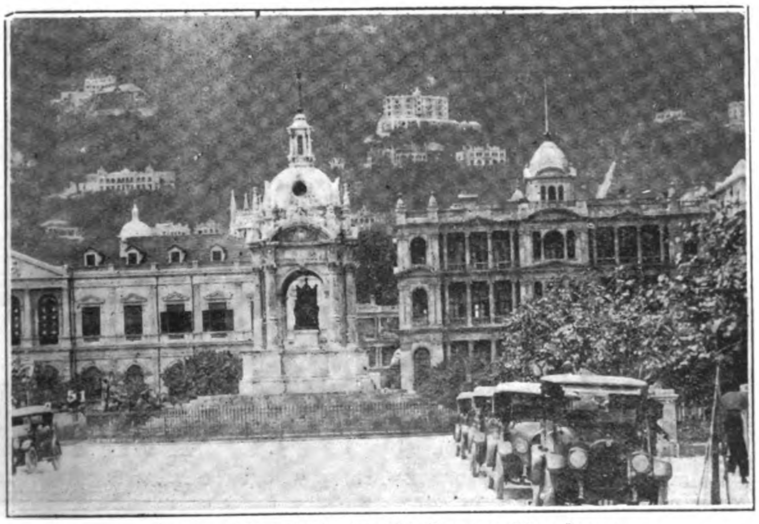
After blasting, the stones were broken by the laborers into pieces of a size suitable for feeding the crushers. Upon leaving the crushers the granite is conveyed by a bucket elevator to revolving grading screens from which it drops into bins. From these bins it can either be drawn off on to a mixing platform or that required for transportation by watei can be delivered by means of chutes into trucks. The material when delivered on to the platform is used for higher grade surfacing. Before it is mixed on the platform screen tests are taken to determine the percentage of each grade of stone, together with sand and cement, in order to arrive at as near as possible to maximum density. It is then deposited through a hopper into a rotary dryer where it is heated to a temperature of 350 degrees F, after which it is drawn off into another hopper of known capacity and the requisite amount of asphalt, heated to the same temperature is then added. The levers of the hopper are then drawn and the whole of the ingredients are thoroughly mixed by the aid of a mechanical spiral mixer. From the time it leaves the quarry till it is placed on the roads great care is taken by conveying the material in covered vehicles to ensure it being laid at a temperature of not less than 250 degrees. Ten thousand tons of tar macadam will be laid on Stubbs Road alone during the current year.

Street Paving in Hongkong.

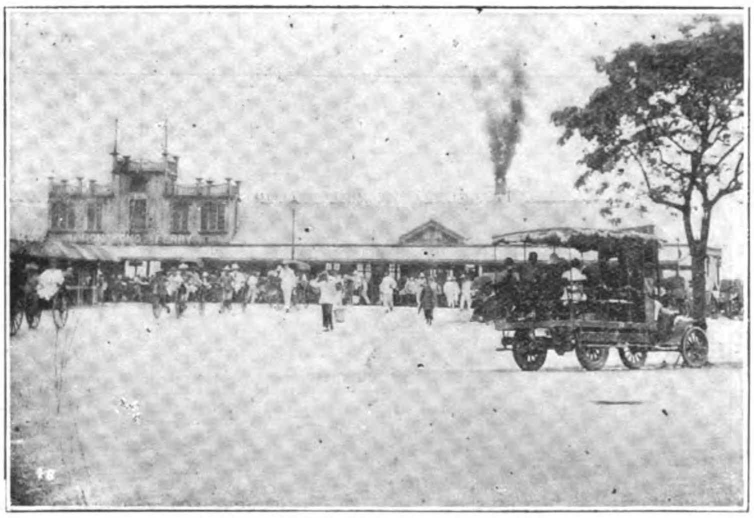
Very little material is wasted in the quarry, the residue of the crushing being carefully screened and utilized together with cement utilized in the manufacture of paving slabs. The present output is about 6,000 slabs a month or 200 a day but in the future it is hoped to turn out not fewer than 300 a day.

All the reinforced concrete piles for government work are made here whilst some outside firms are also supplied with them.

Materials are being supplied at feverish haste, road making goes on apace and as a result durable and spacious thoroughfares are springing into existence.



Automobiles Parked in the Square, Hongkong.



Motor Buses at the Kowloon Ferry.

With these new projects to be effected, the all important necessity for maintaining existing roads and the ever pressing building problem to be solved, the public works department is one of the busiest concerns in the colony. Under-staffed as it is, it is exceedingly difficult to keep pace with the work which has been planned for years ahead.

Among the many schemes the following are the most important: Improving and widening the road through Quarry Bay Village, widening of the Wanchai Road to 42 feet, improvement of the Shaukiwan Road in Shaukiwan Village, Victoria Road improvement, the construction of a road contouring the hillside above Conduit Road (first section) and another road connecting Broadwood Road with Wongneichong Gap Road, the widening of Queen's Road East to 60 feet, Kennedy Road improvements and widening of the Bonham and Conduit Roads. In addition there is the surfacing of the main roads of the city with asphalt, the surfacing of the Peak Road for heavy traffic and the surfacing of sections of the Pokfulam Road, including part of the road touching Aberdeen Village.

Naught but a trip in a motor car to the districts where road making and improvements are being effected will enable one to appreciate the great advantages accruing from these activities. Few people are acquainted with the shy beauty spots existing off the beaten track which are being taken up by new building sites which command wonderful prospects.

Further facilities are being afforded to get from the central part of the city to Repulse Bay via Stubbs Road and Wong Neichong Gap. When this is completed the island will possess another highly important thoroughfare.

Another improvement is the widening of the approach to the Beach Road at Repulse Bay. While three parking grounds for cars have been constructed on his road to accommodate 45 vehicles, 15 to each ground.

Thirty years ago such highways as are now being constructed on the island and mainland were not thought of in any country, concludes the *South China Morning Post*, "The development of automobile traffic led to their construction. Motor traffic has already appeared on the Hongkong roads and in the imminent future with the appearance of taxicabs will be largely increased. Thus the roads now constructed have to be especially adapted to the new conditions which called for harder and more durable material than was deemed necessary in the past. The foresight of our P.W.D. in this respect will become more apparent when the traffic conditions in the colony still closer approximate to western standards."

## Roads, Bridges and Transportation in the Antung District

*(Continued from page 490)*

arrangement:—The estimated cost was 75,000 yen, 10,000 of which the Chinese or customs agreed to pay, the remainder to be paid by the South Manchurian Railway Company. The Okura-Gumi was appointed contractors, and while they supervise the construction, parts of the work have been sublet to Chinese contractors. Owing to the soft nature of the soil composed of muddy silt deposits from the Yalu, it was extremely difficult to get a foundation sufficiently strong to support the piers.

The excavation work was started in April 1922. Strong wooden piles were driven into the mud, powerful pumps and gangs of coolies were employed pumping out the silt, and many hundreds of tons of cement and rocks were dumped into the foundation before it became solid enough to support the structure. It is expected that this bridge will be finished and open to traffic in a few weeks.

There are some other bridges over the creeks on the road to San-tao-lang-t'ow, as also steel bridges in Antung over which the South Manchurian Railway runs, the material being supplied by Dorman Long & Co., Ltd., Middlesbrough.

San-tao-lang-t'ow (Three wave heads) is about 20 miles from the mouth of the Yalu river, situated on the right bank about ten miles by road from Antung. There is good anchorage and room for several steamers to lie safely in rough weather. The obstruction to navigation in the river between San-tao-lang-t'ow and Antung is known as the Wu-Tao-Kao-bar (fifth creek). The creeks on the Chinese side or right bank of the Yalu are numbered, beginning from the big east creek known as Ta-Tung-kow near the mouth of the Yalu; the boundary bridge mentioned above spans the 7th creek (Chi-Tao-kao) near the Antung custom house.

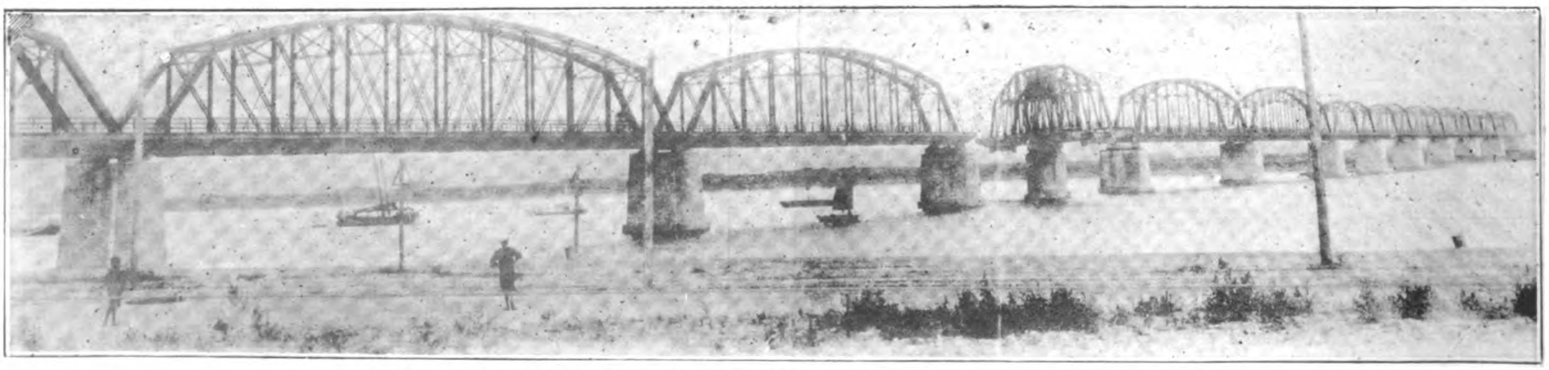
Until the Wu-Tao-Kao bar be removed, boats of more than 4-ft. draft will have trouble crossing the bar, coming and going to and from Antung, during low water. The removal of the bar would be a simple dredging operation, but whether it would be successful or not depends on how the river would act afterwards.

The future prosperity of San-tao-lang-tow depends on better communication with Antung, this could be accomplished at little cost by making or improving the road. The rock at Mou-Kwei-San (Helmet hill) being of a brittle nature is easily broken. This hill is midway between Antung and San-tao-lang-to'w, and would provide good road-making material. The pass at Mou-Kwei-San which is cut through the hill is not wide enough for two carts to pass each other, the north bound traffic must wait until the south bound carts come down or *vice versâ.*

It seems strange that this main artery of trade and passenger traffic has not been attended to before now, when this road is made, the passenger traffic, at any rate, between Antung and San-tao-lang-t'ow will be solved and motor-cars will then carry passengers and expensive cargo for the steamers lying at San-tao-lang-t'ow.

With better communication by road, San-tao-lang-to'w is destined to enjoy prosperity and owing to its high elevation overlooking the river a better site for city or town could not be found. It is never flooded by the Yalu waters and the drainage question which is now the great trouble in Antung would be avoided; there are indications of San-tao-lang-to's becoming a prominent gateway for the water-borne cargo of Manchuria when the road which is now under construction be finished.

To develop this locality in company with the Japanese, a Chinese McAdam with money and authority is wanted.



**The Great Railway Bridge over the Yalu River at Antung connecting China and Korea**

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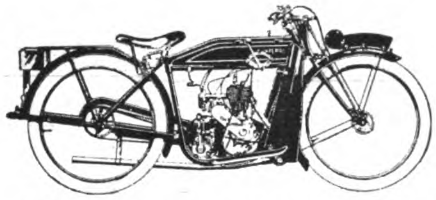

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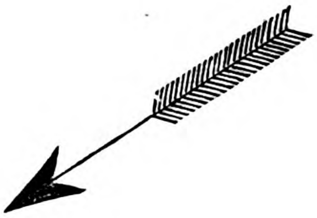


# Rea's Far Eastern Manual

**16 Jinkee Road Shanghai, China**

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF THE INTERIOR
CITY OF MANILA

FIRE DEPARTMENT
CENTRAL OFFICE

May 12, 1922.

Mr. F. R. Van Rensselaer,
Export Manager,
American-LaFrance Fire Engine Co. Inc.,
Elmira, New York, U. S. A.

Sir:

In compliance with your recent request, I am inclosing a snapshot of our American-LaFrance four-wheel drive aerial which is coming into her own as five-story reenforced concrete buildings are being erected all over the City and there is quite a colony of them in the down-town districts, towering far above the little-tiled roof (firemen's nut-crackers) picturesque buildings of former Spanish arbhitecture.

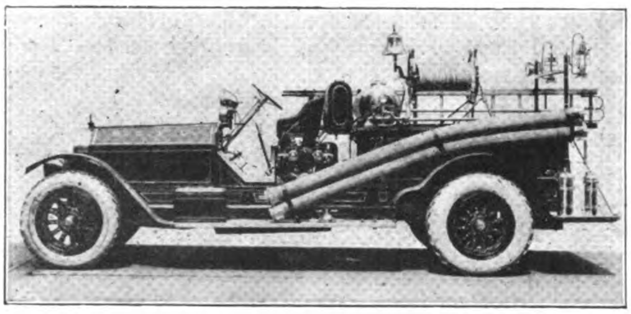
I am also inclosing a snapshot of our latest "HE" Pumper, an American-LaFrance 75 which is engaged in the rather tame performance of testing-out a newly installed "Underwriters' Stand-pipe.

The two-above LaFrance apparatus are secord to none in this department.

Very respectfully,

OTIS L. VANDERFORD,
Chief. Fire Department.

Our equipment has been perfectly successful in the city of Manila. It is proving its merit the world over.



**Type 12, Triple Combination Pumping, Chemical & Hose Car.**

This complete fire-fighting unit combines high efficiency pump, chemical appliances and hose body. Its high speed enables it to reach a fire in the minimum time, its powerful pump discharges at the rate of 1,000 gals. per minute at a pump pressure of 120 lbs.
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On the Kuala-Kubu-Kuala Lipis Road.

Road through the Hills of Malaya.

Motor Service, Kuala Kubu-Kuala Lipis.

# Roads and Autos in British Malaya

## Straits Settlements Roads

THERE are 621 miles of metalled road in the Straits Settlements and 92 miles of unmetalled. There are approximately 8,000 cars and 2,000 commercial vehicles in use; these figures show an enormous increase on those returned in 1914, when the respective totals were 2,115 and 186. The government now own eight cars and fifty-nine lorries.

PARTICULARS OF GOVERNMENT VEHICLES

| | | |
|---|---|---|
| 4 Napier Mail Vans | $2\frac{1}{2}$ tons | .. Transport of mails. |
| 1 Denby Mail Van | $2\frac{1}{2}$ ,, | .. ” |
| 1 Denby ,, ,, | 1 ton | .. ” |
| 2 Guy Mail Vans | $2\frac{1}{2}$ tons | .. ” |
| 2 Ford ,, ,, | 12 cwt. | .. ” |
| 6 Ford ,, ,, | 1 ton | .. ” |
| 3 Dennis Lorries | 4 tons | .. Transport of road metal and stores. |
| 12 ,, ,, | $3\frac{1}{2}$ ,, | .. ” |
| 1 Dennis Lorry | 2 ,, | .. ” |
| 4 Denby Lorries | $2\frac{1}{2}$ ,, | .. ” |
| 13 ,, ,, | $2\frac{1}{2}$ to 3 ,, | .. ” |
| 2 ,, ,, | 2 ,, | .. ” |
| 3 ,, ,, | 1 ton | .. ” |
| 1 Guy Lorry | 2 tons | .. ” |
| 2 Daimler Lorries | $2\frac{1}{2}$ ,, | .. ” |
| 1 Vauxhall Limousine .. | | .. For the governor's use. |
| 1 Austin Touring Car .. | | .. ” |
| 1 Ford Touring Car .. | | .. For the use of the governor's staff. |
| 1 Ford 1 ton Truck .. | | .. For transporting government house goods. |
| 1 Oakland Touring Car | | .. For the use ot the colonial secretary. |
| 1 Ford ,, ,, | | .. ” |
| 1 Daimler ,, ,, | | .. For the use of the resident councillor, Penang. |
| 1 Austin ,, ,, | | .. For the use of the resident councillor, Malacca. |
| 3 Ford Touring Cars .. | | .. For government use in Malacca. |

All the above vehicles are run on "Shell" benzine.

The loads are usually made up to two tons. Passenger fares on local omnibuses work out at three cents per mile; transport of goods is not charged by weight, but lorries are hired by the hour, and the average charge is $3 per hour. Running costs of cars are given as about 22 cents per mile and those of lorries 50 cents per mile, inclusive of interest and depreciation. The metalled roads are made of granite and laterite, and are kept in good condition. The average cost per mile of construction of a laterite road is $20,000, and of a metal road $45,000, while annual maintenance comes out at $900 per mile. The minimum metalled width is 12-ft., and 14-ft. is allowed between side drains. The condition is dusty in dry weather and muddy in wet. The surface soil is argillaceous red earth, which when dry is hard and when wet is very soft. The ruling gradient is $3\frac{1}{3}$ per cent., on main roads the maximum gradient is $6\frac{1}{4}$ per cent., on tracks $12\frac{1}{2}$ per cent., and long gradients are exceptional. The bridges have a minimum width of 14-ft. and will carry 10 tons. There are no streams to be forded, but roads are occasionally flooded to a depth of 12-in.

The maximum altitude above sea-level of any motor road, with the exception of 685-ft. in Penang, is 300-ft. The speed limits recommended for cars and lorries are 20 and 10 miles per hour.

Natives drive all the government vehicles, and with European overseers are capable of doing repairs. Labor obtainable is Chinese, Tamil, and Malay, while as to wages Europeans get from $250 to $600 per mensem and natives $40 to $160 per mensem. In Singapore and Penang there are workshops capable of overhauling any mechanically propelled vehicle, while the other settlements have a number of shops which are able to deal with car and lorry repairs. There are facilities available for putting on or removing solid rubber tires, and any timber used for the framework of lorries should be well seasoned to withstand exposure to tropical heat.

On the roads there are wells and streams at convenient intervals which form the roadside water supply, and in the towns there are properly regulated supplies. Japanese coal costs $18 per ton, Australian $24.50 per ton, and coke $45 per ton. There is no benzol or commercial alcohol in the market, but petrol is obtainable at $1 per gallon, petroleum trom $3.35 to $3.65 per 4-gallon tin, wood at $10 per ton, and oil fuel at $14,50 per 67-gallong drum.

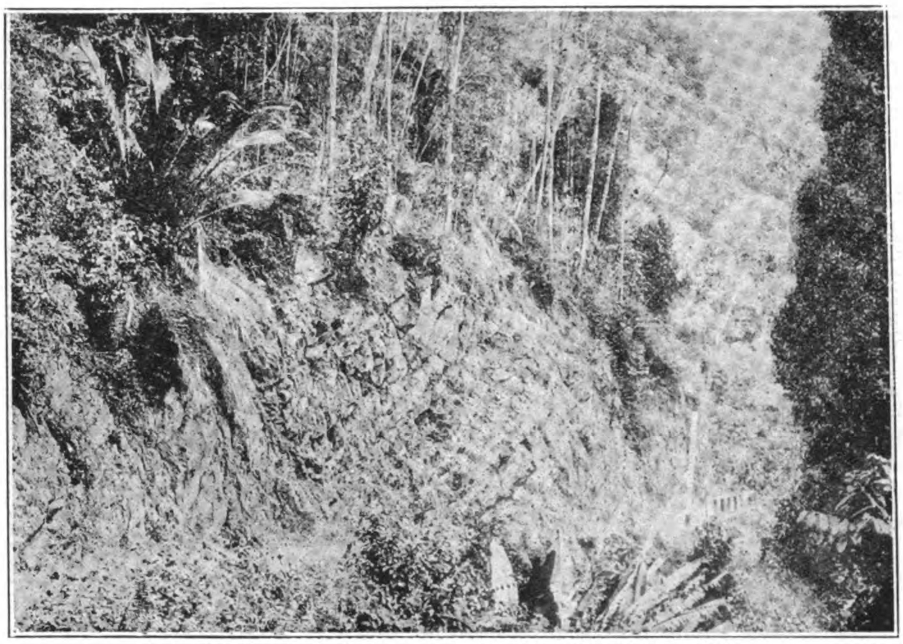
The Malay peninsula is an exceptionally rich country, and, if money be invested in road and railway development and enterprise is encouraged, there will be great scope for progress not only in existing and established industries, but also for the promotion of others.

## Trunk Roads

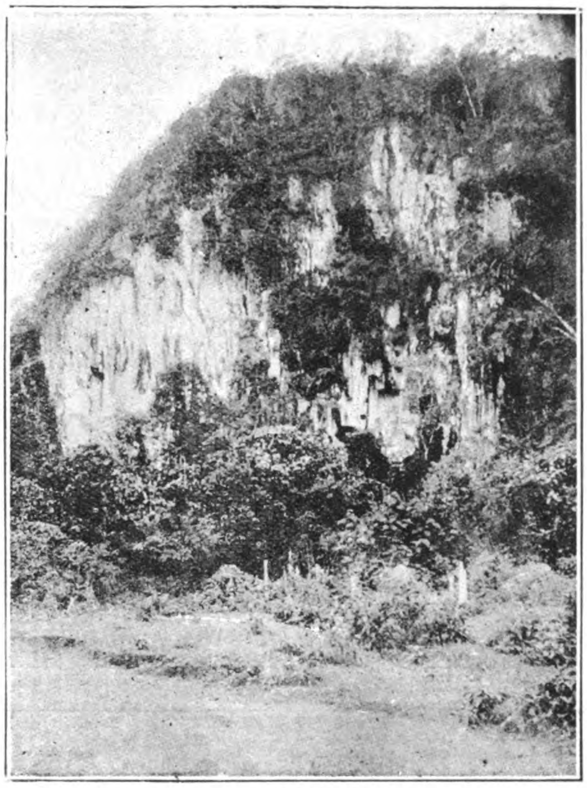
British Malaya possesses an excellent road system. A main trunk road runs from Prai (on the mainland opposite Penang), down the length of the peninsula, through Malacca to the borders of Johore. This road has now been extended northwards to the Siamese boundary in Perlis, and will be carried southwards to Johore

Bahru and connect by ferry with Singapore. A proportion of this extension, which is a formation 25-ft. wide, metalled to a width of 16-ft., has already been completed, and as the ruling gradient does not exceed 1 in 40 it should make an excellent motor road. Road surfaces in the states generally are good, but in some districts the roads are narrow, with a succession of sharp bends which, in view of the slow-moving bullock traffic, need careful manipulation. The best time for motoring is during the dry season, which lasts from April to September. The temperature, which varies from 70 deg. to 90 deg. F. in the shade, keeps within these limits throughout the year. The hours of daylight are unchanging all the year round; it is light at 6 a.m., and lamps must be lit at 6 p.m. Generally speaking, no special type of car is required for the Malay States, but a tropical radiator should always be fitted. Petrol and tires can be obtained in practically every town.

The metalling used in Perak is granite, laterite, limestone, and quartzite, and the mileage is about 860 of metalled road and about 76 of the unmetalled kind. The average cost of construction is $15,000, and of maintenance per mile per annum of metalled roads $1,350 to $2,250. The roads are never dusty or muddy; they are kept in good condition, and the minimum width is 24-ft. The ruling gradient is about 1 in 40, and the maximum and longest gradient is over Kuala Kangsar Pass, this being 1 in 17.35 and about a mile and a half long. There are no streams to be forded, and on a bridge the clear roadway of which does not exceed 20-ft. in width one load of 10 tons can be carried on four wheels. The width of the bridges, which are kept in a good state of repair, is 20-ft. on main roads and 18-ft. on branch roads. As may be judged from particulars given above of gradients, the maximum altitude above sea-level of any motor road is not sufficien to cause any serious loss of power, being only 475-ft.



A road through the luxuriant vegetation of the Pahang Hills.



A limestone quarry site at Batu Gua, in Pahang.

Placing an Armco culvert in a British Malayan Road.

## Labor Supply

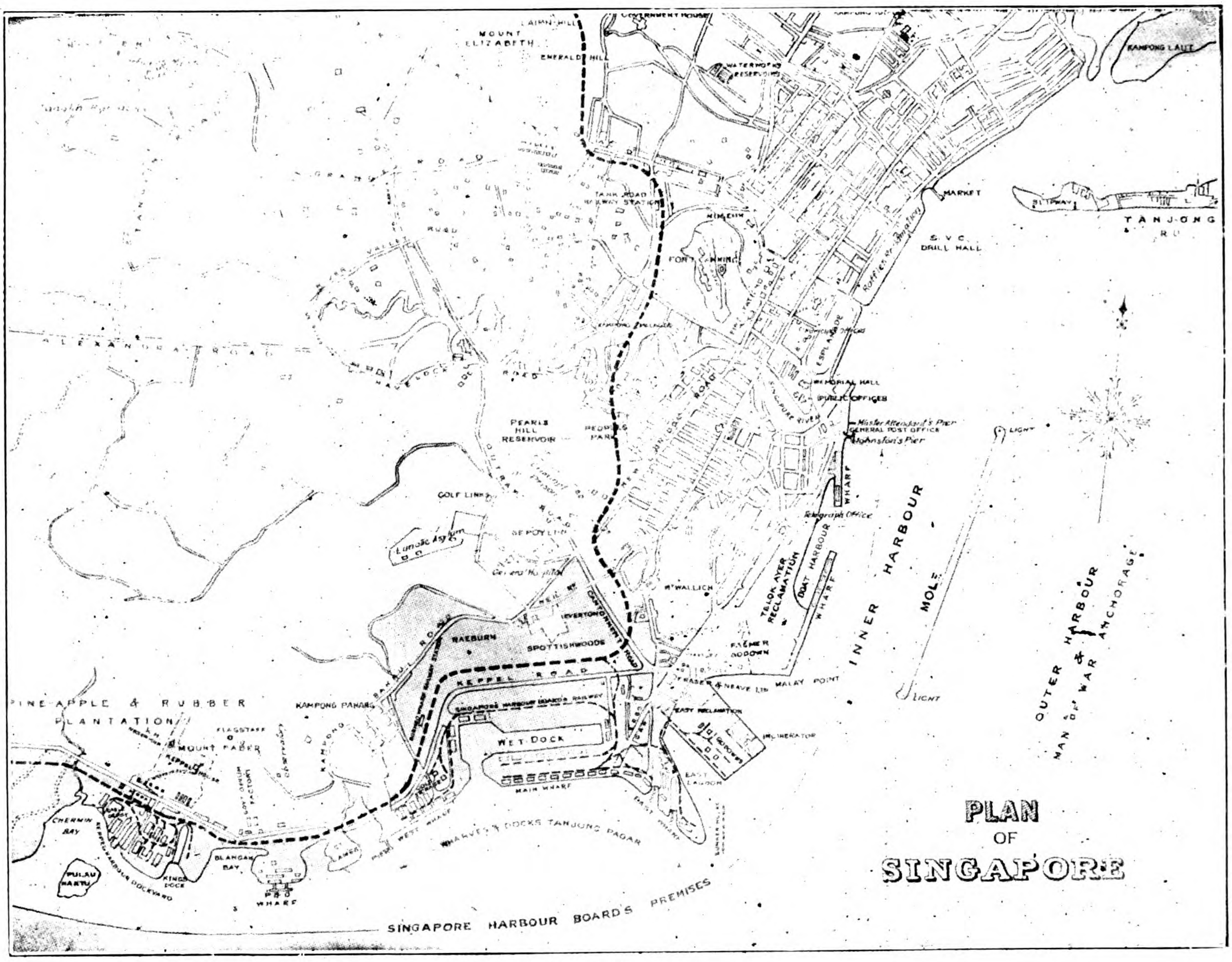
The approximate number of private cars is 608, of hired cars 710, of lorries 70, and of motor-omnibuses 13. The government owns no cars, but runs 73 commercial vehicles, particulars of which are given below. There appears to be no fixed rate for goods cartage, but passengers are conveyed at 5 cents per mile. The Ford car has proved popular, largely on account of the facilities for obtaining spare parts. The cost of petrol is $1.10 per gallon, of petroleum 95 cents per gallon, and of wood $6 per ton. Usually, water is not obtainable easily by the roadside, but there are piped supplies in the towns, and the water is very soft. Natives are used for driving the government lorries, and under European supervision they are adept at running and repairing motor vehicles. The labor obtainable is Malay, Chinese, Tamil, Singalese, and Javanese. Native mechanics get from $1 to $5 per day. At Ipoh there are facilities for dealing with solid tires, and there are numerous workshops in Perak. Local hard woods are better than teak for body-framing.

PARTICULARS OF GOVERNMENT VEHICLES.

| Particulars of Vehicle. | Use made of Vehicle. |
|---|---|
| 6 Clydesdale Lorries (2½ tons) | Carting metal. |
| 10 Dennis Lorries (3½-4 tons) | Carting metal. |
| 5 Denby Lorries (3 tons) | Carting metal. |
| 1 Ford Tractor (1 ton) | P. W. D. transport. |
| 25 Clydesdale Lorries (3 tons) | Conservancy, scavenging, abattoir, water cart, and metal carrying. |
| 9 Dennis Lorries (6 tons) | Metal carrying. |
| 1 Sunbeam Ambulance | — |
| 6 Clydesdale Lorries | Conservancy and scavenging. |

Petrol used in every case.

The mileage of the metal roads in Selangor is 613, of gravelled 65, and of unmetalled 18. For metalling, laterite, granite, limestone, quartzite, and sandstone are used, and the surface soil varies from hard clay to peat. The condition of unmetalled roads during the wet weather is very bad. As regards mud and dust, conditions alternate throughout the year; laterite roads are more dusy and muddy than those made of limestone or

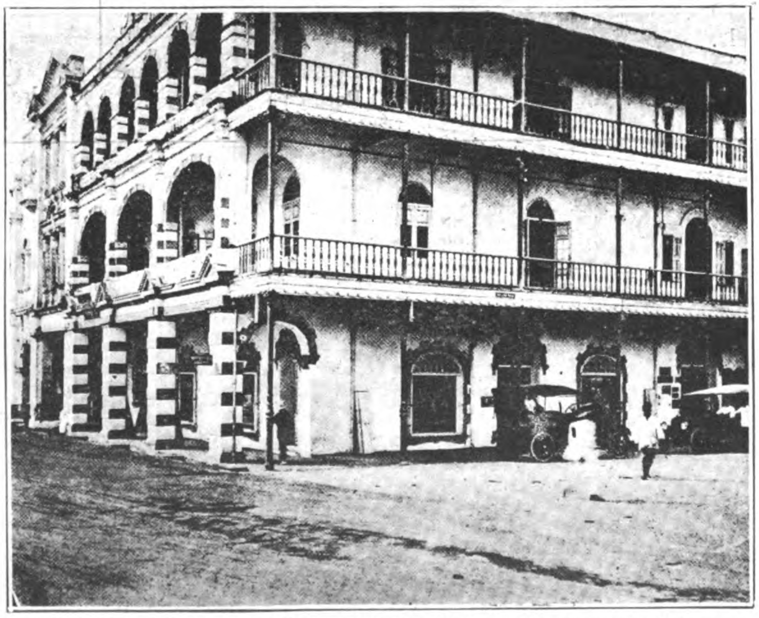



**Map of Singapore**

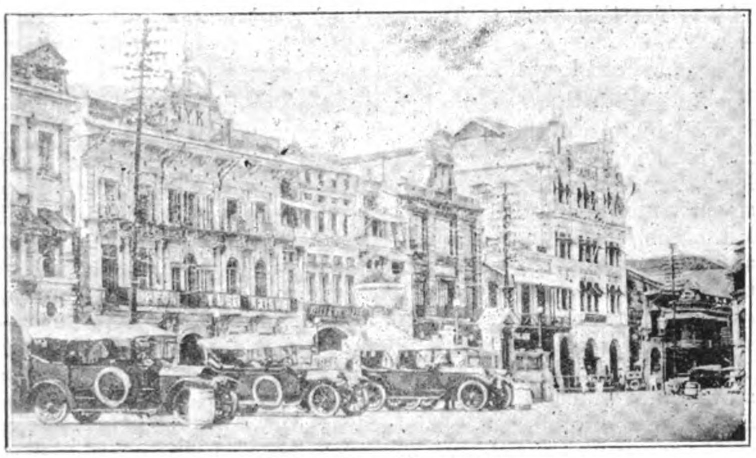
granite. The minimum width in cuttings is 19-ft., and 22-ft. on embankments. As to costs, the average per mile of construction works out at $11,100, and for maintenance per mile per annum at $525. The maximum gradient is about 1 in 20, the ruling gradient 1 in 25, and the longest slope 12 miles. As a rule there are no streams to be crossed except when rivers overflow. The roads may then be flooded to a depth of three feet or more in certain localities for short periods. The bridges are well kept, are built with a minimum width of 12-ft., and on main roads will take loads of from 10 to 20 tons. About 3,500-ft. is the maximum altitude; 25 miles per hour is the maximum desirable for cars, and if due regard be given to the avoidance of damage to roads the limit for 3-ton lorries should not exceed 12 miles per hour.

## Use of Lorries

Touring cars in Selangor number 1,612 and commercial vehicles 134, of which the public works department owns 36. These lorries are used for transporting road material; the loads vary from 1 to 3 tons according to the capacity of the machines, and the following are the makes employed:—Albion, Halford, Dennis, Ford, Thronycroft, Vulcan, Guy and Foden. All are run on petrol with the exception of the last named, which burns firewood. Lorries of a carrying capacity of three tons or under have proved the most successful on granite and limestone roads. On laterite and gravel roads the load carried should not exceed one ton, as heavier traffic has been found to damage the foundations. It is impossible for vehicles to traverse the country off the roads. In connexion with running costs the following data may be taken as a guide. Cars 35 to 45 cents per mile, 3-ton lorries 30 to 50 c.p.m., Ford 1-ton lorries 20 to 30 c.p.m., inclusive of wages, repairs, and depreciation. Coal is priced at $8 to $13, coke at $60 per ton, petroleum $0.94c. per gallon, petrol at $1.10c. per gallon, and wood at $6 to $7 per ton. There is an abundant supply of clean water. Teak is not essential for bodies as other hard woods may be used. Numerous



**A Malayan Garage and Motor Works: Office of the Central Malaya Engineering and Motor Works at Kuala Lumpur.**



Raffles Place, Singapore

workshops capable of dealing with repairs exist, and there are means available locally for fitting solid rubber tires. Natives can be used for driving and looking after cars and lorries and receive from $1 to $2 in wages ; Europeans in a supervizing capacity get from $250 to $400 per month. The labor obtainable is Malay, Javanese, Chinese and Indian.

## Trailers

In Negri Sembilan there are 596 motors of the touring kind and twenty-four of the industrial type. The government owns one car, five ambulances, and seventeen lorries. The car is of Sunbeam make and is used by the resident on duty ; the ambulances are of Sunbeam and Ford manufacture, and the lorries, employed on the transport of road metal and conservancy work, are 30 cwt. Albions. As to rates and running costs, passenger conveyance works out roughly at 6 cents per mile, the Albion lorries cost about 40 cents a mile, and, depending on weight, etc., the operation charges of touring cars vary from 25 to 45 cents. The use of more than one trailer at a time has not been found satisfactory owing to the short radius curves on the roads. The mileage of metalled roads is 433, of unmetalled nine, and there is a considerable mileage of private estate roads. The roads are dry and slightly dusty, are kept in good order, and granite and laterite are used for metalling. The cost of constructionaver ages $15,000 per mile, and the annual cost per mile for maintenance is $1,400. Where the roads are not metalled the surface soil is sort. The minimum width of the roads is 16-ft., the maximum gradient is 1 in 20, the ruling gradient is 1 in 30, and there are slopes up to three miles in length of 1 in 30. The bridges have a minimum width of 18-ft. and will carry fifteen tons. There are no streams to be crossed by fording, and 1,300-ft. forms the maximum altitude above sea level. The speeds recommended are thirty-five miles an hour for cars and fifteen for lorries. There are no particular difficulties experienced in getting repairs done or solid tires fitted, and Chinese, Tamil, and Malay labor is obtainable, and capable of effecting repairs in addition to operating motor-vehicles. Chinese mechanics are paid $1.50 to $3 per day. Teak is not essential for the framework of wagon bodies, and as to roadside water supply, streams are plentiful. In towns the supplies, which are good, are from public standpipes. Thew ater is very soft, but roadside streams are usually heavily laden with mining silt. Benzol and commercial alcohol are not available, but coke costs $55 per ton ex-Singapore, petroleum $0.88c. to $0.99c., petrol $1.15c. to $1.30c. per gallon, and wood $4.50c. to $5.50c. per ton.

## Heights of 3,000 Feet

In Pahang there are 358 miles of metalled road and forty-three of unmetalled. The hill roads cost on an average between $20,000 and $30,000 per mile of construction, and the ordinary roads $12,000 to $15,000. The materials used for metalling are limestone, schist, granite, trap, quartzite, laterite, and mining metal. The annual cost per mile for maintenance is $1,321.68c. The roads are kept in good condition and are dry, but mechanical transport should only be used on metalled roads. The nature of the surface soil is brown clay and ironstone gravel, and the condition may be described as fair. The minimum width of metalling is 12-ft., and of earth cuttings 22-ft. In respect of gradients, the maxi-

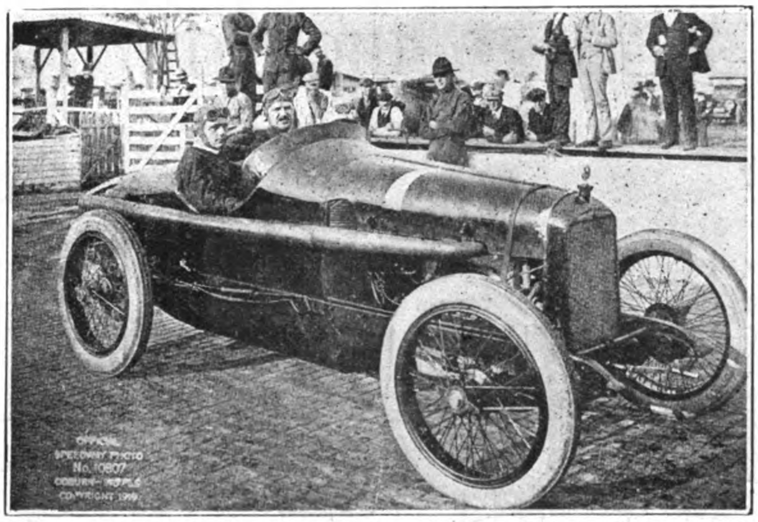

**Graphite Transmission and Differential Grease No. 677**

We are proud to state that No. 677 has justified the labor and expense devoted to a really intelligent effort to produce an ideal gear lubricant. It has successfully stood the test of years. There is nothing like it on the market. It is the grease the "Speed Kings" use.

No. 677 is graphited grease of medium density that flows over the gears like an oil, yet possesses the peculiar property of not settling when the gears are not in motion. It reaches all the bearings and provides a graphite coating that prevents wear, reduces friction and causes cool running at all times. No. 677 remains unchanged in hot or cold weather. It will last far longer than the best plain grease.

No. 677 is recommended for transmissions and differentials, except those designed for light oil lubrication. The consistency is about that of heavy gear oil. It is also the most satisfactory lubricant for electric gear shift mechanisms, the reverse gears of power boats, and for change-speed gear boxes of motorcycles.

Sold in one, five and ten pound tins. Larger packages if desired.



"Many times Dixon's Graphite Automobile Lubricants have pulled my car through a trying race without lubricating difficulty."—LOUIS CHEVROLET.

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**Graphite Cup Greases**

Cup Greases containing fine flake graphite reduce friction to a minimum. By using these high-grade graphited greases bearings soon acquire the well-known graphite polish that eliminates friction and causes easy running. Used in all grease cups, wheel spindles, etc.

Dixon's Graphite Cup Grease No. 3 is recommended, except in warm climates, where No. 5 is more suitable. The consistency of each grade changes but little under wide temperature variation.

The importance of attending to the numerous small bearings and moving parts of cars is frequently overlooked. Wherever you see a grease cup don't think it is put on as an ornament, but give it a turn once a day or once a week according to the requirements. Don't forget to keep the cups filled with grease.

Sold in one, five and ten pound tins. Larger packages if desired.

mum on first-class roads is 1 in 40, and on second-class 1 in 30 ; in a few places there are gradients of from ten to fifteen miles in length. There are no streams to be passed through and the iron bridges will carry forty tons and those constructed of timber ten tons. They are kept in good condition, and the minimum width of bridges of the first class is 20-ft., while that of the second class is 2-ft. less. The maximum speed desirable for motor-cars is 30 to 35 m.p.h. and of lorries 12 to 15 m.p.h. The maximum altitude to which motor-vehicles have to ascend is about 3,000-ft.

Coal, coke, benzol, and commercial alcohol are not used. Petroleum costs $4.15c. per tin of "Fish" brand oil, petrol $1.30c, per gallon, and wood (per thousand pieces 18 × 2 × 2-in.) $6.34c. There is a plentiful supply of good soft water. The number of touring cars is 113, and of commercial vehicles thirty-nine. The government owns two of the former and eleven of the latter class, and some particulars of these are given below. The steam tractors and petrol lorries have both proved successful, but lighter vehicles are preferred owing to the nature of the road construction. Hired cars run by private enterprise have no fixed rates but vary from 5 to 10 cents per mile per passenger, while cheaper rates are usually quoted on popular routes. There are government and private repair-shops. Motors are driven by natives, and repaired by them under European surveillance. The labor is Chinese, Malay, and Indian, and native mechanics get $45 to $90 per mensem. Teak is not necessary for body-work.

| Particulars of vehicle. | | Use made of vehicle. | Running cost per mile. |
|---|---|---|---|
| 3 | Ton Albion lorry | Transport of road materials, etc. | .51 cents |
| 3½ | ,, ,, ,, | ,, | .37 ,, |
| 1 | ,, ,, ,, | ,, | .81 ,, |
| 2 | ,, Vulcan lorry | ,, | .85 ,, |
| 1 | ,, Ford lorry | ,, | .42 ,, |
| 1 | ,, ,, ,, | ,, | .55 ,, |
| 4½ | ,, Traction engine | ,, | .83 ,, |
| *4½ | ,, ,, ,, | ,, | — |
| 4½ | Traction engine | Transport of road materials, etc. | 1.53 cents |
| 1 | ,, Ford lorry .. | ,, | .43 ,, |

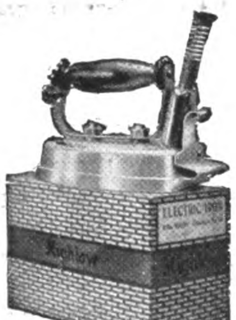
* Under repair during the year. All these are run on petrol with the exception of the traction engines, which use firewood.

In Kedah there are no long or steep gradients, the maximum being 1 in 30, and the highest altitude above sea level of any motoring road is 600-ft. The speed limits recommended for cars and lorries are 30 and 12 miles per hour respectively. Two hundred and seventy miles of road are metalled, and there are 111 miles unmetalled. The average cost of construction is $15,000 per mile and of annual maintenance approximately $1,125 per mile. Limestone and granite are used for metalling ; the roads are well kept, and at different seasons are dry, dusty, and muddy. Then nature of the surface soil is clay. The roads are formed with 24-ft. width and 12-ft. of metal. The bridges will carry 10 tons on one axle, and have a minimum width of 16-ft. There are no rivers to be forded. The approximate number of vehicles in the country is 393 cars and thirty-seven utility vehicles, of which the government owns three and twenty-four respectively ; these are used for transporting P.W.D. material, and consist of eight 3-ton Albion (run on paraffin), five 2½-ton Dennis, eight 1½-ton Albion, and three 1-ton Ford, the last sixteen mentioned vehicles being operated on petrol. Petroleum costs 95 cents per imperial gallon, petrol $1.05 per similar quantity, and wood $1 per 100 pieces, each piece weighing at least 2½-lb. No trouble need be experienced as regards water supply in the country, and there are pipes in the chief towns. There are no facilities available locally for dealing with solid rubber tires, but, as regards repairs, there are small P.W.D. shops. Natives are employed in running and repairing vehicles ; their wages run from $2 to $3 per day, and the labor obtainable is similar to that in Negri Sembilan—namely, Chinese, Tamil and Malay. Usual hard wood is suitable for body work.

## Motor Vehicles in Johore

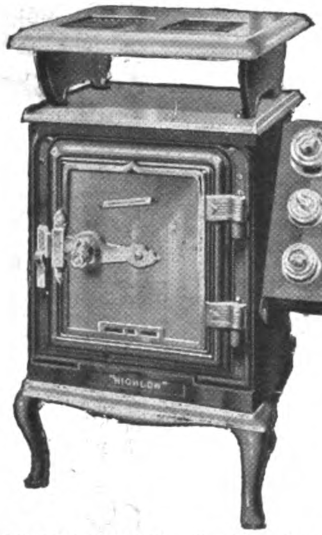
The number of cars in Johore is about seven hundred and of commercial vehicles 120. The government owns 150 of the former type and seventy of the latter kind. The work is of a general transport nature, consisting of the conveyance of government


# Electric Cooking "HIGHLOW" Apparatus



No. 50. IRON. Loading 500 Watts. Weight 6lbs.

**Thumb rest.**
**Strong Tip-up Stand.**
**Best Nickel-plated finish.**



ELECTRIC COOKER. Total Loading 4 k.w.

No. 60. ELECTRIC KETTLE. 750 Watts. Polished Copper or Nickel-plated, 2 pints Capacity.

**Elements are wound on clear ruby mica with nickel contacts taken direct to the terminals.**

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**Merkland Works, Partick, Glasgow, Scotland**

officers, of stores, and of road-making material. All the vehicles are run on petrol, the prevailing price of which is similar to that charged in the Straits Settlements. This also applies to the cost of coal and petroleum, etc. Lorries operate for about 25 cents per mile. The passenger rate per mile per seat is 9 cents, or $3 to $4 per hour per car ; and goods 4 cents per mile per picul. The water supply is by pipe and well ; water is usually clean, and obtainable by the roadside.

Of metalled roads there are 576 miles, and 62 of unmetalled. For the former granite and laterite are used, and a minimum width of 20-ft. is provided. The roads are kept in a good state, and are dry for six months and wet for the remainder. The unmetalled roads are fit for motor traffic only in dry weather. The average cost of building the roads is $18,000 per mile, and of maintenance $1,000 per mile per annum. There are no long gradients ; the maximum is 1 in 20 and the ruling gradient 1 in 25 ; nor do vehicles have to ford any streams. The bridges are well looked after, have a minimum width of 16-ft., and are capable of carrying 12-ton loads. The highest altitude is under 500-ft., and 30 and 10 miles per hour are about the maximum speeds desirable for cars and lorries.

Teak is not essential for body work, but is preferable. Natives can undertake the running and repair of motors, and receive $1.25 to $2.50 per day. There are no local facilities for pressing on and off solid rubber tires, but there are P.W.D. workshops which deal with repairs. The labor obtainable is Tamil, Chinese and Malay. The following are among the makes and types of vehicle run by government :—

| | |
|---|---|
| 1-ton Ford. | 30-cwt. Albion. |
| Ford cars. | 2-ton Leyland. |
| 30-cwt. Denby | 5-seater Studebaker. |
| 2-ton Vulcan. | 3-seater Wolseley. |
| 2-ton Dennis. | 3-seater Arrol Johnston. |

In the Federated Malay States, together with Kelantan and Kedah, the government in 1914 owned eighty-two cars and eighteen commercial vehicles, which comprised the following makes :—

(*a*) Touring Cars.

Wolseley, Napier, Austin, Sunbeam, Siddeley-Deasy, Ford, Studebaker, running on petrol and used for conveyance of government officials.

(*b*) Motor Lorries, etc.

| | |
|---|---|
| Halley 2 ton | Petrol and paraffin. Used for carrying road metal and P.W.D. materials. |
| Albion 16 H.P. and 30 cwt. and 2 ton) | |
| Lacre 2 ton | |
| Straker-Squire 3 ton | |
| Halford 24 H.P. | |
| Leyland | |
| Dennis Fire Engines | |
| Thornycroft Motor Watering Carts | |

(*c*) Steam Wagons, etc.

| | |
|---|---|
| 14 Foden Steam Wagons | Wood fuel. Carrying road metal, etc. |
| 22 Aveling and Porter Tractors and and Traction Engines | |

Since 1914 the government have bought the following :—

| | | |
|---|---|---|
| Negri Sembilan | 14 | 30 cwt. Albion Lorries |
| Kedah | 8 | 2½ ton Albion Lorries |
| | 1 | 16/20 h.p. Wolseley Touring Car |
| Selangor | 5 | 3 ton Halford Tip Wagons |
| | 1 | 30 cwt. Albion |
| | 4 | Merryweather Fire Engines |
| | 1 | Merryweather Hose Tender |
| | 1 | Lacre Police Patrol Wagon on 2-ton Chassis |
| Other States | 6 | 30 cwt. Albion Lorries (Prai) |
| | 3 | 25 h.p. Crossley Motor Ambulances (second-hand for local military force) |
| | 1 | Merryweather Fire Engine |
| | 1 | Crossley R. F. C. Model Touring Car |
| | 1 | Stellite 3-Seater |
| | 1 | 20 h.p. Napier Touring Car |
| | 1 | 20 h.p. Napier Mail Van |

The total value of imports to the F. M. S., January, 1921-January, 1922, was £12,018,137, and from the United Kingdom £3,103,039, and the total value of exports was £15,806,627, and to the United Kingdom £1,645,069.

Kelantan has fifty miles of metalled and sixty-five of unmetalled roads, and there are approximately forty-five cars and four lorries run by the government. In Trengganu the cars number thirteen, exclusive of three government commercial vehicles, and Perlis has twelve cars and one motor lorry. Altitude is not of importance in any of the three states, the highest (140-ft. above sea level) being in Kelantan, and, as may be judged, there are no severe or long gradients. Roads are kept in fair condition, as are also the bridges. There are no completely equipped workshops in any of the three places ; the water supplies are sufficient, through in Trengganu the water is not always clean. The price of petrol in Kelantan is given as $1.02½ per gallon, in Perlis as $1.10 per gallon, and in Trengganu as 2s. 10d. per gallon.—*Times Trade Supplement.*

## Petroleum in the Dutch East Indies

Indications of petroleum were discovered in Boeton, southeast of the Celebas, several years ago, but because of its remoteness and the difficulty of procuring coolie labor, a comprehensive survey has never been made. The Dutch colonial government is about to make an investigation there in order to determine the extent of the deposit.

## Korean Railways May Consolidate

It is reported that negotiations for the amalgamation of eight privately owned Korean railways are under way, but as the plan must be submitted to the shareholders of each company it is not expected that the organization of the new concern will be completed before August or September of this year.

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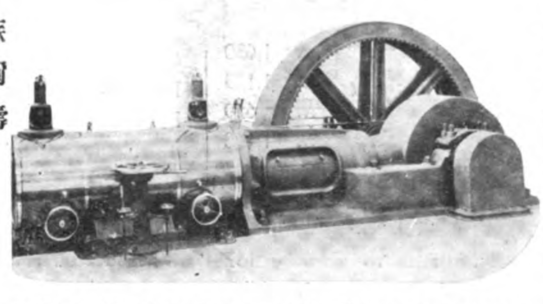

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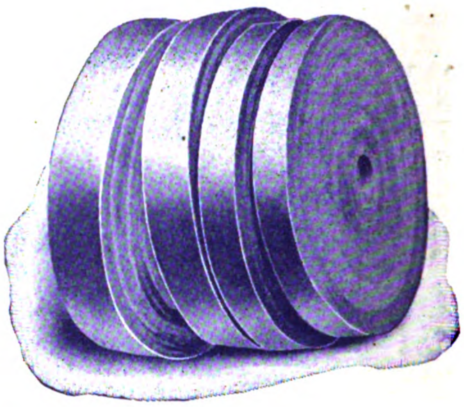

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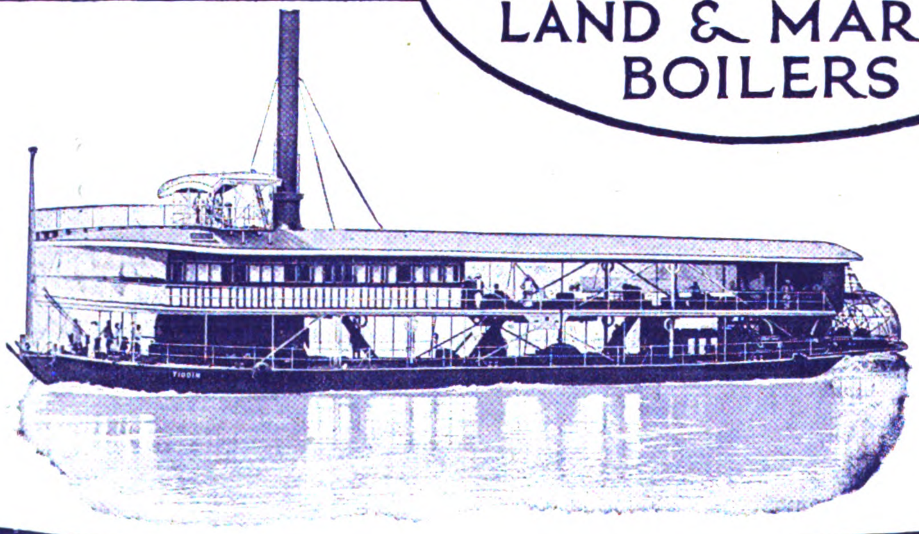
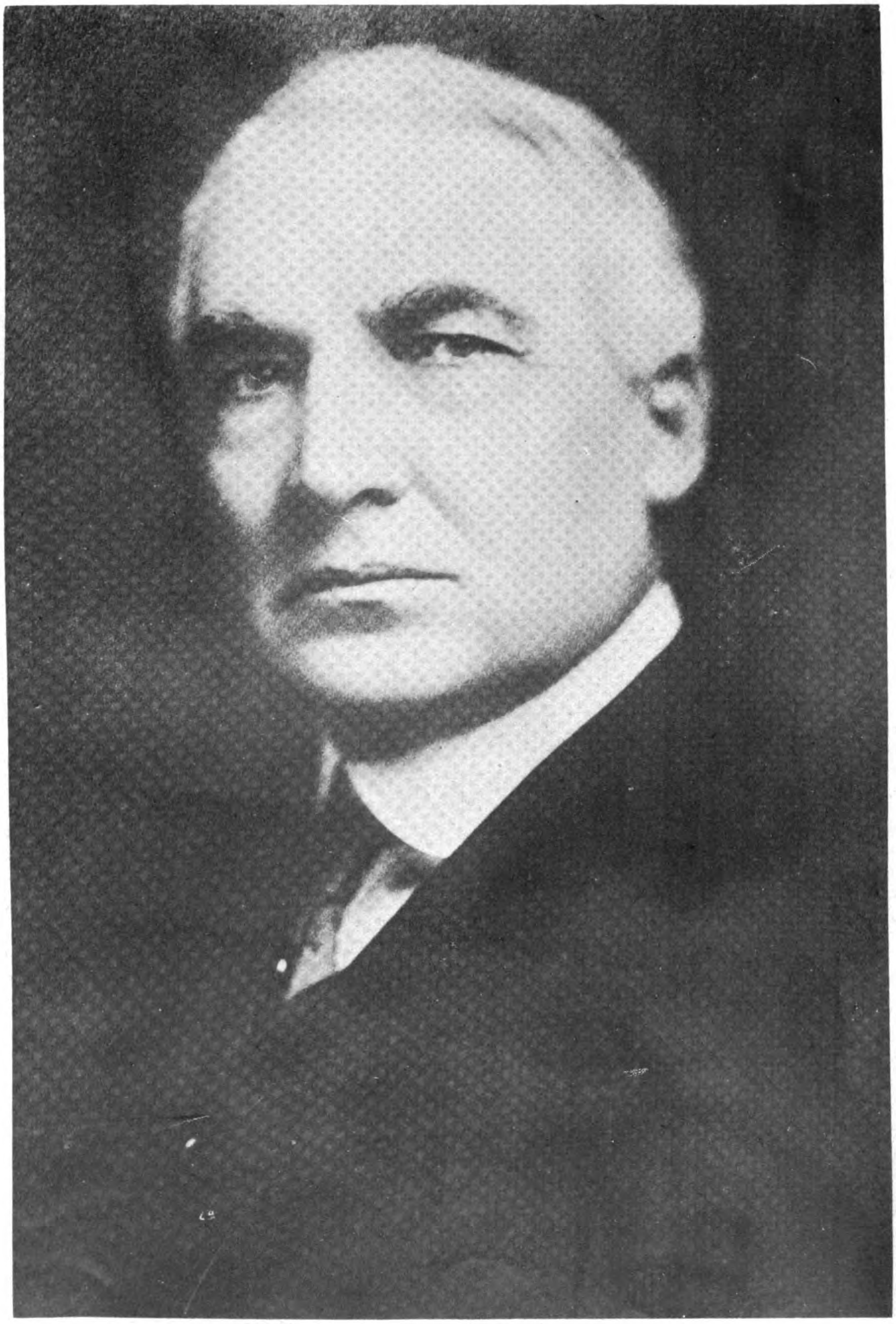




WARREN GAMALIEL HARDING

*Twenty-ninth President of the United States of America*
*Born, November 2, 1865. Died, August 2, 1923*

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

Vol. XIX SHANGHAI, AUGUST, 1923 No. 8

# Shall We Trust Japan?

*By Franklin D. Roosevelt*

*Reprinted from the July Issue of "Asia"*

*That an assistant secretary of the navy, none of whose chief duties during a large part of his term of office was to prepare to fight Japan, can now write as Mr. Roosevelt does in this plea for a pacific attitude on the part of the United States toward Japan, must bring a new conviction of the possibilities for a permanent and increasingly strong bond of friendship. Mr. Roosevelt was assistant secretary not only before and during the world war, but also after the armistice. It was then that the policy of building the greatest navy in the world—to be prepared for the immediate contingency of a possible war with Japan, while the Anglo-Japanese alliance was still in effect—was being rapidly put into operation. Treaties, ententes, friendship societies have their place in an expression of good feeling between nations; but, when the naval men of one land sincerely recognize a spirit of honest goodwill in the naval men of another, there is usually reality behind it.*—Editor's Note.

* * *

WHY do so many Americans, after witnessing the devastation and the futility of war, continue to think of Japan and the Japanese in terms of war? Why have so many Japanese a similar mental attitude toward the United States? Is this mutually apprehensive habit of mind, to whatever understandable origins it may be due, justified to-day?

It must be noted that, up to 1898, relations between the United States and Japan had been largely sentimental. We justly believed that we had been instrumental in awakening Japan to western civilization. Japan seemed to be appropriately grateful for the more abundant life thus opened to a formerly hermit nation. The awakened Japanese government sent its picked sons to us for education in the new methods. Among others the future Admiral Uriu, who last summer in Japan entertained his Annapolis classmates and Secretary Denby, came to the United States naval academy. Commercially the two nations were not yet rivals, there were no military points of contact and the Japanese had not yet migrated to California in any large numbers.

There has been, however, an apprehensive habit of mind in both countries for many years. When for the first time, in 1898, the American flag adventured territorially overseas, "imperialism" became a brand-new topic with news value on both sides of the Pacific. Discussion as to the defenses of the new insular possessions of the United States began immediately thereafter in military and naval circles and spread thence to the newspapers, which gave to the whole subject an exaggerated importance. Anti-imperialists used the threat of taken-for-granted Japanese aggression to bolster up their otherwise academic arguments. So, too, the Japanese, finding a new and pushing western power in their southern back yard, used the new American developments following the Spanish-American war, with the presumably changing foreign policy contingent thereupon, as a sufficiently obvious argument for popularizing naval expansion.

During the next decade both nations expanded enormously in naval armament and Pacific commerce. In 1904—1905 Japan defeated Russia and by the peace of Portsmouth overflowed with military rule, colonization, railway development and manufactured goods into Korea and Manchuria. And, to make the situation more delicate, our own Pacific coast, adding political irritation to commercial jealousy and growing suspicion, developed a "Japanese Peril."

What more natural than that the two nations should begin to consider the possibilities of war? Outside the executive departments at Washington it has never been known in this country that, during ten nervous days in the early summer of 1908, the United States hovered on the edge of an ultimatum from Japan. Yet long before the events of 1914 centered attention elsewhere, an American-Japanese war was the best bet of the prohets. Its imminence began to be taken for granted. Responsible journalists, not only in America but in Europe as well, alluded to it as merely a question of time. To-day, in 1923, although the much anticipated war is not even seriously considered, many people in both nations cling to the old habit of mind.

But has not the time come to change our hypothesis? The feeling of the past was largely a natural result of new alinements and new problems. In international affairs novelties are apt to arouse suspicion. We have not forgotten the apprehension awakened in England and in Australia by Japanese naval operations in the Pacific archipelagoes in 1914—1915. More recent experience presents the vivid example of the general consternation caused all over Europe and, to a lesser degree, in this country, by the phoenix-like rise of the Turkish nationalists under Kemal and the consequent changes in the political map of the Levant. As for the mutual distrust that has undoubtedly been characteristic of Japan and the United States during recent years, I am firmly convinced that it was the perfectly logical outcome, not of any one cause, but of a series of almost inevitable causes based on new conditions, which were practically forced on both governments. The question therefore resolves itself into this: Have these cause been, or can they be, sufficiently removed so that a new point of view may be substituted for the old? Can the two nations henceforward base their thoughts of each other on the assumption of peace?

The first answer that occurs—and perhaps the most pertinent—is that the race for naval supremacy has been at least temporarily checked by the Washington conference in 1921. The lifting of the burden of stupendous naval programs was financially important, especially to Japan, and the suspension of competition in the principal types of war-ships has already done something to allay war talk.

To my mind, however, there is another phase of the Washington Conference which, though generally overlooked, has a curiously important bearing upon the future relations of the two major Pacific powers. I refer to what may best be called the naval strategical dead-lock which has been created. After 1898 every high officer in the army and navy of both Japan and the United States, together with many selected junior officers, had spent days and weeks and months in studying what, aside from the question of German imperialistic designs in the western hemisphere, was in this country the cardinal war problem. From my own knowledge, for instance, it may be stated that the general board of the navy and

the general staff of the army of the United States, together with the joint board representing both services, used to study with the utmost care the problem of the defenses of the Philippines.

And it may now be said, in reviewing these conferences, that the distance of the islands from our continental shores and the lack of adequate bases on the Pacific coast, in Hawaii, Guam and the Philippines themselves led many officers of both services to admit that in the event of war with Japan the Philippines could not be held. This, remember, was ten years ago, before the extraordinary development of the submarine and of air-craft. The Japanese fleet, to be sure, was at that time numerically far inferior to our own—less than half its paper strength—but military and naval men knew the almost insurmountable difficulties of maintaining a preponderant American fleet in Asiatic waters. The line of communication was too dangerously long. On the purely military side our army experts found an almost hopeless situation. Though the defenses of Corregidor Island in Manila Bay might prevent a repetition of Dewey's exploit of 1898, what could a handful of American troops be expected to accomplish if an invading Japanese army were once landed at almost any other of innumerable practical locations on the coast of Luzon ? Nevertheless, just so long as the race of naval armaments continued, our responsible officers of the higher commands continued vigorously to make the best plans possible for the defense of American possessions in the Far East. And these plans, with the jeopardy they implied, were evidences of the need for the appropriations asked in the annual bills presented to congress.

These labors have been, if not terminated, at least materially changed by the Washington conference of 1921. A reorientation, so to speak, of naval matters began with the ratification of the naval treaty by the three ranking naval powers. For the next ten years the American navy is to be roughly as five is to three of the Japanese navy. Furthermore, the United States has agreed not to add any fortifications in the Philippines or in Guam. To say "add" is perhaps a euphemism ; for no fortifications now existing there can be, in the light of the last war, seriously considered.

During these earlier years, I remember, the wiser officers and statesmen on this side of the water were convinced that a war between the United States and Japan would have been likely to result in a military dead-lock. For the United States to have held the Philippines would have been, as I have indicated, a scarcely achievable task ; for the Japanese to have invaded—or rather to have maintained any invasion—on our Pacific coast would have been an impossible task. If, with a fleet double the size of Japan's and our vastly greater resources, invasion of the western shores of the Pacific was admitted to be probably impossible, certainly impracticable, for us, how much more formidable was the corresponding problem presented to the military strategists of Japan ! It must not be forgotten, moreover—the point will bear the emphasis of repetitions—that this impasse was reached before the days of effective submarines and air-craft, and that even at that time, when offensive operations over long sea-distances were less difficult than now, war would, in all probability, have been decided on economic issues. And in these the United States had, and has, a vast superiority.

Nevertheless, public opinion was not then educated to such a point of view and, frankly, no considerable portion of it in the United States yet grasps, I am inclined to think, the essential facts of the military situation. Many of us have not forgotten the real scares during the great war over the possibility of Japanese-German secret bases in Mexico and even in Alaskan waters. If it is probably true that prior to 1921 a strategical naval and military dead-lock existed, it is certainly true that neither Japan nor the United States recognized the fact.

As long as ten years ago naval experts said that a fleet crossing a wide ocean from its home base must of necessity lose from a quarter to a third of its fighting value. If that judgment was true ten years ago, then the principle is even more true to-day ; for the addition of two new dimensions, under water and in the air, to the fighting-area has made the protection of the capital ship—superdreadnought or battle cruiser, the fundamental fighting-unit—a much harder task than it was then. If our naval experts a decade ago doubted whether we could hold the Philippines with a fleet more than twice as powerful as that of Japan, what would they say to-day, when we have a fleet rated as only five to three with that of Japan—in actual efficiency of material and number of personnel the ratio is actually now lower than that agreed upon—and the new instruments of warfare capable of intensive use over a short radius, undeveloped ten years ago, have now been enormously multiplied ? And on the other hand, even if Japan in 1914 had any false notion that she could threaten us either through Mexico or by direct invasion of the Pacific coast, it is safe to say that her strategists have now tacitly abandoned such ideas.

Nobody, presumably, after all the prophets of 1914 have been proved without honor in any country, would attempt to say what would happen at the end of a military dead-lock between Japan and the United States. After the first year or two of hostilities economic causes would become the determining factor. Tableau : Japan and the United States, four or five thousand miles apart, making faces at one another across a no-man's water as broad as the Pacific. Some genius might then arise to ask what it was all about and what the use was of the atrophy of national life and development. Or, to take a pessimistic view, jingo counsels might prevail in both nations until one or the other, or both, had bled to death through the pocketbook. If, then, it were realized by the people of this country and of Japan that a war would be a futile gesture, attended by no sufficiently compensating results, each nation might be in a fair way to change its apprehensive habit of mind.

Nearly a year and a half ago the Washington conference terminated its work and signed the naval agreement. Great Britain, Japan and the United States—the three participants chiefly affected by it—promptly ratified it. Since neither of the two non-ratifying powers, France and Italy, entered seriously into the naval situation, there was consequently a gentlemen's agreement or understanding effected impliedly on the part of Great Britain, Japan and the United States whereby the terms of the formal naval treaty should be carried out with the same force as if all five signatory powers had promptly ratified. Great Britain has faithfully lived up to her part of the agreement, a recent attempt to show bad faith, in the matter of alterations to capital ships such as to permit an increase elevation and consequent greater range of turret-guns, having been proved (March 22) entirely without grounds. Japan, contrary to her tactics on certain past occasions, has lived up not only to the letter but to the spirit of the treaty. Premier Hara, in sending his delegation to the Washington conference, emphasized the chance thus afforded his nation and government to become established on a new basis of faith. Under the leadership of Premier Kato, the government has seized this opportunity. It has indeed been at pains to show the highest form of *bonâ fides* in connection with the engagements entered into at Washington, even though each and every one of the terms to which the Japanese delegates subscribed involved some national sacrifice, of prestige, of political ambition, of dignity.

With regard to the scrapping of capital ships, the peculiar situation in which Japan's chief delegate and present Premier found himself has escaped due appreciation. Kato, Admiral Kato, it must be remembered, is the creator of the Japanese navy. When therefore as a member of the big three of sea-power he was called upon to vote for drastic naval disarmament, and later on obliged as premier to carry out to the letter his national undertaking, he was performing a renunciatory act far more searching than the colder statesmanship of Mr. Hughes or Mr. Balfour. Kato and his colleagues, at the instance of a rival naval power, that power whose naval rivalry was most immediately threatening to Japan, were called upon to destroy what he himself had patiently created and built up during sixteen years of serious political and financial difficulties.

Kato proved himself capable of that great gesture and, what is more important, capable also of the less dramatic performance. The scrapping of naval vessels condemned by the treaty has gone forward faster in Japan than in this country. The historic naval base at Port Arthur, endeared to the Japanese by every consideration of national sentiment, has been abandoned, and the larger one on the Japanese mainland at Maizuru has also been dismantled. It may be contended that neither of these stations has great strategical value, but this is an open question. In any event, the Japanese have carried out their pledge.

On July 2, 1922, the Japanese withdrew their garrison of five hundred men from Hankow on the Yangtze and on October 26 of last year evacuated Siberia, according to their treaty engagements, with the last of a division which approximated twelve thousand men. About a month later, on or about November 22, they gave up their radio station on Russian Island, Siberia. Later, on January 1, to be exact, they gave up all their post-offices in China with

the exception of those retained along the line of their South Manchuria railway. This was precisely according to agreement.

It may be remembered that the Chinese delegates at Versailles refused to sign the peace document because of the reservation to Japan therein of the German rights and claims to the sacred province of Shantung. Japan's signature to the peace was contingent upon that reservation. Shantung was expressly the *sine qua non* of Japanese adherence to the peace of Versailles. Shantung was the gist of the twenty-one demands. And yet on September 14, 1922, Japan withdrew from Shantung, handing over everything to the Chinese, in accordance with her Washington pledges, amid the astonished contemplation of the journalists of the world and of the dumfounded Chinese themselves. Joint administration of the railroad was continued as agreed upon. In this latter case of very material sacrifice the irreconcilables point out that Japan in reality gained in the long run more than she lost in Shantung. A Chinese boycott had crippled her trade in this, one of the richest provinces in the republic, these critics explain, and Japanese policies and ambitions in Shantung were rapidly stirring up a national resentment throughout China. However that may be, the fact remains that the Kato administration has carried out to the letter in Shantung what Admiral Kato signed to do at Washington.

These, then, are the facts. It seems a pity that our own government has failed to enlighten the ignorance of the nation on matters of such vital importance. I do not hesitate to say that such thousands of American citizens as give these interests any thought at all are at this moment wondering whether Japan has been, or is, carrying out hei vast naval building program as announced after the war. What a difference in popular sentiment might have occurred, and might still occur, if the true facts had been promptly and widely made known to the public! If our government would spend half the energy in disseminating this healing kind of information that it wastes in creating misapprehensions about its own policy, the whole country would benefit thereby materially and morally. Once upon a time, not so many years ago, the government of the United States was a professed believer in open diplomacy. I am told that those times have changed. I begin to believe that they have changed when I realize that one of the most magnificent opportunities any government ever had has been allowed to slip during the past year.

Possibly the delay in the scrapping of United States ships as provided for and pledged in accordance with the treaty may lie at the bottom of the minimized success of the Washington conference. Japan's determined course as undertaken by her principal representative at the conference, Admiral Kato, won for his government a new and wider respect abroad. Japan's subsequent course at home, under the leadership of the same Baron Kato as premier, has been an exhibition not only of good faith but of a national desire to prove to the world that suspicions of the past are no longer justified.

Now with regard also to the very important question of Japanese and American interests in China, the situation is somewhat improved. The idea of the partition of China, which hung like a cloud on the horizon of two generations of Japanese growth, I regard as having been dissipated, if not forever, then for our own times, by the great war. During these same generations and longer the United States, innocent of territorial ambitions, has been the proverbial friend of China, and American sympathies have been pro-Chinese rather than pro-Japanese. Perhaps, however, we are appreciating now a little more readily than formerly the Japanese point of view. Although to-day the open door, brought into general recognition and pledged at the Washington conference of 1921, is, with the Monroe doctrine, the only definitely expressed foreign policy of the United States, we can now recognize that there is a real necessity to Japan of the markets and the raw products of that part of the Chinese mainland contiguous to her island shores. Here, then, is another valid reason, a generous and a sensible reason, for altering or abandoning the old-fashioned habit of mind.

On the final point and the most delicate, the question of Japanese immigration and property-owning in the United States, it is difficult to write without arousing unreasoning passions on one side or on both. So far as Americans are concerned, it must be admitted that, as a whole, they honestly believe—and in this belief they are at one with the people of Australasia and Canada—that the mingling of white with oriental blood on an extensive scale is harmful to our future citizenship. This belief extends to and affects not only the Japanese, as a race, but other oriental peoples of acknowlodged dignity and integrity, such as the Chinese, the natives of the Philippines and the Hindus of India. As a corollary of this conviction, Americans object to the holding of large amounts of real property, of land, by aliens or by those descended from mixed marriages. Frankly, they do not want non-assimilable immigrants as citizens, nor do they desire any extensive proprietorship of land without citizenship.

But the reverse of the position thus taken holds equally true. In other words, I do not believe that the American people now or in the future will insist upon the right or privilege of entry into an oriental country to such an extent as to threaten racial purity or to jeopardize the land-owing prerogatives of citizenship. I think I may sincerely claim for American public opinion in this respect an honest adherence to the Golden Rule. Surely the people of the East will come to realize that we ask of them on their side of the great water no more favorable rule, we expect no lighter restrictions, than we demand in regard to our native sand. Whether this tendency, this reciprocity of thought and policy, shall be expressed in the future through "gentlemen's agreements" or by treaties, it seems to me evident that the atmosphere is slowly clearing and that in this respect also we shall have cause to eliminate another threat to international comity.

Are there any remaining causes of probably offense which might justify a continuance of the old attitude? Yes, one other must be taken into consideration—commercial rivalry in the Pacific. A certain school of international thought has exalted this as the basic cause of all armed conflicts between nations. With this school I most profoundly disagree. Some wars, undeniably, have in large measure been the result of commercial competition. But others have been based upon racial antipathy and still others on pure military aggrandizement, on religious bigotry or on internal revolution. No general rule that will stand analysis can be applied. During the past hundred and ten years, for instance, the United States has been in many respects Great Britain's most serious commercial competitor. Yet these rival nations look back on a record of unbroken peace during all that time.

In the case of Japan it is true that we shall continue to overlap and perhaps to clash in the development of the commerce of the Pacific, but when one considers the potential trade of the vast territories and huge populations bordering the North and South Pacific oceans there would seem to be enough commercial room and to spare for both Japan and us well into the indefinite future. If it is proved that within one great nation co-operation rather than cutthroat competition best fosters an honorable and mutually beneficial trade, why is not the same formula true as between two nations operating in the same broad area? Europe is providing abundant and impressive examples of the contrary. More specifically, reciprocal markets between Japan and the United States appeal to business communities on both sides of the Pacific. Our trade with Japan alone last year was larger than that with all the rest of the oriental field combined. Furthermore, in the great staples of American export, in oil and cotton and tobacco, Japan is not now and will not conceivably become a serious competitor. In manufactured goods, especially the cheaper varieties, Japan, with preferential rates, a subsidized merchant marine and the shorter haul over government-owned lines, has an undoubted advantage on the contiguous mainland of China. But the higher grades of American manufactures continue to hold their own in markets where the Chinese buy for value. Stiff competition in the foreign field will benefit out inflated standards of profit and bring about a more careful study of foreign markets as well as more elastic adaptation to them.

Finally, I believe that we may assume the principal causes of friction in the past either to have been removed or to be on the road to eventual elimination. That status alone, however, is not sufficient. Things cannot remain merely negative. If we eliminate the habit of mind of the past something else, some other habit of mind, must take its place. Therein lies a magnificent opportunity. The United States and Japan came through the world war in better physical and economic condition than any others of the great powers. Their loss in man-power was relatively very small. Their gain in potential world markets and in home resources was correspondingly great. Their national debts, though materially increased, were in part taken care of by their growth in national weatlh. In both

countires currency and national credit have remained sound. Both nations are solvent. Most of the rest of the civilized world has been hard hit. Whole populations have been thrown out of great. To-day the school of those who believe that the solvent nations, those who are in a position to help restore the world, must play their magnanimous part, is almost daily receiving accessions of strength. Whether it be from a purely selfish desire for additional prosperity, or whether it rise from the deep belief that we owe a little something to mankind as a whole, the demand for the quieting of the troubled waters is heard on every side.

Shall the United States enter upon this great task for mankind ? If we say " Yes," we must ask further : " Shall we undertake this mission alone ? Is it too big for us ? Can any one else help ? "

It is a task of the first magnitude ; of such magnitude that ordinary political gentry stand back appalled. If we accept their ostrich point of view, we shall never begin, we shall never highly daie. We shall miss our great opportunity. But it would seem to be a matter of common sense that, if we once do devote ourselves to this work, we should call in all the assistance available. It is a world undertaking. South America ought to help and, in the light of the Pan-American congress at Santiago, will help; the British colonies should lend a hand. And why, in all reason, should not Japan, shoulder to shoulder with us, provide her aid as well ? If, instead of looking for causes of offense, we in all good faith confidently expect from Japan co-operation in world upbuilding, we shall go far toward insuring peace.

# The Peking School of Journalism

## A Waste of Money

THE American people are being called upon to endow a school of journalism at the Peking University, and a drive for $500,000 has been opened at its American headquarters in New York. It would seem that the very best way to teach young Chinese the rudiments of modern journalism is through practical work on an existing American newspaper or magazine issued in China. The endowment of a purely national organ in China would ensure the profitable publication of one of the best journals in the Far East for the advancement of national interests and ideals, and at the same time enable a fair number of young Chinese to acquire practical experience essential to their future usefulness.

If the half million gold dollars were employed to establish a real American organ in China with the provision that a certain sum be expended each year in training Chinese university graduates in practical newspaper reporting, and the sponsors of the scheme would lend their influence in encouraging legitimate advertising support to such a medium, the net results to China and America would be far greater than turning out a yearly batch of cub graduates aspiring to editorial honors without having passed through the initial hard stages of reporting.

What the Chinese require in newspaper education can only be learned by practical experience in a well regulated editorial office with a hard-boiled city editor on the desk, enforcing discipline and a regard for facts.

The details of the school of journalism project were drawn up by Dr. J. Leighton Stuart, president of Peking University, before he returned to China a few days ago. As technical advisers, New York newspaper editors and a member of the Columbia School of Journalism conferred with Dr. Stuart, says the *New York Times*.

The endowment estimate includes a provision for traveling fellowships similar to the Pulitzer traveling scholarships granted annually to three graduates of the Columbia School who have made exceptional records. The Peking School of Journalism is to award two two-year fellowships, each carrying a stipend of $1,000 a year, to enable graduates who evince appropriate promise to take advanced studies in universities in the United States and gain first-hand knowledge of American newspaper work, with a view to returning to China better equipped for work on native papers.

The new school, according to the policy outlined, will offer a four-year course leading to a baccalaureate degree. The academic work will centre on general studies, especially political sciince, history, the Engish language, economics and modern commerce, to afford a well-rounded background for editorial work. The technical training is to be provided in actual practice, rather than in academic theory, by establishing contacts between the students and the native newspaper offices in Peking.

Dr. Stuart pointed out that the city offered exceptional opportunities for student editors and writers to gain experience along with their scholastic training. Peking now has about seventy-five native-language daily newspapers, or about double the number published in any other Chinese city, besides many magazines. In all, about 800 dailies are now published throughout China, virtually all of which have been established since the beginning of the anti-monarchical movement which culminated in the revolution of 1911. In 1895, before this movement began to operate, there were only thirty-one native daily papers in China.

There has been no correlative provision for professionl education of the great body of young editors and writers who have come forward with this expansion of the press in China, according to Dr. Stuart. The demand is accentuated by the consciousness of Chinese editors and publishers of a need for informed writers. Dr. Stuart said that Peking University already had students intending to do newspaper work, although no technical instruction was yet offered.

The only university in China now having a department of journalism is St. John's University, in Shanghai. Courses were begun there in 1921, taught by Don D. Patterson, now of the Missouri School of Journalism. While this department serves the central China section, the northern section remains without any journalistic educational facilities.

Dr. Stuart hopes that sufficient funds will be obtained, together with the amounts already in hand for this specific purpose, to open the school in the Fall of 1924. The endowment estimate calls for three professors of journalism, two of whom are to be American University graduates experienced in newspaper work in the United States, and the third a Chinese journalist. The full staff, which probably will not be completed until later than the initial year, is to include two assistant professors.

In the above statement, Dr. Stuart invites attention to the reason why it is difficult to train Chinese into independent journalists, when he points to the exceptional facilities offered by Peking for student editors and writers to gain experience along with their scholastic training. Peking may have seventy-five or more daily newspapers, but exactly seventy-five or more are subsidized organs published in the interest of some party, faction or individual leader. These papers do not seek news. They would not recognize news if they saw it and, when it conflicts with their policy, would not publish it if paid to do so. The practical training to be obtained on such newspapers is not of that order which will tend to develop a high regard for the ethics of the profession. There is little scope for independent thought under prevailing newspaper conditions in China. Few Chinese newspapers are commercial propositions. The Chinese merchant or manufacturer does not advertise or properly support their press, while the subscription rate is so low as to exclude any profit from this source of revenue. It is fair to state that ninety per cent. of the 800 Chinese newspapers exist on official subsidies. Until these conditions are reversed and Chinese newspapers can be run as a business proposition, it will bring no lasting benefits to China or America to spend $500,000 in educating youths who will have to repudiate their ideals in order to exist. The net result will be that nearly every graduate will start his own paper under the patronage of some party or official and with letters of recommendation from the School of Journalism will pester American manufacturers to advertise.

# The Racial Issue

## Chinese Defiance of American Immigration Laws Threatens to Overshadow the Japanese Problem

TWO days after the Chinese smuggling schooner *Mary Beatrice* was towed into New York with all the marks of a battle royal around her blood-stained decks, Secretary of Labor Davis announced in Washington that over 5,000 Chinese were illegally in New York alone, while Chinese compradores in the know admitted that the total was nearer 10,000. What would have happened had this same number of Japanese laborers evaded our immigration laws and slipped into the Pacific coast states, is better left to the imagination. By this time, America or at least California would have declared hostilities and the war of the races would now be on. The Chinese, as our pet philanthropic recreation, are permitted to do things which we would never tolerate from other peoples. However, the test is coming and more rapidly than people at home imagine.

In the February number of THE FAR EASTERN REVIEW we invited attention to the shifting of the Asiatic problem from the Pacific coast to the Gulf and Atlantic states, reverting to its original anti-Chinese character. At that time it was estimated that over 25,000 Chinese coolies in Cuba, Jamaica, and the Bahamas were patiently waiting their turn to be smuggled across to the promised land at $500 per head. The Gulf states, the first to feel the effects of the new invasion, were even then up in arms and the revenue and immigration services hard pressed to enforce the law.

In addition to this method of flouting our immigration laws, thousands of Chinese are pouring into New York through the loophole provided by a federal court ruling holding that Chinese seamen are entitled to shore leave without the $500 bond formerly imposed. Despite all precautions on the part of the authorities, nearly 6,000 Chinese seamen have deserted while on shore leave scattering into the interior where it is difficult to locate them. The situation became so intolerable that the federal authorities were forced to act and on June 7 made their first raid. Within an hour over fifty Chinese laborers illegally in the country were rounded up in Long Island City while scores of others have sicce been captured in other metropolitan districts.

This is only the commencement of a problem which is certain to develop into an issue that will have a far-reaching effect upon the relations between America and China. Coolie smuggling is fast assuming even greater proportions than ocean bootlegging. Freebooters are building up a traffic in immigrants in defiance of the legal quota, more profitable even than rum-running. It would take the entire American army to run down the Chinese seamen who violate their shore privileges and a formidable auxiliary have to stop the profitable smuggling of Asiatics by means of fast motor-boats from Mexico, Cuba and other Caribbean islands.

" The total number of Chinese illegally residing in the United States, says Secretary Davis, " can only be ascertained by actual enrollment. To deport those actually in New York Davis would cost over $1,000,000." If such an estimate is correct, then the cost of repatriating the other tens of thousands of Chinese who have seeped into the interior, and whose number can only be roughly estimated, may well ascend to over $10,000,000. President Harding has announced that he will ask the next congress for stringent action to prevent the illegal entry of aliens.

The story of the *Mary Beatrice* brought home to the people of New York the story that is old in the Gulf state ports, and still older on the Pacific coast, where any time these past forty years government officials have been busy trailing a mosquito fleet engaged in bringing in Chinese from lower California at $350 to $800 a head. One ring alone working from Ensenada, Mexico, says a writer in the *New York Times*, is credited with having smuggled into the United States 1,000 coolies a month for several years. The Chinese coolie stoically take chances to get into the forbidden land that white men do not often risk and the stories of these expeditions read like old-time dime novels. These smugglers stop at nothing. If hard pressed they will callously sacrifice their human freight or convoy as the case may be, in order to escape capture.

Yet the Chinese keep coming, undeterred by the hardships and the possibility of losing their lives or of being turned back if caught. No coolie has the cash to pay the high charges exacted by the smuggling gangs. The logical deduction is that he is financed by some central organization which profits from this influx of Chinese labor into America. It is safe to deduce that this organization is exclusively Chinese, the ringleaders of which are to be found in the United States with agents in China, chiefly in Hongkong, Canton or Amoy.

The Chinese have carried with them to America that supreme contempt they hold towards the western conception of law and order. It may be true that the individual Chinese is meek, willing and orderly, but these virtues do not exist amongst their society leaders, who are above American law, discipline and punishment. American hostility to the Japanese arises in part from the difficulty of assimilation and because they retain allegiance to their country. We are prone to overlook in the midst of the avalanche of sentimental propaganda that the Chinese also retain their allegiance to their customs and reject the right of American law to interfere in their internal affairs. The Chinese laborer in America recognizes only the laws of his *tong* or society rendering it that allegiance and tribute in assessments withheld from the proper authorities. The Chinatown *tong* wars of New York, San Francisco and other large American cities are beyond the power of the police furnishing ample evidence of a state of affairs which emphasizes the above statement. If further evidence be required it is found in the following New York news item of May 23 ulto. :—

"The treaty between the Hip Sing and Ong Leong *tongs* to keep the peace of Chinatown has reappeared as strangely as it vanished late last summer. Dr. Carleton Simon, special deputy police commissioner in charge of the narcotic division, turned it over to representatives of the two *tongs* at police headquarters, but refused to say how he had got it. Edward Gong, secretary of the Hip Sings, and Henry Moy, secretary of the Ong Leongs, received it and said they would keep it in the offices of the Chinese merchants' association, where it will remain as a guarantee of peace.

" Elaborate ceremonies attended the return of the document. Ten representatives of the New York Chinese were present. Major-General G. P. Wang, chief inspector of police of Kiangsu province, with headquarters at Nanking, China, was a guest of honor. He urged the Chinese to obey our laws and avoid the traffic in drugs and gambling.

" The treaty was signed eleven years ago. Under it, peace reigned among the Chinese in America until last August, when the treaty disappeared, coincident with the assassination of Dr. Ko Low, president of the Hip Sings. Threats of trouble have been heard since the murder."

Here we have the evidence of the existence of a government within a government, in which assassination and intimidation is employed to settle their inter-society quarrels. The smuggling of narcotics into America is largely controlled by these societies and it is also known that the same gangs are financing the coolie trade in defiance of our laws. Secretary Davis says it would cost a million to deport the Chinese illegally in New York, and when we add to this the sums required to deport those scattered throughout the country and the cost of an efficient immigration service, the tax on the American treasury would wipe out any surplus in the profits we receive from Chinese trade after deducting our contributions for philanthropic uplift. At present, it would seem that the net result to our national economy is written in red ink. If our government should elect to employ the Boxer indemnity as a fund to enforce our immigration laws instead of applying it for further uplift work in China, it would meet with considerable applause from the tax payers.

The present trend of Asiatic immigration must be taken as a reflection of the unstable conditions prevailing in China that are forcing thousands overseas to gain the living denied them in their own country. The Chinese are slowly seeping into and establishing colonies in all countries open to their entrance. An Associated Press dispatch from Papeete, Tahiti, dated May 1, announcing the opening of a new Chinese bank described the tremendous strides the Chinese have made in the past ten years in capturing the trade of these islands.

" Steadily every industry is passing into their hands—vanilla curing, market gardening, butchering, pearl shell and pearl buying. They are strong in all lines of merchandising, and now have turned their attention to financing their activities through their own banks.

"The history of the Chinese in Tahiti is an illustration of oriental infiltration where there are no laws to limit or prevent it. The French government, owing to a treaty with China, vital to the interests of the great

French colony fo Indo-China, places practically no restrictions on incoming Chinese in Tahiti.

"Originally, Chinese immigrants were brought here as indentured laborers about the time of the American civil war, when a large and flourishing cotton plantation was being operated by English interests. When the price of cotton fell with the close of the war, in 1865, the plantation was abandoned and the majority of the Chinese coolies were returned to their country.

"A few, however, remained, entered business in a small way and gradually, by adapting their methods to those of the natives, obtained a grip on trade. This grip they have strengthened until to-day the European traders view the future with pessimism. Some go as far as to predict that within five years all the commerce of the islands will be in the hands of the Chinese."

The story of Tahiti is the story of all other small countries where the Chinese have gone in large numbers. The world, however, clamors more and more for cheap labor and where the demand is, it is met by China. The problem in the United States is fast developing into one which will overshadow the controversy with Japan, with no prospect of settlement through usual diplomatic procedure. Japan, at least, can exercise some control over her emigration, but in the absence of all authority in China it will be difficult to enter into any agreement with this country relieving the American treasury of the enormous cost of enforcing our laws. At the present rate of development, it will not be many years before the Chinese question will supersede that precipitated by the Japanese in California, and as the years roll on without any solution, the racial issue will once more take precedence over all others. As long as America and Europe stands by and permits Russia to monopolize the waste lands of Asia, forcing the yellow man over the Pacific for his existence, the problem will grow, and the time will come when, to consolidate Russia's hold on vast territories stolen from the Mongolian race, the white races of the Pacific will have to face the issue that should be settled on the plains of Central Asia.

* * *

# America's Supremacy in Rubber Manufacture

BECAUSE of certain advantages which it will be hard to overcome, England may remain the largest producer of crude rubber for a long time to come, but America is emphasizing daily her prominence in the field of rubber manufacture.

In the rubber world, one group of scientific men is being watched with the greatest interest. For a number of years this group has been making announcements of important new discoveries with a regularity that has centered the attention of the whole industry upon it. This group makes up what is known as the development department of the United Stated Rubber Company and it is responsible for the development of three new processes which mean more to the rubber manufacturer and to the user of rubber products than anything that has been accomplished in the rubber industry since vulcanization was discovered in 1839.

The three new developments are: (1) Sprayed rubber, for use in the manufacture of all rubber products; (2) Web cord, a fundamental improvement in the art of cord tire making; and (3) a new method of building and vulcanizing cord tires.

Sprayed rubber is produced by a revolutionary new method which eliminates that great bugbear of rubber manufacture, lack of uniformity. Hitherto each rubber grower has transformed his liquid rubber into blocks and sheets by a process of coagulation which called for pouring acids into the liquid rubber or by drying it in smoke.

Needless to say rubber when it reached the factories from the great number of individual plantations was anything but uniform in quality, and there was of necessity a good deal of haphazard work about turning it into useful articles. This lack of uniformity in the raw rubber accounts in part for the fact, so well known to motorists, that one tire would give a phenomenal mileage, while another in the same set, made at the same time, would fall far short of making a satisfactory record. Both went through exactly the same manufacturing process but the lack of uniformity of the raw rubber was partly responsible for the widely varying performances.

Under the acid method of coagulation, which is in general use on the plantations in the Far East where more than eighty per cent. of the rubber comes from, such a small thing as a rainy day might produce a big difference in the quality of the rubber produced. Rain falling into the cups set to catch the rubber as it flowed from the trees would dilute the liquid rubber, and account had to be taken of this dilution when the liquid rubber was put through the coagulation process.

Under the spray process, it makes no difference whether the liquid rubber has been diluted or not. This process extracts from the liquid rubber—latex, as it is called in rubber circles—every atom of rubber. If the latex is rich and full of rubber, the spray process extracts it all. But if the latex is diluted and "thin," the spray process is just as effective and takes out every particle of rubber the liquid contains.

Another very important feature of spray rubber is that it is absolutely pure and of full strength. Rubber coagulated by the smoke process is produced chiefly in the "wild rubber" areas in South America. The workers are natives, unused to the careful, scientific methods required in high-grade manufacture and smoked rubber is frequently filled with impurities such as dirt, sticks and leaves. Acid-treated rubber, as produced on the plantations, has sacrificed some of its strength through contact with the acids and through the manipulation through which it passed before it reached the market. Sprayed rubber is absolutely pure and possesses all the strength of the virgin rubber. Scientific tests show it to have a tensile strength never before equalled by any commercial rubber.

Sprayed rubber may be produced on the plantations and shipped to the United States in blocks or any desirable form, or the latex may be shipped to that country in the tanks of ships and converted into blocks there. Units for making sprayed rubber are in operation by the United States Rubber Company both in America and on the company's large plantations in Sumatra.

While of importance to manufacturers of all kinds of rubber goods, the development of this type of rubber is especially important to tire manufacture, insuring a toughness and uniformity in tread stock and other rubber parts of a tire never before known.

Web cord is the name of a wonderful new cord fabric for tires in which each individual cord has been immersed in rubber latex until it is literally impregnated. Every motorist knows by now that the length of life of his tires depends largely upon the thoroughness with which each cord in the carcass is impregnated and surrounded by rubber, the object of this being to reduce friction.

In making Web cord, the cords are given a latex bath. Cotton absorbs rubber in this new liquid form quickly, so that by the time the bath is completed each cord and every thread in each cord has been saturated with liquid rubber.

As the cords come out of the bath they lie side by side, and the natural adhesiveness of this virgin rubber causes them to stick together. By the time they have dried they form a firm sheet. There are no cross threads whatever, this feature and the thorough rubberization of the cords constituting the essential points of difference between Web Cord and the cord fabric heretofore in use. It is from the fact that there is no cross weave that the fabric gets its name of "Web Cord." Actual use of tire thus made conclusively shows that this fabric makes the strongest and longest wearing tires yet produced.

The essential feature of this process is, of course, that the cords are given a bath in pure latex. This method of treatment should not be confused with the old method of dipping in rubber solution. One of the oldest methods of making tire fabric has been to dip the fabric into a rubber solution made by dissolving crude rubber in benzine or some similar solvent. This old method was not only crude and ineffective, but devitalized the cotton by dissolving out some of the natural oils and waxes.

The third development—a new method of building and vulcanizing cord tires—has a wide significance in tire manufacture, where it displaces the old "cord" method of tire building.

To the tire user it means that the structure of the carcass of the tire is brought very much nearer to perfection than ever before, and that many of the causes of tire break-down have been eliminated.

The new process is called the "flat-band" process of tire building, the name being derived from the fact that under this method tires are built flat and then fashioned into normal tire shape by special machinery, instead of being built to tire shape around a metal core.

The result of the use of the new process is a uniform tire, equalized throughout in resiliency and resistance to wear, in which each cord contributes always its full strength.

Under the old process the human element played an important part in cord tire construction, and there was always the likelihood that in stretching cord fabric around a core by hand there would be a variation in the tension or a departure from the correct direction of the cords. The tension and the direction of the cords are now determined by a machine that makes no mistakes and these two serious opportunities for tires being faulty are eliminated.

# Railway Electrification in Japan

## The Yoro and Tobu Program

THE Yoro railway line owned by the Ibigawa Denki Kabushiki Kaisha has been electrified from Ogaki on the main Tokaido division of the Imperial Government Railways, to Kuwana on the Kansai division, a distance of 26.8 miles: and from Ogaki to Ibi, a distance of 9 miles, making a total of 35.8 miles of electrified line.

This railway was originally a steam-operated line owned by the Yoro Tetsudo K.K. (Yoro Railway Co.) taken over in 1922 by the Ibigawa Electric Co. Permission was obtained from the authorities last year for its electrification and the construction hurried. As a result, the first electric cars were run over the completed lines in May this year.

By steam, from Ogaki to Kuwana the time was 2 hours, but the new electric cars now make the trip in just half that time. This is one of only two 1,500 volt private electric railways in Japan, the other being the Osaka Railway Co. The Ibigawa Electric Co. has also received permission to build a new electric line, between Kuwana station and Yokkaichi, about ten miles, gauge 3-ft. 6-in., using 45 or 50 pound rails, single track line, using D.C., overhead transmission lines.

The following description of the equipment of the power stations and transformer stations of this railway line is furnished by the company:—

### Nishi Ogaki Power Plant

Generators: Maximum capacity 500 kilowatts; average, 150 kilowatts; volts, 555 A.C. 750 D.C.; 6 phase, 60 cycles; 1,800 R.P.M.; two generators, with one in reserve: three in all; two connected, 1,500 volts; manufactured by Shibaura Denki Seisakujo, Tokyo.

Transformers: 150 K.V.A.; first pressure 9,500, 10,000 and 10,500, 11,000 volts; stepped down to 55 volts, single phase; 60 cycles; oil-cooled—3 units making one set. 1 unit in reserve; Manufactured by Shibaura Denki Seisakujo.

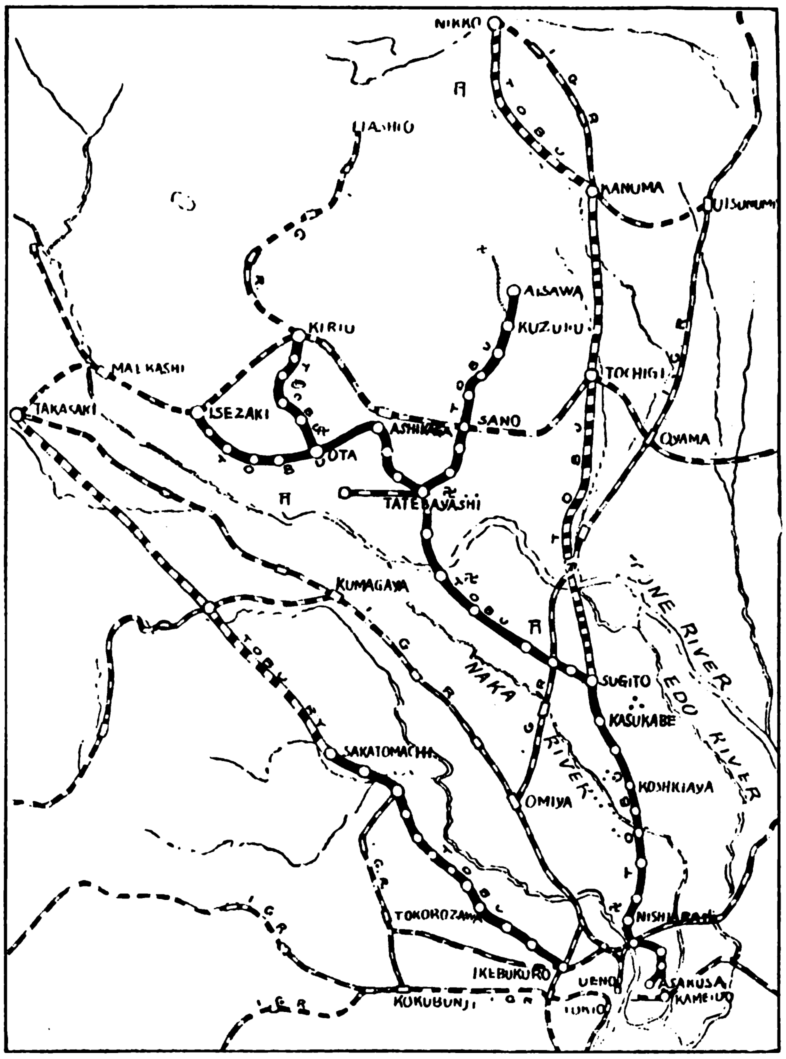
### Tado Transformer Station

Equipment same as in Nishi Ogaki plant, except 20 K.V.A., single phase; 3 units, for power and light.

The power for the electric railway is transmitted from the transformer stations to Nishio station, the main line of transmission from that station to Tado being 20½ miles long, non-insulated, copper wire, B.S. 12, seven strands, to carry at maximum pressure 11,000 volts, A.C., 3 phase current. The poles carrying the wires are steel, cypress and cedar.

The railway line itself is served by overhead lines, hung on poles at both sides of the tracks (except in the stations), made of non-insulated copper, B.S. 40, for a maximum pressure of 1,500 volts, D.C., 2 phase.

The electric passenger cars are described as follows: 4 wheel bogie type, of which the company owns 8; weight: 27.78 tons; passengers: seated, 44, standing, 30; truck, 27 M.C.B., wheel diameter 33-in.; brakes: air, and hand; motors, direct wound: 50 h.p., 750 volts, 2 motors; D.C. connected, 1,500 volts; 4 motors in each car; gears, 65/79; brake: special multiple, P.C. No. 2; pantograph: made by: body, Nihon Sharyo K.K.; truck: Brill; air brake and controller: G.E.; Electric locomotives are now being designed.




Map showing the lines of the Tobu Railway Company. This Company controls more than 140 miles of railway in the Tokyo District, of which, it is reported, 89 miles are to be electrified

### The Tobu Program

This is one of the most important electrification programs projected in Japan. It is reported that the Tobu Railway Co., the longest and most important of the private steam railways in the country, has just completed a contract for the electrification of its entire line, some 89 miles in all. Details are not yet available. The importance of this line in serving Tokyo can be seen from the map.

Including the lines licensed for construction but not yet included in the company's plans for new work, this company controls more than 140 miles of railway in and around the Kwanto district, the vicinity of Tokyo. The population of this district is on the increase at a greater rate than in any other part of Japan, and the increasing value of the silk business, the principal industry in the region the Tobu railway serves, is yearly making the company's profits greater and greater. This company, though, puts a large part of its profit each year back into improved equipment, and extending its lines. The line from Sugito to Nikko, through Tochigi and Kanuma is said to be the next licensed line which will be constructed.

### Electric Railways in Osaka Suburbs

During the war, applications for licenses to construct electric railways amounted to more than 60. About fifteen of these have since been cancelled, either because they failed to begin construction within the fixed period, or because of changes in the projects which necessitated changes in the license.

The lines licensed to construct in the vicinity of Osaka are itemized below. Some of them have commenced construction, but for the greater part work has not yet been started, because of difficulties in raising the funds needed in the present state of the money market.

| Name of Company | Termini | Mileage | Capital |
|---|---|---|---|
| Minami Osaka Dentstsu | Sakai City—Yamato Takata Machi ... ... ... | 18.1 | Y.2,500,000 |
| Kita Osaka Dentetsu | Nishinari Gun, Nakashima machi—Kita Ku, Nishinoda, Sumida Machi ... ... | 1.2 | 1,700,000 |
| Konan Dentetsu | Osaka City—Sakai City ... | 10. | 5,000,000 |
| Hanwa Dentetsu | Tosei Gun, Tanabe Cho-Wakayama City ... ... | 36.7 | Y.2,000,000 |
| Hantan Denki | Nishinari Gun, Nakatsu Machi—Kyoto City, Kameoka Machi ... ... ... | 28. | 8,000,000 |
| Sangu Dentetsu | Tosei Gun, Daioji Mura—Yamada City, Miye Prefecture ... ... ... | 91.44 | 2,800,000 |
| Tamatsukuri Denki | Shinstzu Mura, Osaka—Tennoji, 3.52 miles, Tsuruhashi Machi ... ... ... | 4.2 | 3,600,000 |
| Izumi Denki | Senpoku Hamadera Machi—Sennan Sano Machi ... | 11.42 | 11,000,000 |
| Ikoma Denki | KitaIkomaMura—KitaKochi, Maikata Machi ... ... | 9.36 | 2,000,000 |
| Osaka Denki | Kochi Gun, Fuse Mura—Yamato Yagi Machi ... ... | 20. | 3,000,000 |
| „ | 4 chome, Tenma Bachi—Nakakichi Koshaei Mura ... | 9.18 | 3,500,000 |
| Nankai Tetsudo | Bokutei Mura, Tosei Gun, Imamiya Station of Kansai Government Railways Line | 3.5 | 3,600,000 |
| Osaka Tetsudo | Kashiwabara — Tamatsukuri Kashiwabara — Hyotanayama, Kori Mura ... | 21.8 | 2,600,000 |
| Kita Osaka Dentetsu | Toyosaki Machi, Nishinari Gun, 4 chome, Tenjinbashi Suji ... ... ... ... | 4 | 1,300,000 |
| Hanshin Kyuko | Shikitsu Machi, Kitsu, Adachi Machi, Tosei Gun ... ... | 4 | 3,000,000 |
| Izumi Denki | Hamadera Machi, Imamiya Machi, Tosei Gun ... ... | 8.4 | 10,000,000 |
| Kitsugawa Tetsudo | Shikitsumachi, Tosei Gun, Fukida Machi, Mishima Gun ... ... ... | 16.2 | 8,000,000 |
| Shin Osaka Dentetsu | Hieshima Mura, Nishinari Gun, Kamitsumura, Nishinari Gun ... ... ... | 10.64 | 8,000,000 |
| Myoken Dentetsu | Yoshikawa, Hono Gun, Togo Mura, Anamushi Gun ... | 3.32 | 5,000,000 |
| Ikoma Cable Car Line | Otomura, Nakakochi, Summit of Ikoma Mountain ... | 1.68 | 400,000 |

The Yagi line of the Osaka Denki, and the lines of the four new companies, Konan Dentetsu, Tzumi Denki, Ikoma Cable Car Line, and the Arrima Denki, not listed above, have all recently received their licenses.

## Municipal Transportation in Osaka and Tokyo

The most important details in the plans for the enlargement of the boundaries of the cities of Tokyo and Osaka, are those for the extension of the existing transportation systems. These organs of communication to-day are so incomplete that they are almost the laughing stock of the world. Unless extended, it is impossible to carry out the ambitious schemes for city expansion and improvements.

Viscount Goto, who recently resigned as mayor of Tokyo, devised plans for a Greater Tokyo, and presented them before the last session of the diet where they failed to receive approval. It was believed in the diet that the plans were quite desirable, but it was also considered that the most urgent duty of the Tokyo municipality is the immediate construction of an adequate transportation system within its present boundaries.

Many Transformer Stations in Japan are equipped with Japanese-made equipment. The picture shows the interior of the Transformer Shops of the Hidachi Engineering Works, owned by the Kuhara interests

It was planned in 1910 that the licensed routes owned by the municipality should be constructed with an appropriation of Y.130,000,000. These lines have been gradually opened, but the expansion of Tokyo has been so great that the old transportation plan could not cope with the ever growing needs of the population. The outstanding feature of the transportation system in Tokyo is the glaring fact that there is no parallel at all between the growth of the city and its suburbs, and the transportation lines.

The city of Tokyo depends for its supply of power upon the three private concerns, the Kinugawa Hydro-Electric Co., the Katsuragawa Hydro-Electric Power Co., and the Inawashiro Water Power Co., and when accidents occur, transportation stops. Such accidents are frequent, and it is becoming more and more difficult to move the city's surface cars with ease. There are about 180 miles of surface lines in Tokyo to-day, and not more than 1,400 cars in continuous operation. The population of the city is estimated at two and a half millions. The lines being incomplete, according to the location, traffic is always confused. The local papers invariably declare that one is taking one's life in one's hands both morning and night in trying to get to business and home again on a Tokyo city surface tram; and this is hardly an overstatement of the facts.

The only auxiliary transportation system in Tokyo city is the city and Suburban Motor Bus Company's motor bus service along certain of the main streets of the city. It is reported that this company is meeting with financial difficulties, and it is a fact that the service is entirely too expensive. The business results have been so poor that it has been impossible to expand its system in accordance with the city's needs.

There are many plans for improving Tokyo's unbearable transportation system, but after all, these are only plans, and the public keeps asking, when will they begin construction?

The chief of the Tokyo electric bureau, Nagao Hampei, has recently advanced another plan to meet the existing emergency, created largely by the building up of a great business centre in the heart of Tokyo called the Marunouchi district. His idea is to construct a double track subway line one mile long between Toranomon and Hitotsubashi, passing through the Marunouchi district.

The present tram lines leading into Marunouchi cannot begin to handle the rush hour traffic, and it is to help out at this time, that this subway is planned. This line would pass from Toranomon by Tokyo station, and to Ota Machi, coming out at the entrance to the Imperial Commercial University at Nishiki Cho, in Kanda. The cost of construction for each mile of single track is estimated at Y.3,500,000, a total of Y.7,000,000 in all. The plan has been approved by the city assembly. The plans and survey will be drawn up next year! This does not seem to be rushing to meet the emergency.

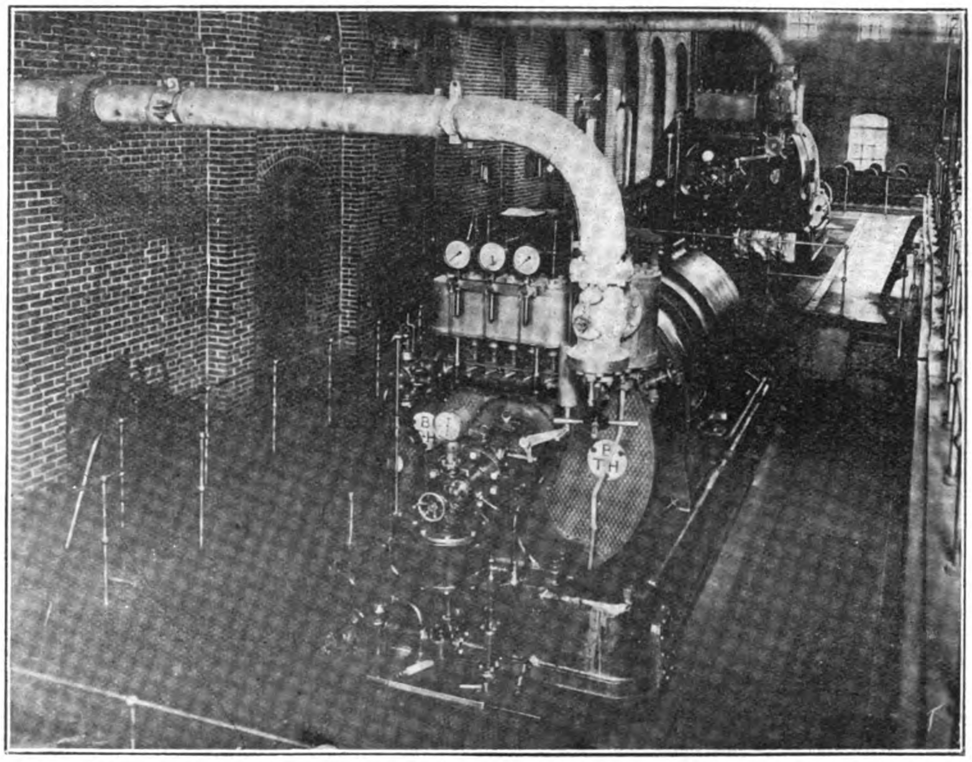
Certain attempts have been made to decrease the congestion along main lines of traffic by operating express service cars. A trial made some three months ago, between Shinjuku and Hibiya Park was rather disconcerting in its results. It was found that the running time was more often than not, longer than that of the ordinary services. It is said that the city municipal tramway authorities learned more about the absurdly congested state of the surface system from

these tests than from all the complaints made against the service during the past five years.

The subway plan does not cover much ground. It only relieves (if it will relieve) and it is to be doubted if it can ever do that especially as by the time it is built the emergency will be infinitely more acute than it is now, the traffic in Marunouchi, and Kanda, where at the early morning hours, and around 5 o'clock in the evening there is an ever growing traffic of business men and students. As a matter of fact the plan is generally derided by the more careful students of Tokyo's transportation problems.

## The Osaka Plan

Osaka is also growing beyond its present surface tramway facilities. The Osaka municipal assembly has been considering a plan for the construction of a high speed railway system in the city limits at a cost of Y.130,000,000. Construction, when started, is to be completed in five years.



Two B. T. H. Turbo-Generating Sets installed by the General Electric Company in the Sumiyoshi Power Station of the Kyushu Electric Light and Traction Company at Hakata

The plan includes: From Umeda station (The Osaka Railway Station on the Tokaido Line) one line will be built to the west, passing along the west bank of the Yokohori Gawa, passing through Shinanobashi and Yotsubashi, reaching Minato Machi station. It will then turn to the south and reach the station of the Nankai Tetsudo Co., and from there proceed to Tennoji Park.

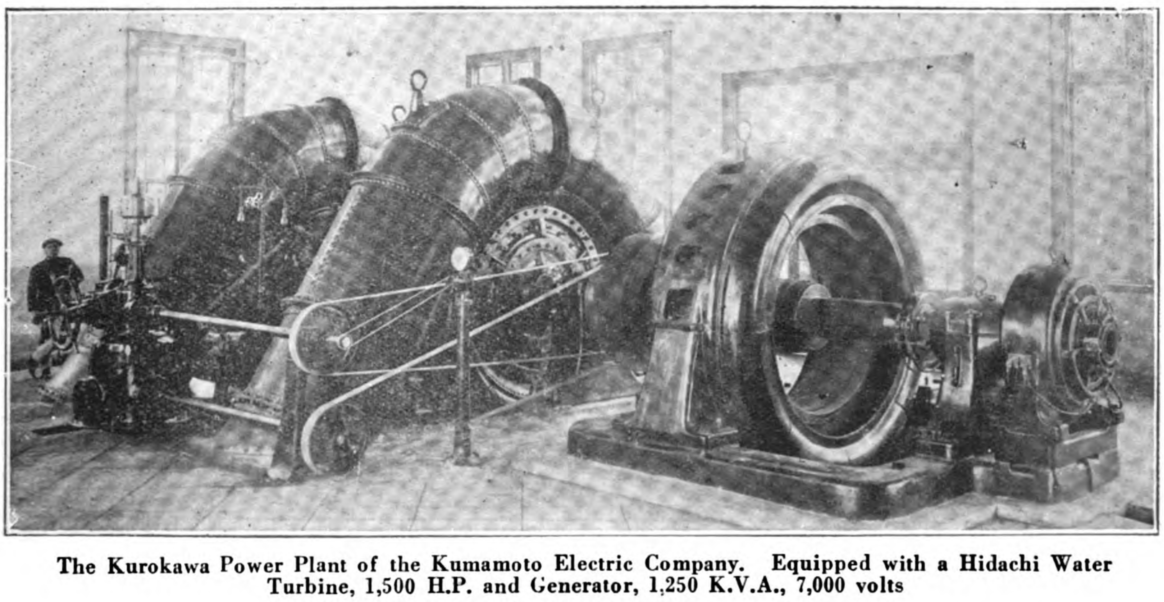
The second line will start from Umeda station and turn to the east, obliquely to Kitano Machi underground, coming out at Sugawara Machi, Nakanoshima, passing through Higashi Bashi, along the east bank of the Yokohori Gawa. At Sueyoshi Bu, it will turn to the south-east, and at Kawaraya Machi, Teraka Koya Shita, it will go underground again, and straight ahead to Kami Honmachi 6 chome, to the end of the line of the Osaka Kido company. From this point it will curve away to the south-west on to Tenoji Park where it will connect with the line from the west. From the connecting point the east line will again pass to the line of the Hankai Densha, connecting with it between Kasumi Cho, and Imamiya stopping points. From this point a branch will be built to the Osaka Kido line at Kami Honmachi. The line will come to the surface at Nihonbashi Suji, one to the south of Sen Michi Mae, will connect with the west line. A branch will also be built from Yotsu Bashi which will pass from Nishi Nagahori Gawa through Matsusima, reaching Kujo, where it will connect with the suburban surface tram lines.

The total distance of these main lines and their branches is 33 miles. Compared with the Tokyo plan this is an ambitious scheme, and as it is planned to reach the stations now scattered in all outlying districts about the city, it will be of immense benefit in bringing the people into and out of the main districts of the city. Part of the line will be underground, part elevated, and part surface. The details are not yet available. The assembly has not yet passed the scheme.

If this line is approved and constructed, it will undoubtedly favorably affect the transportation situation in Tokyo. The capital can hardly permit itself to be placed in the second position in such an important matter of civic improvement.

It is reported that the private railway lines leading out of Osaka in all directions, are planning a central station for all their lines, to be built in the heart of Osaka city. If this is accomplished it will undoubtedly make Osaka the best served city in Japan.

Although several reports have been published recently to the effect that the Tokyo Underground Railway Co. has been able to raise the funds needed for its construction plans for building a subway in Tokyo, they are not officially confirmed. Negotiations are under way with an important American engineering construction firm, but they are entirely dependent on the reports of their engineers, now in Tokyo.



The Kurokawa Power Plant of the Kumamoto Electric Company. Equipped with a Hidachi Water Turbine, 1,500 H.P. and Generator, 1,250 K.V.A., 7,000 volts

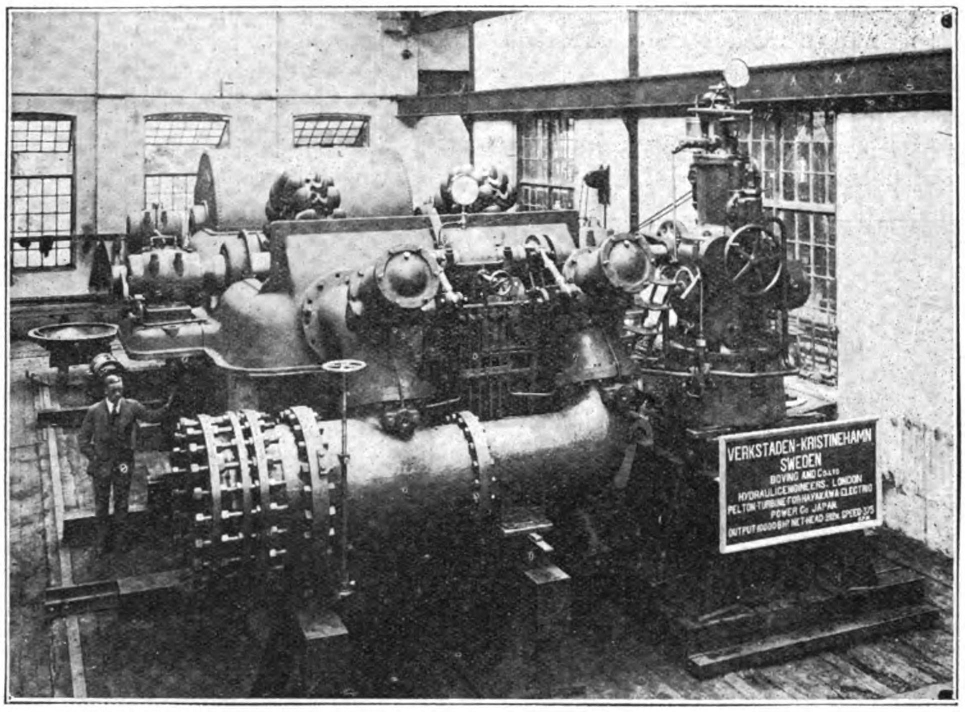
## Tokaido Line Electrification

The department of railways is very busily perfecting its arrangements for the electrification of the Tokaido line, especially on the sections between Odawara and Tokyo, and Ofuna and Yokusuka.

Recently two electric locomotives purchased from Westinghouse were tried out with satisfying results. Two from the General Electric were also tested satisfactorily. Two locomotives from Brown Boveri and others from the English Electric will soon arrive for trial.

Japanese manufacturers, the Hidachi Enigneering Co., the Shibaura Engineering Works, and the Toyo Electric Mfg. Machinery Co. have received orders for the genera-

tors, and transformers needed in the stations to supply this line. These orders are nearing completion. It is believed that the government railway car building shops at Omiya, near Tokyo, will soon be able to build all the cars needed for these electrified lines, and that within two or three years Japan will be in a position to supply all the equipment needed in its newly electrified railways.




**The Hayakawa Electric Power Company, of Tokyo, recently purchased from Boving & Co. four 10,000 H.P. Petton Turbines, 375 r.p.m., under a head of 700 feet, for installation at its new power plant on the Hayakawa River, a tributary of the Fujikawa, in the Tokyo supply district. The turbines to be delivered this summer, will be directly connected to Shibaura Engineering Works' Generators of 7,000 k.w.**

The transformer stations which will be erected along the new Tokaido line are listed below:—

*Kawasaki Transformer Station.*—Rotary Converters: 2 units, 3 sets, 2,000 kilowatts. Transformers: 3 units, 2,100 K.V.A., ordered from the English Electric Co.

*Kawasaki Juden Transformer Station.*—Transformers: 9 units, 3,000 K.V.A., ordered from Shibaura Engineering Works.

*Kawasaki Transformer Station.*—Rotary Converters: 2 units, 2 sets, 1,000 kilowatts. Transformers: 2 units, 2,100 K,V.A., ordered from Westinghouse. (Takata & Co., Agents.)

*Ofuna Transformer Station.*—Motor converters: 3 units, 2,000 kilowatts. Bruce Peebles (Healing & Co., Agents). Transformers: 3 units, 2,100 K.V.A., orderedfrom Mitsubishi Denki K.K.

*Ninomiya Transformer Station.*—Motor Converters: 2 units, 2,000 kilowatts. Bruce Peebles (Healing & Co., Agents). Transformers: 2 units, 2,100 K.V.A., ordered from Mitsubishi Denki K.K.

*Akabana Juden Transformer Station.*—Transformers: 6 units, 3,000 K.V.A., ordered from Hidachi Engineering Works.

Electric car motors of 150 h.p. each have been ordered from:

Hidachi Engineering Works, 100; Toyo Denki Seizo K.K., 100; Shibaura Engineering Works, 20.

Controllers have been ordered from:

Hidachi Engineering Works, 100; Shibaura Engineering Works, 50.

Pantographs have been ordered from:

Hidachi Engineering Works; Shibaura Engineering Works and Toyo Denki Seizo K.K.

All these companies are working almost at capacity to supply these orders.

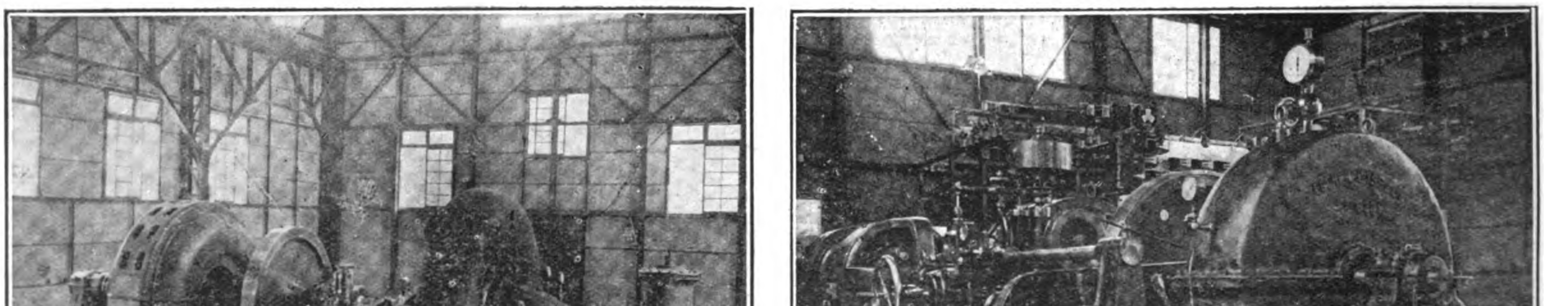
## Power Supply

The government is building the Shinano River power plant to supply the power needed by this electrification. This plant is far from completed, and at present the only plant the government owns which can supply power to the Tokaido line is the Akabane steam plant, in the suburbs of Tokyo, generating 10,000 kilowatts.

In the beginning, power will be purchased from private companies. The department of railways will make a leisurely survey of the power needs of this line and consider ways and means of providing the necessary power later on. There is much discussion going on in the railway department at present concerning the purchase of more equipment. One party is anxious to purchase many more locomotives abroad this year, while the other urges consideration of the locomotives which have arrived and are arriving before others are imported. It is believed that the conservative element will have its way, much to the disappointment of many electric machinery manufacturers.

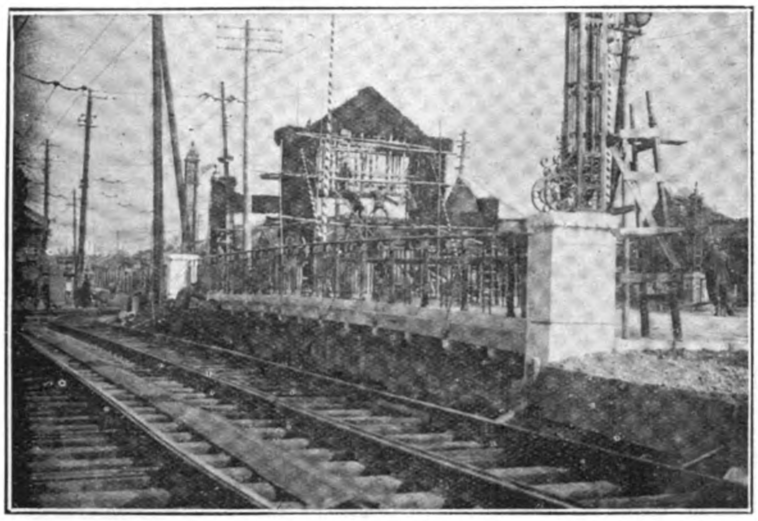
## Plans to Electrify Japanese Steam Railways

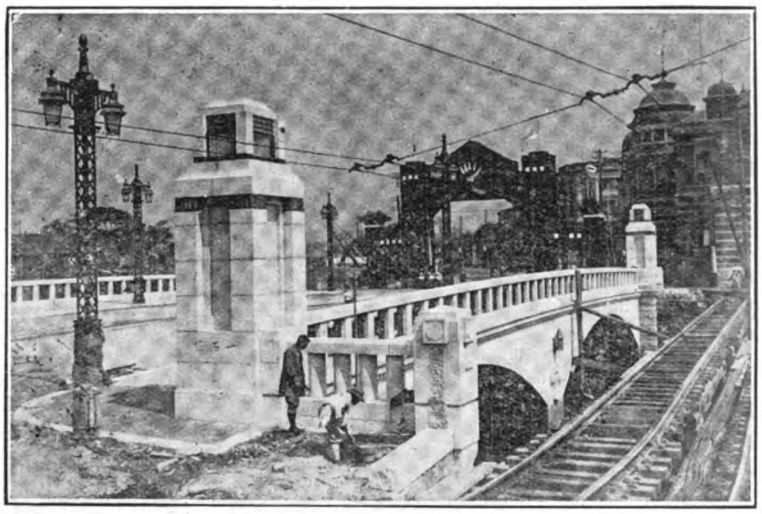
The outstanding feature in the transportation situation in Japan to-day is the extensive electrification of private railways which is rapidly being carried out. The Musashino railway electrification has attracted such favorable notice that other lines have turned their attention to electrification, with the result that it is



**Escher, Wyss Water Turbines in the new plant of the Toyama Electric Company**

**Main Turbine** **Exciter Turbine**





Types of New Bridges over the canals of Tokyo, made necessary for carrying the heavy tramway traffic

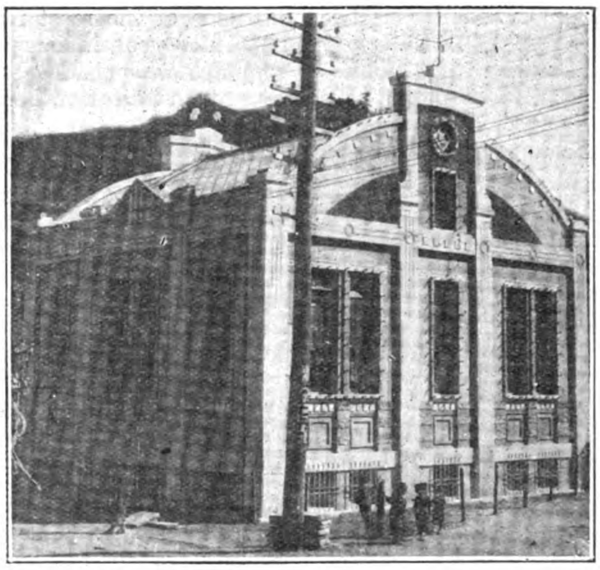
just now reported in Tokyo that the Tobu Railway Co. will electrify its entire line. This railway is Japan's most important private railway line, and its example is sure to have a most decided effect on the future electrification of other lines.

The Satobe railway originally constructed to transport the materials for erecting the Toyo Aluminium Co. plant has just been electrified for general freight and passenger service.

The Chikuma railway constructed in 1921 to carry the materials for building the power plant of the Keihin Electric Power Co., to-day it is the only country railway line using bogie type cars.

The Yamanote electric line, owned by the government, running around the city of Tokyo from Tokyo station to Uyeno station, passing through all important suburbs, now carries 50 per cent. more passengers than it was originally planned for. It is utterly unable to handle the traffic.

All private railways in Nagano prefecture have recently turned their attention to electrification. One-tenth of them own their own power, and estimate that they can consume it all on their railway lines. Fifty miles of railways have been built in this prefecture, and there are 80 miles licensed not yet built. Besides these there are another 80 miles of licensed steam railways not yet constructed. More than 60 miles of these steam lines will be built for electric operation, and new licenses are now being requested to cover the changes.



The Jotoku railway originally built as a connecting link between the Joban and Tohoku lines of the Imperial Government Railways, a distance of 32 miles, with a 3-ft. 6-in. gauge, will soon be electrified, with a 4-ft. 8½-in. gauge.

The electric bureau of the railway department is now investigating applications for electrification from the

Yabakei Railway Co., an excursion line, with a 2-ft. 6-in. gauge.

Nansatsu Railway Co., passenger and freight line, 3-ft. 6-in. gauge.

Nishio Railway Co., passenger and freight line, 3-ft. 6-in. gauge.

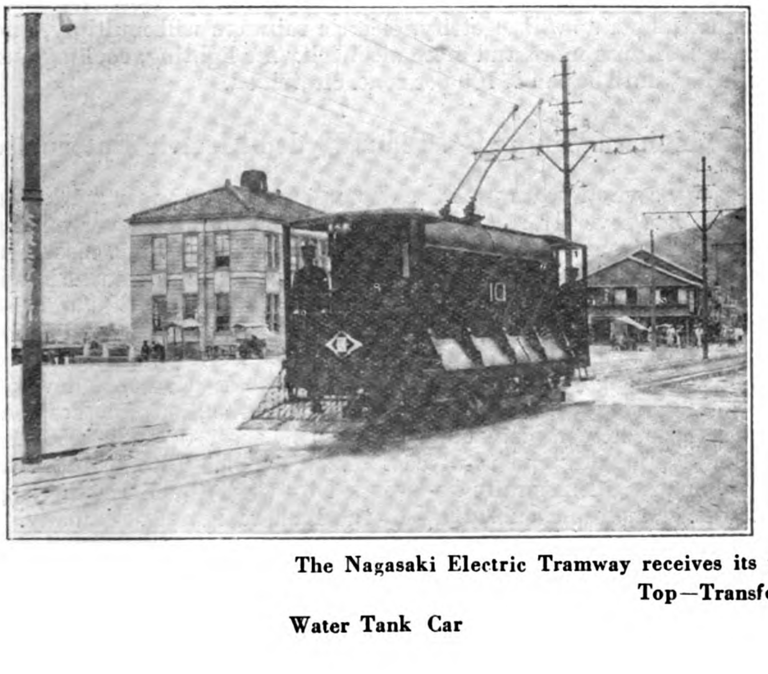
Kokura Railway Co., passenger and freight line, 3-ft. 6-in. gauge.

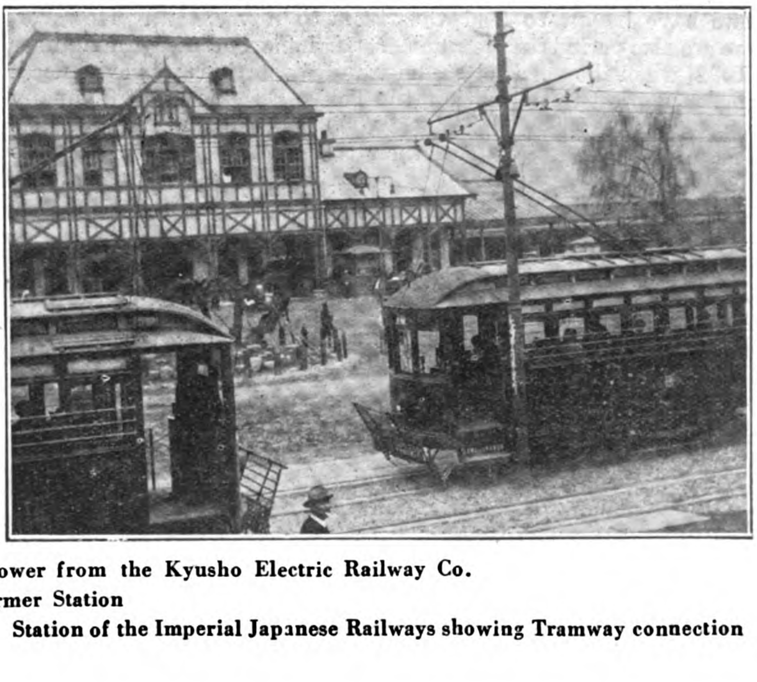
Information on these companies follows:

*Yabakei*: capitalized at Y.625,000, has 15.4 miles of line in operation, constructed at a cost of Y.52,500 a mile. It owns five water tanks, and uses a 28.3 pound rail. Operates 15 passenger cars, and 41 freight cars.

*Nishio*: capitalized at Y.600,000, has 16.4 miles of line in operation, constructed at a cost of Y.35,500 a mile. It owns four water tanks, and used a 20-pound rail. It owns 13 passenger cars.

*Kokura*: capitalized at Y.4,520,000, has 24.9 miles of line in operation, construction costs not known publicly.



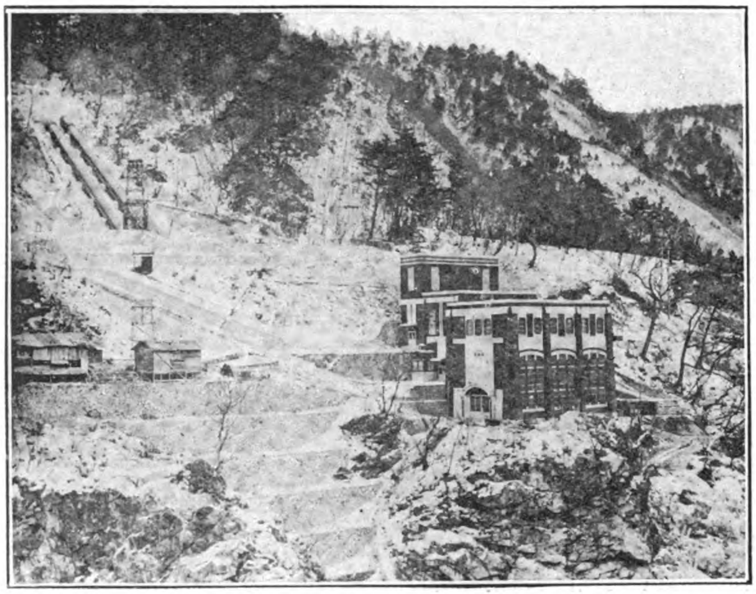


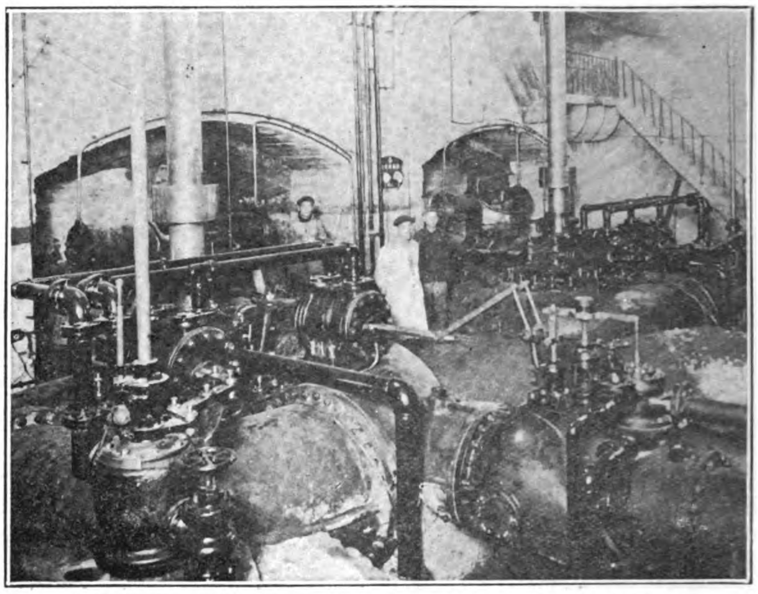
The Nagasaki Electric Tramway receives its power from the Kyusho Electric Railway Co.

Top—Transformer Station

Water Tank Car

Station of the Imperial Japanese Railways showing Tramway connection





**One of the Kinugawa Water Power Company's plants equipped with a 5,700 H.P. Water Turbine, 500 r.p.m. at 275-ft. head, made at the Kameido Shops of the Hidachi Engineering Works**

It owns ten water tanks, uses a 60-pound rail, and owns 16 passenger cars, and 230 freight cars.

*Nansatsu*: capitalized at Y.1,000,000, has 19.6 miles of line in operation, construction costs not publicly known. It uses a 45-pound rail. Other details not published.

All these lines will be electrified by 1926. The Nishio and Yabakei will require about Y.18,000 to Y.19,000 a mile for electric equipment, and the Kokura from Y.23,000 to Y.24,000. Rails now 20 pounds, with a 2-ft. 6-in. gauge must be changed to 60 pounds with a 3-ft. 6-in. gauge. But the Yabakei with its 28-pound rails and 2-ft. 6-in. gauge can use a 9-ton electric locomotive without making any great changes. The Nishio will change to a 3-ft. 6-in. gauge, and use a 15-ton locomotive.

The only one of these lines which will own its power supply is the Kokura Railway Co., which will construct a hydro-electric plant in North Kyushu to supply its needs. The others will purchase power from the Kyushu Water Power Co.

## Hydro-Electric Companies Place Large Contracts for Steam Plants

The recent large expansion in water power plants in Japan has greatly stimulated the use of electric light and power for industries and railways. At the same time, it has necessitated the installation of large steam turbines located near the centres of distribution, which must carry the load during periods of low water. This emergency usually occurs in the winter before the snows have begun to feed the rivers to any extent. However, there are also periods in the summer, particularly during the summer of 1922, when the need for steam stand-by stations was evidenced. In order to meet this situation, the Tokyo Electric Light Company has projected a 100,000 K.W. (150,000 H.P.) steam plant, and has just ordered the first half of their equipment, consisting of two 25,000 K.W. fifty cycle turbine generators from the Westinghouse Electric International Company, through their agents, Takata & Co.

This equipment, with necessary switch gear condensers, boiler plant and buildings represents an investment of Y.8,000,000. The machines are the largest ever supplied to Japan and operate at a speed of 1,500 turns per minute. Each unit weighs 300 tons, which, accordingly, must be dismantled for shipment, and rebuilt by experts at the site in Tokyo. Some idea of the size of these units can be obtained from the fact that one ton of coal per minute is required to operate the two machines at full load. These turbines are of the well-known Westinghouse impulse-reaction type, and are of the same general design as machines now in use which were installed fifteen years ago.

Another important order has been placed with the Westinghouse Company by the Toho Electric Power Company, for their Najima power station near the twin cities of Hakata and Fukuoka in the island of Kyushu. This installation consists of one unit of 20,000 kilowatts, operating at 1,800 r.p.m., as it must supply 60 cycle current. The site chosen for the plant is ideal, as it is located on a river within easy distance of numerous coal mines. Furthermore, it is practically at the centre of distribution for electric power and light in the island of Kyushu.

One of the most important uses of this machine will be to guarantee a continuous power supply to the Kyushu electric railway company which is developing interurban lines to insure easy and rapid transportation between the cities of this dist.ict.

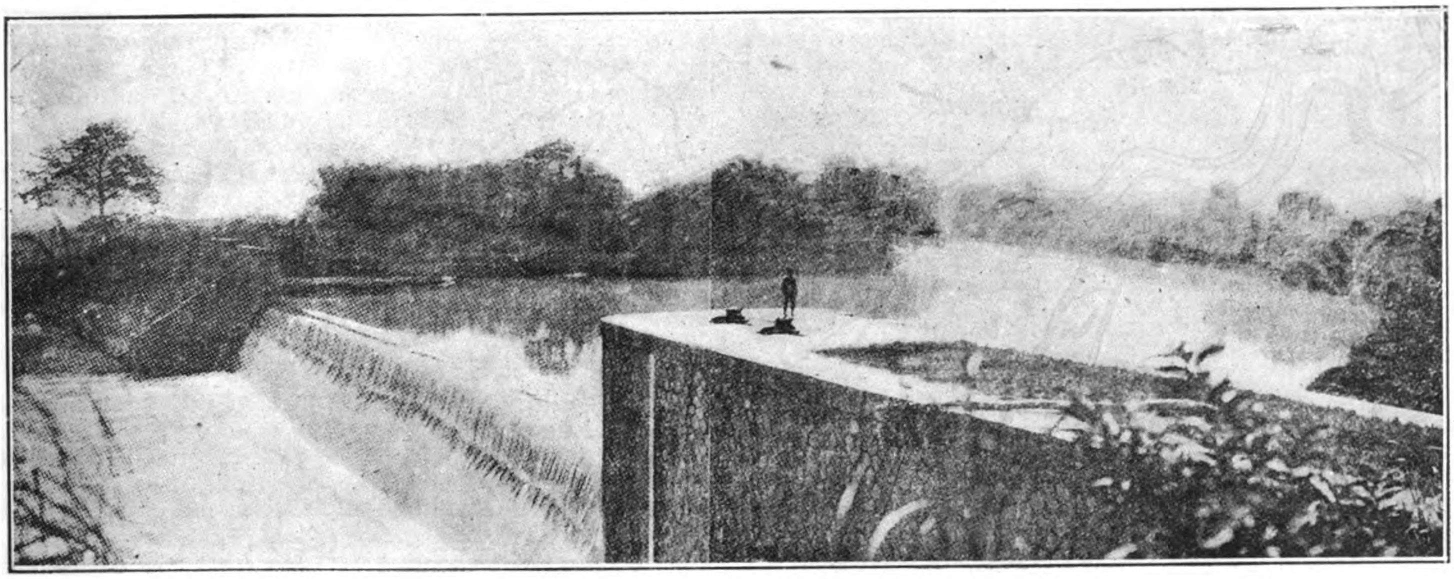
The reason for the selection of these 40,000 h.p. turbine generators was the fact that this make had been thoroughly tried out in Japan with the most gratifying results. As long ago as 1917, Westinghouse 25,000 kilowatt turbines were ordered by the Osaka Electric Light Company for installation at their Kasugade No. 2 power station. These have been operating for some time, supplying a large part of the light used by the city of Osaka, and a continuous run of two months without inspection is of common occurrence. In the future, such exacting demands will not be made, as these machines will be linked up with the super-power hydro-electric system of the Daido Electric Power Company, which has now invaded Osaka.

These stand-by steam turbine plants in Tokyo, Osaka and Kyushu will serve as a guarantee of electric light and power to over 5,000,000 people. The use of electricity will be greatly stimulated by these safeguards, and there will no longer be any hesitation towards making use of the conveniences offered by electricity. All industrial plants will electrify, electric railways will multiply, and homes will use more and more electricity for lighting, cooking and heating, until Japan is 100 per cent. electrified.

## The Kuhara Mining Co. Plans Hydro-Electric Enterprise

For several years past the depression of the copper market in Japan has severely restricted the operations of all copper mining companies, and among them the Kuhara Mining Co. has also been obliged to suspend several of its plans. Recent improvement in the price of copper abroad has had a very favorable effect on the Japanese copper companies and the Kuhara Mining Co. is now said to be preparing to begin construction of hydro-electric plants planned many years ago, on the Sho, Shira and Koshira Rivers, to develop a total of 100,000 k.w. It is estimated that the first period of construction will complete 60,000 k.w., at a cost of Y.600,000 per kilowatt, making the total cost Y.24,000,000. All the machine equipment will naturally be supplied by the Hitachi Engineering Works, which is a subsidiary of the Kuhara Mining Company.

It is expected that work will be begun this year, and that a call for payment of unpaid balance of capital on the new share issues of the Kuhara Mining Company will soon be made.



Irrigation at Kep—Can-son Dam

# Irrigation in Indo-China

ALTHOUGH in recent years the cultivation of certain new plants, such as hevea, cotton, sugar-cane, etc., has been introduced into Indo-China, that of rice remains far and away the most important, and this plant requires a large amount of irrigation per acre. For this reason irrigation is of capital importance in a country where the rains and consequently the volume of the rivers are very irregular. The problems to be solved are three-fold: ordinary irrigation by gravitation, controlling rivers and their floods (the Red River and the Me-kong) and regulating the effects of the tide in the canals of Cochin-China.

## 1. Tonkin

In Tonkin it is a question of irrigating the land and also of protecting them from the floods of the Red River. While it is true that some of the irrigation canals may be utilized for navigation, yet this use remains strictly subordinate to that of irrigation.

Although Tonkin is very densely populated yet it is manifest that the natives do not draw all the riches they might out of the soil, the principal reason for which is the irregular natural irrigation. The water arrives either too soon and is afterwards insufficient for the proper growth of rice or other crops, or too late to allow of the sowing, or, owing to copious rains or to the river bursting its banks, the whole country is flooded and the crops are totally lost.

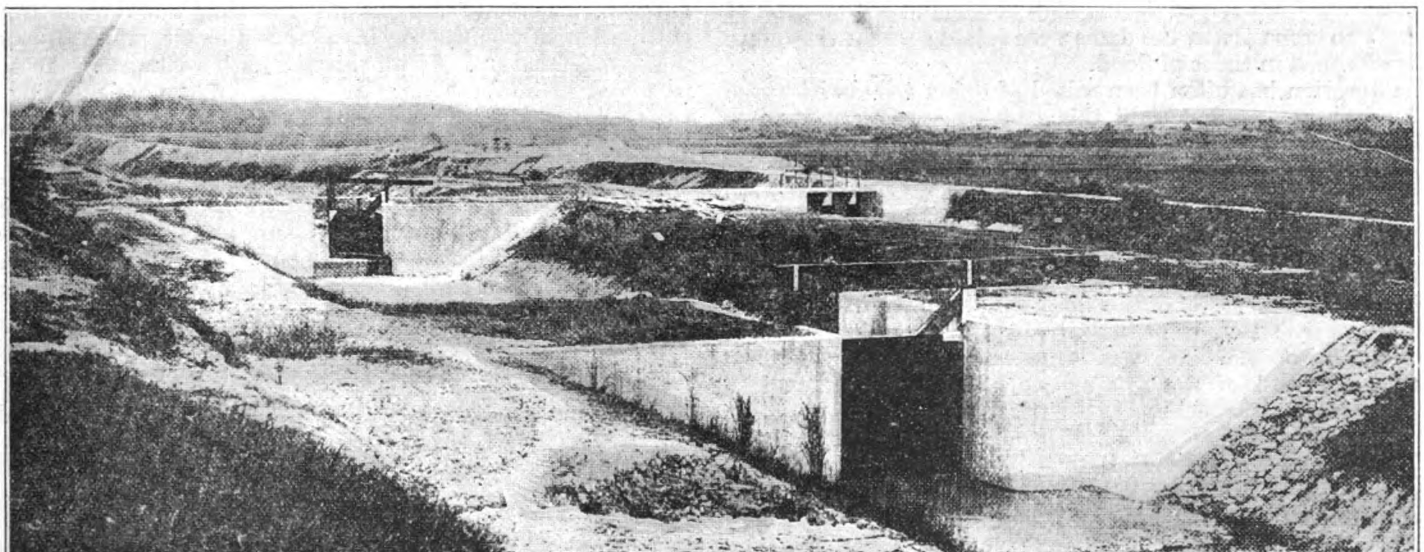
### (A) Works Against Floods

In Tonkin the delta of the Red River is the most fertile and the most densely populated part, so that the works controlling this river are of the highest importance.

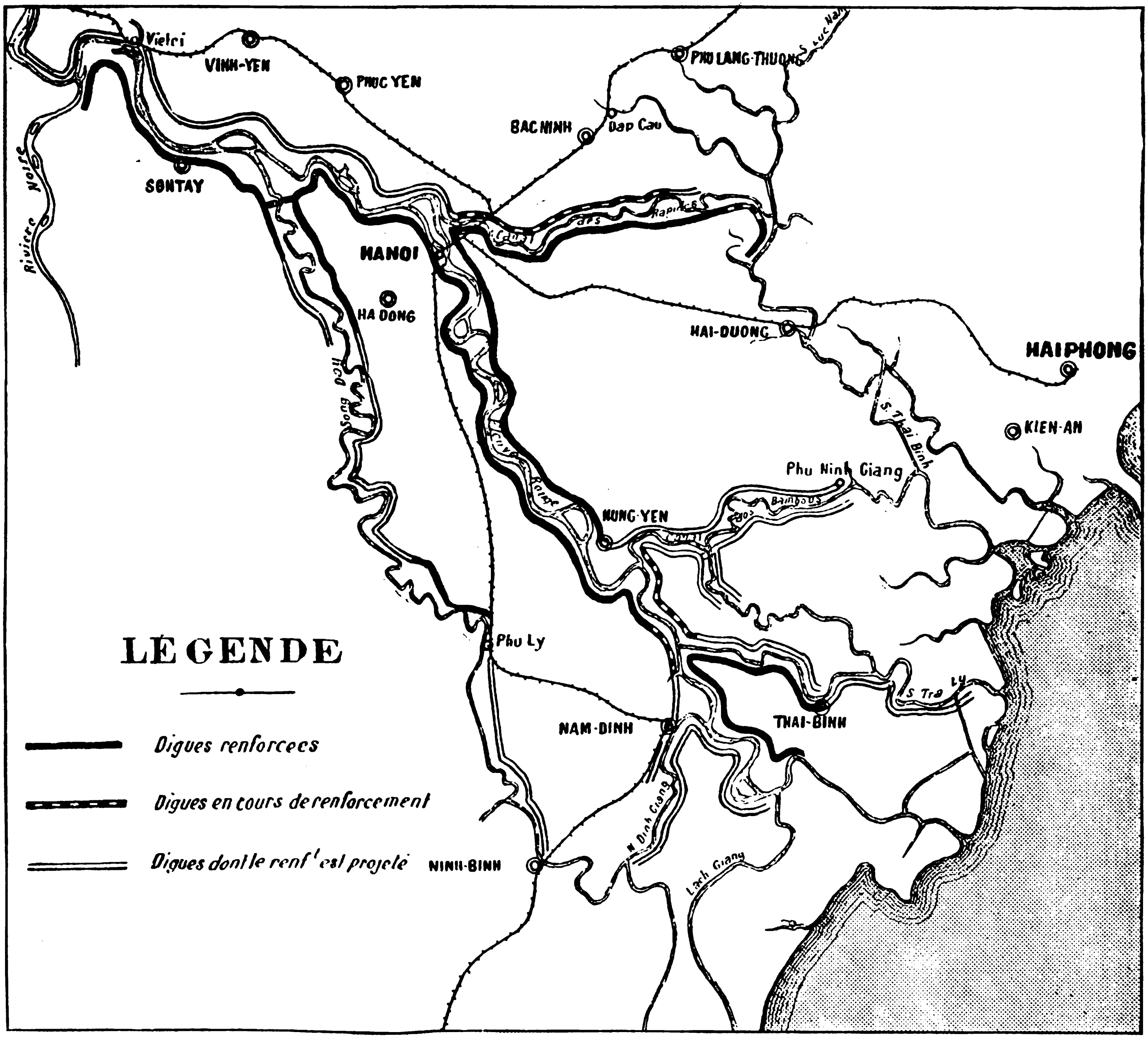
Both the Red River itself and the mouths through which it reaches the sea are protected by dams, so that in flood times the level of the water is considerably higher than the surrounding country. In 1917 the Red River at Hanoi reached the height of 38-ft. above sea-level, whereas the surrounding country is but $16\frac{1}{2}$-ft., from which will be seen the extent of the danger menacing the delta during several months of each year.

The breaking of a dam always spells disaster, for not only are the crops destroyed but the mud huts of the natives are quickly swept away and they and their cattle are often drowned. Further, when the water breaks through it deposits an immense fan-shaped spit of sand reaching often far over the country and putting an end to all cultivation of the land thus covered.

The damming of the Red River began some 700 years ago, although an embankment to protect the town of Thanh-Long



Irrigation at Vihn-Yeh—Lock and Regulating Weir




River Embankments of Tonkin

(now Hanoi) existed prior to this. At first but low dams were built which were submerged during high floods, but with a view of obtaining two crops a year the dams were raised so, that they were never overtopped in times of flood.

The question has often been raised of doing away with these embankments, and at first sight this solution appears attractive, for it is contended by many people that the Red River would thus become a second Nile covering the rice-fields each year with its fertilizing mud, and as the annual floods would be spread all over the country, it would be about a foot deep at the most, while the fertility due to the mud would make up or the loss of one of the present annual crops.

After a thorough study of this question, during which the most enlightened natives were consulted, it was recognized in 1905 that the suppression of the dams was impossible, and that the only thing to do was to keep them up and to strengthen them against the erosive and bursting actions of the river. That this is no mean task will be realized when one bears in mind that the volume of water brought down by the Red River has been known to reach 30,000 cubic yards (6,600,000 gals.) per second, and that during the floods of 1917 some 52,000,000,000 cubic yards (8,800,000,000) gals.) of water poured through the breaches in the embankments.

These breaches may be caused either by infiltration or simple pressure or by syphoning. In times of flood the banks are watched day and night, and they and the land immediately behind them are always kept as far as possible free from buildings or from such cultivation as would make inspection difficult, while all near-lying ponds are filled up. In all this the native villagers take a willing part and maintain a constant guard on the neighboring dams. On the least sign of danger the villagers, who naturally realize that their all is at stake, are called and carry out the necessary strengthening works without delay.

A breach may also be caused by the flood overtopping the main dams owing to the little supplementary dams hurriedly raised in times of specially high flood not being strong or high enough to retain the water which, beginning by a thin overtopping stream, soon washes everything away.

Finally breaches may be due to the river changing its course as its erosive action at bends is very great.

All this goes to show the vital importance of these defence works, which have been thoroughly studied by each succeeding government engineer. The vagaries of the Red River are by now sufficiently known to enable application to be made of suitable remedies for the mitigation, as far as possible, of its inherent dangers, but in view of the enormous volumes of water that have to be dealt with, as well as to the suddenness of the floods, it would be too much to expect to eliminate all accidents. It is, however, hoped

to reduce these to a minimum by strengthening the dams and improving the access to the sea.

In Tonkin some 1,250 miles of dams are to be found; and their maintenance necessitates the consolidation of weak spots, the building of new dams and the raising of others above flood level, as well as the fixing of the bed of the river.

The consolidation of the dams has been undertaken since 1918 and has cost as follow:

| | |
|---|---|
| 1918 | 300,000 piastres |
| 1919 | 360,000 — |
| 1920 | 560,000 — |
| 1921 | 540,000 — |
| Total | 1,760,000 — |

Every effort has been made to fix the bed of the river as far as possible. In 250 places rip-rap stonework has been built, costing in 1916 about 300,000 piastres, while since 1917 some 80,000 piastres have been devoted to this work every year.

At some important places the actual bank on the outside has been faced with stone and this has been notably the case at Son-tai and at Xam-Thi and Co-lieu in the province of Hadong; the cost of this was as follows:

| | |
|---|---|
| Son-tai | 20,000 piastres |
| Xam-Thi | 130,000 — |
| Co-lieu | 100,000 — |

All the works above enumerated have notably reduced the number of breaches, and further projects for the improvement of the months of the rivers are now being studied.

## (B) Irrigation

Although exposed to floods in the rainy season the crops require irrigation in the dry.

Before the French occupation the natives had taken no serious steps towards irrigating their fields; rudimentary sluices, it is true, had been established here and there but under unscientific conditions. These works furnished but poor results and simply met, in an extremely inefficient manner, certain limited local conditions.

The French authorities found it necessary to undertake works to protect their new proteges from the annual menace of famine and, as soon as the map of Tonkin on the scale of 1 : 100,000 (about 16 miles to the inch) and of the Delta on the larger scale of 1 : 20,000 (about three miles to the inch) were published, the department of public works immediately busied itself with this question.

In 1903 regular measurements were undertaken of the rainfall, humidity of the atmosphere and of the heights of the rivers.

The Delta produces two crops of rice—one known as the fifth month crop and corresponding to the dry season and the other known as the tenth month crop, corresponding to the rainy season. Irrigation is wanted more or less solely for the earlier, and it can be carried out by gravitation or by pumping.

## (A) Irrigation by Gravitation

The earliest preliminary trials were undertaken over a limited area in the plain of Kep in the province of Bac-Jiang.

The water was taken from the Song-Thuong in which a dam 460-ft. long and having an over-fall of 230-ft. was built, the water being brought by a canal five miles long to the head of the area of distribution, en route another over-fall of 177-ft. practically kept the water of the canal at one constant level.

The canals in the irrigation zone were as follows:

1° A main canal of 20¼ miles;

2° 20 miles of arteries, and smaller arteries;

3° A network of still smaller arteries of a total length of about 186 miles. This has been at work since 1914 and includes: dams and over-falls on the main canal, sluices at the beginning of each large or small artery, syphons, aquaducts, races, water-chutes, iron and masonry bridges and wooden foot-bridges, the whole covering 18,534 acres.

The cost of construction was 675,599 piastres or 36.5 piastres per acre irrigated, and the yearly upkeep amounts to about 405 piastres per acre.

This irrigation on the plain of Kep has shown the great value of irrigating the land in Tonkin, for worth but 25.3 piastres an acre before the work was commenced, it now fetches about 81 piastres and its owners have become the best customers for phosphated manures.

Such a conclusive trial has naturally led to further schemes and at the present time irrigation works covering an area of about 42,000 acres have just been opened at Vinh-Yen: this comprised the building of a dam and the cutting of a network of canals, as well as the construction or all other necessary works. The work commenced at the end of 1914 have been recently (1922) opened. The total cost was estimated at 1,100,000 piastres or 26.2 per acre irrigated.

Further, work will shortly be begun on another scheme on the Song-Kau including a navigable canal between Thai-Nguyen and Phu-Lang-Thuong and permitting of the irrigation of 84,000 acres, the cost of which is estimated at 3,000,000 piastres.

## (B) Irrigation by Pumping

Irrigation by gravitation is not always possible and in many cases pumping must be resorted to. Experiments have been made at Phu-Xa, immediately above Hanoï which have determined the amount of water required and the cost of carrying out such pumping work. On these data the following schemes have been proposed:—

| | |
|---|---|
| North Kesat | 98,850 acres |
| South Kesat | 197,700 ,, |
| North Bac-Ninh | 111,200 ,, |
| North Hadong | 76,600 ,, |
| South Hadong | 51,000 ,, |
| Sontai | 34,600 ,, |
| North Sontai | 24,700 ,, |
| Phu-Tho | 24,700 ,, |
| Total | 620,250 acres |

The estimates amount to 11,475,000 piastres or 18.8 piastres per acre.

## (C) Drainage

A fresh problem has to be solved in the lower delta, which is cut up by numerous water-ways into "compartments" protected against floods by dams. Rain-water has to be drained from these "compartments" and this is at all times difficult on account of the dams and impossible in time of flood owing to the height of the water in the canals which form their lines of demarcation.

Works undertaken in the Hanoï "compartment" of about 250,000 acres and bounded by the Red River, the Dai and the Phu-Li canal have already improved some 74,000 acres, and by pumping it is hoped to improve another 98,850 acres. This first amelioration has been arrived at by widening and clearing the canals in the "compartment," isolating certain secondary "compartments" and constructing weirs.

## (D) Keeping Out Salt Water

Works for protecting the "compartments" of Song-Da-Lo (Kien-An), Doson (Kien-An), Vinh-Bao (Haiduong), Tien-Hai and Truc-Ninh (Thai-Binh) and of Kim-Son (Ninh-Binh) from salt or brackish water have already been carried out and consist principally of the construction of embankments and evacuation sluices on ground recently won from the sea. A supplementary system of irrigation canals brings the necessary fresh water for the crops.

## II. Annam

Annam consists of a narrow strip of lowland lying between the sea and the Annamite chain of mountains which here and there throws out spurs running down to the coast. The cultivable land is to be found in the deltas of the short torrential rivers running down from the mountains.

Here, where rain falls much more irregularly than is the case in Tonkin irrigation becomes of greater importance. As a rule agriculture is possible only during the rainy season and the one harvest is often spoilt, so that in this strip of country with one of the heaviest rain-falls in the world a comparatively short drought may cause a famine.

The Annamites, after driving out or absorbing the Chams, who certainly understood irrigation better than their conquerors, have gone in this direction only so far as their feeble tools allowed, and it became incumbent on the French authorities to do something towards irrigating the series of little deltas, wherein are to be found the arable lands. Irrigation works in the province of Thanh-Hoa were the first to be undertaken and they comprise: a dam on the Song-Chu, hydro-electric works on the main canal thus

formed and a network of smaller irrigation canals for the irrigation of some 123,500 acres by gravitation and 49,400 acres by pumps driven by power derived from the electric station. The first cost is put at 3,500,000 piastres for the acreage irrigated by gravitation (28.3 piastres per acre) and 1,000,000 piastres for that irrigated by pumping (20.2 piastres per acre), and the works begun in 1918 should be completed in 1923.

Work is in progress on a scheme for irrigating 49,400 acres by gravitation in Phu-Yen taking its water from the Song-Da Rang.

The public works department proposes to carry out the following schemes :—

1° By gravitation :

| | |
|---|---|
| Kwang-Ngai .. .. .. .. .. .. | 74,100 acres |
| Hue .. .. .. .. .. .. .. .. | 37,050 „ |
| Kwang-Nam .. .. .. .. .. .. | 74,100 „ |
| Nhatrang Phanrang .. .. .. .. .. | 49,400 „ |
| Total .. .. .. .. .. .. .. | 234,650 acres |

The estimated cost, including the irrigation of the Phu-Yen, amounts to $8,600,000.

2° By pumping:

| | |
|---|---|
| Hatinh .. .. .. .. .. .. .. | 98,850 acres |
| Hué .. .. .. .. .. .. .. .. | 37,050 „ |
| Vinh.. .. .. .. .. .. .. .. | 123,550 „ |
| Kwinhon .. .. .. .. .. .. .. | 49,400 „ |
| Kwang-Nam .. .. .. .. .. .. | 74,100 „ |
| Total .. .. .. .. .. .. .. | 382,950 acres |

At an estimated cost of $7,000,000.

## III. Cambodia

Irrigation is as necessary in Cambodia as in Tonkin and Annam, as the rains are very irregular and the advantages to be derived therefrom are quite as important.

A scheme has been proposed for the irrigation of some 197,700 acres by a canal from the Preck Knot, the cost of which is estimated at $6,000,000.

Previous to this a scheme was proposed to cut an irrigation canal from above the falls at Khong on the Me-kong, but this has been abandoned in favor of an electric station utilizing the falls at Sambor and supplying power for irrigating by pumping the lands bordering on the Me-kong, and it is expected that some 1,235,600 acres could be irrigated at a first cost of $23,000,000.

## IV. Cochin-China

In this country successive budgets have provided funds for maintaining and cutting large canals for regulating the tidal waters, as well as the floods of the Me-kong, for the benefit of existing and proposed rice-fields.

These canals will serve at the same time for the circulation of the natives and for the transport of goods and produce of the soil to the various local markets and, especially as regards rice, to the factories and over-seas quays of Cholon-Saïgon.

These water-ways are an essential organ of the life and development of Cochin-China. For the last twenty-five years the network has been systematically increased and forms a striking feature of the country, admired alike by the natives and by foreign visitors. The report of the last colonial commission of inspection calls attention to these water-ways and to the methodical way in which they have been developed by the government of Indo-China.

In the canals uniting two rivers in which tidal action is felt, this current enters from the two ends, carrying with it a light mud and depositing the same where the two currents meet, which is practically always about the same spot, forming here a shoal of mud. To avoid the formation of these shoals, with their attendant disadvantages the public works department, which has studied the problem since 1880, decided to form basins at the neutral points wherein the mud would be naturally deposited, and the first works of this kind were carried out in 1891 in the Duperré Canal and were followed by similar undertakings in the Saintard Canal, in the Chinese Arroyo, at a second point on the Duperré Canal, on the Mangthit and on the Lapvo Canal, all of which proved highly satisfactory.

Before the arrival of the French, the Annamites constructed, maintained and improved the canals as best they could with the very limited means at their command, with the result that as a rule these water-ways were much too small. In 1884 the French authorities bought dredgers and later bids were asked for in Paris for the dredging of the canals of Cochin-China. This work was commenced in 1894, the contract amounting to 12,000,000 francs and at the same time the Authorities carried out dredging operations according to a fixed schedule with its own dredgers. Work has been continued ever since, successive contracts having been let to a French Company. The most recent contract is for the five years ending December 31, 1926 and the minimum yearly expenditure is fixed at $1,200,000 for the large water-ways and $70,000 for the smaller ones making at total of $6,420,000 for the whole period.

The latest program is for the same five years and the expenditure is estimated at $7,250,000 of which $6,000,000 will be provided by the general budget of the union and the remainder by the local budget of Cochin-China. This includes the dredging of some 86,325,000 cubic yards in existing canals at an estimated cost of $2,650,000, and the improvement of existing ways in the Plaine des Jones, as well as the cutting of new canals. The public works department of Cochin-China is actually engaged in making a complete map with contour lines of the Plaine des Jones.

It may be mentioned that dredging operations were pushed forward in 1920, 9,367,582 cubic yards being dredged at a cost of $1,296,104.

The usefulness of these canals may be measured by the increasing exports of rice which rose from 500,000 tonnes in 1898 to 1,020,000 in 1920 and over 1,500,000 tonnes in 1921. At the same time these increased facilities for irrigation have made it possible to cultivate sugar-cane, cotton and coco-nut palms.

## Appendices

1. Table showing existing and proposed irrigation works :
2. Map showing the river dams in Tonkin :
3. Map of the canals in Cochin-China.

## Irrigation Works in Indo-China

### A.—Tonkin.

#### I. *Existing Works.*

| | | | |
|---|---|---|---|
| Kep .. .. | 18,534 acres | By gravitation. | Cost $ 675,000 |

#### II. *Works in Progress.*

| | | | |
|---|---|---|---|
| Vinh-Yeh .. | 44,481 acres | By gravitation. | Cost $1,100,000 |

#### III. *Proposed Works.*

| | | | |
|---|---|---|---|
| Song-Kau, left bank ... | 84,000 acres | By gravitation | ...Cost $3,000,000 |
| Song-Kau, right bank ... | 96,400 „ | — | — $2,925,000 |
| Kesat, north ... ... | 123,550 „ | 669,650 acres By pumping | ...Cost $11,475,000 |
| Kesat, south ... ... | 197,700 „ | | |
| Bac-Ninh, north ... | 111,200 „ | | |
| Hadong, north ... ... | 76,600 „ | | |
| Hadong, south ... ... | 76,600 „ | | |
| Sontai ... ... ... | 34,600 „ | | |
| Sontai, north ... ... | 24,700 „ | | |
| Phu-Tho ... ... | 24,700 „ | | |
| | | Total for Tonkin ... | $19,175,600 |

### B.—Annam.

#### I. *Works in Progress.*

| | | | |
|---|---|---|---|
| Thanh-Hoa ... ... | 123,550 acres | By gravitation | ...Cost $3,500,000 |
| — ... ... | 49,400 „ | By pumping | ... — $1,000,000 |

#### II. *Proposed Works.*

| | | | |
|---|---|---|---|
| Kwang-Ngai ... ... | 74,000 acres | 283,800 acres By gravitation | ...Cost $8,600,000 |
| Hué ... ... ... | 37,000 „ | | |
| Phu-Yen ... ... | 49,400 „ | | |
| Kwan-Nam ... ... | 74,000 „ | | |
| Nhatrang Phanrang ... | 49,400 „ | | |
| Hating ... ... ... | 98,850 „ | 382,800 acres By pumping | ...Cost $7,000,000 |
| Hué ... ... ... | 37,000 „ | | |
| Vinh ... ... ... | 123,550 „ | | |
| Kwinhon... ... ... | 49,400 „ | | |
| Kwang-Nam ... ... | 74,000 „ | | |
| | | Total in Annam ... | $20,100,000 |

### C.—Cambodia.

#### *Proposed Works.*

| | | | |
|---|---|---|---|
| Preck Knot ... ... | 197,700 acres | By gravitation | ...Cost $ 6,000,000 |
| Me-Kong... ... | ...1,235,000 „ | By pumping | ... — $23,000,000 |
| | | Total in Cambodia... | $29,000,000 |

### D.—Cochin-China.

| | |
|---|---|
| Proposed works ... ... ... ... ... ... ... | $ 8,000,000 |
| Grand Total ... ... ... | $76,275,600 |

# Hydro-Electric Developments in N.E.I.

## The Electrification of Railways Already Well Under Way

*By Richard Hoadley Tingley*

THE coal resources of the Dutch East Indies are limited and largely undeveloped. That the home supply is insufficient to meet the demand is evidenced by the fact that this colony annually imports from 200,000 to 500,000 tons, and exports none. The principal mines, owned and operated by the government, are the Ombilin, near Padang on the west coast of the island of Sumatra; the Boekit Asem collieries near Palembang, toward the east coast of the same island; and those on the small island of Pulo Laut off the southeast coast of Borneo. The total annual production of these mines is barely 500,000 tons—a large portion of which finds its way to the sister island of Java, the largest user of coal, where practically none is mined.

Recognizing the folly of continuing to import coal while permitting its many water-power resources to remain in an undeveloped state, the government, in 1910, organized a new branch of service and appointed Mr. P. A. Roelofsen, C.E., now director of public works, director of the department of water power and electricity, with instructions to report upon the hydro-electric potentialities of the Dutch East Indian possessions as well as upon the water-power sites already developed.

Mr. Roelofsen's report, which does not include certain of the innumerable lesser islands or much of the little-known part of Dutch New Guinea, summarizes the hydro-electric possibilities as follows:

| | |
|---|---|
| Java | 500,000 h.p. |
| Sumatra | 2,000,000 ,, |
| North Borneo | 2,000,000 ,, |
| Celebes | 1,000,000 ,, |
| Total | 5,500,000 h.p. |

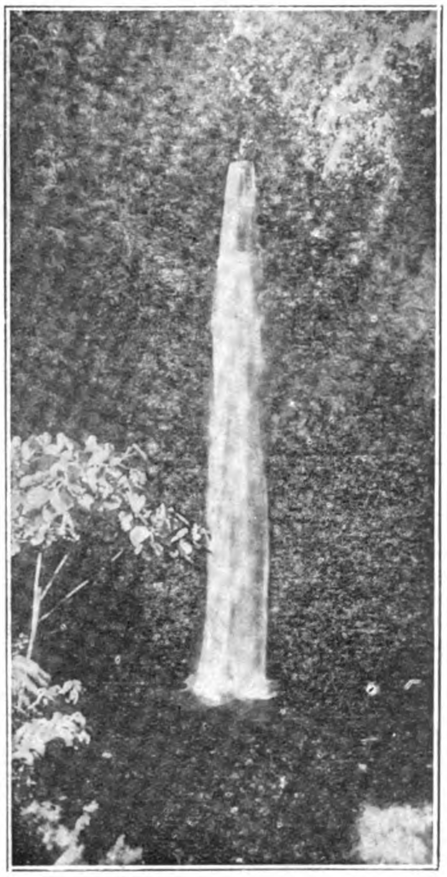
We shall say but little about any of the islands except Java. The others referred to are largely undeveloped, and it will be many years before any of them will be so advanced that it will be practicable to utilize even a small portion of the water-power resources accredited to them. With Java, however, the case is different. This island has a population of about 33,000,000—710 to the square mile, and is by far the most densely inhabited country in the world. Its nearest approach is Belgium, with 650 people per square mile. Of this population, about 110,000 are whites, who are an important factor in the commercial life of the island, while the rest are native Javanese with a sprinkling of Chinese and other Asiatics.

Java is the garden spot of the Dutch East Indies and the most highly developed of the islands. In size it is about equal to that of the state of New York. From the shore line to the base of the mountains that form the backbone of the island, intensive cultivation is in progress the year round and there all the agricultural products are raised for domestic use and for export. So important and valuable are these that Java has been able, in consequence, to maintain for many years a favorable trade balance with the outside world.

Railway construction began in Java in 1878 with a short section of 36 miles from Surabaya to Passoeroean. Since that time a system of about 3,000 miles has been built—1,550 miles of which is owned and operated by the government and the remainder by twelve private companies. The greater portion of this mileage is of their standard gauge, that is, three feet six inches. A small part, however, is distinctly narrow gauge, about two feet, and another small portion is equal to the United States standard of 4 feet 8½ inches. Some idea of the comparative extensiveness of Java's

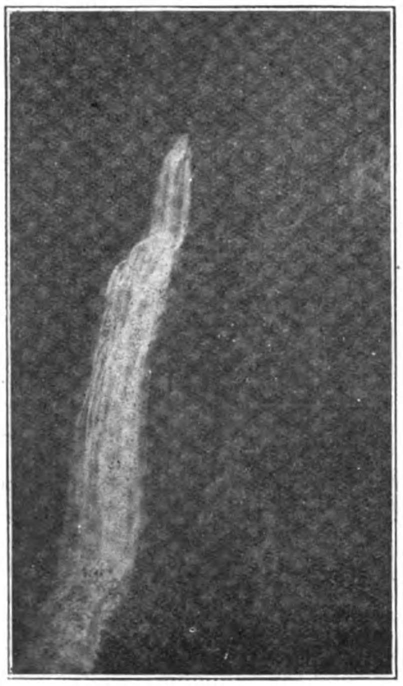
Fall in Tji Saroena, West Java

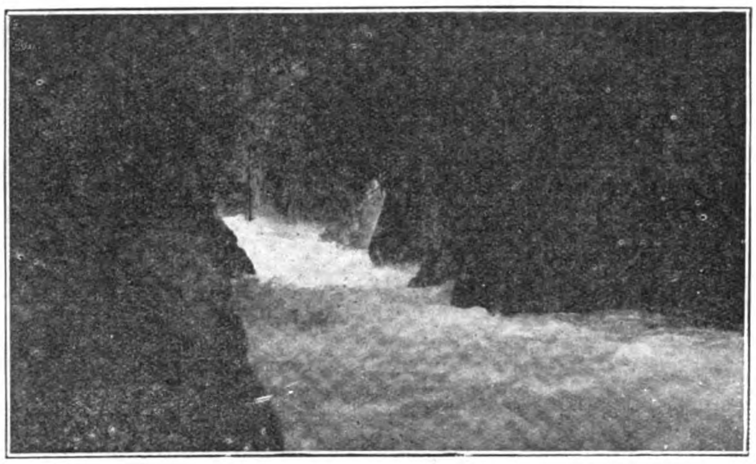
Fall Near Dago, West Java



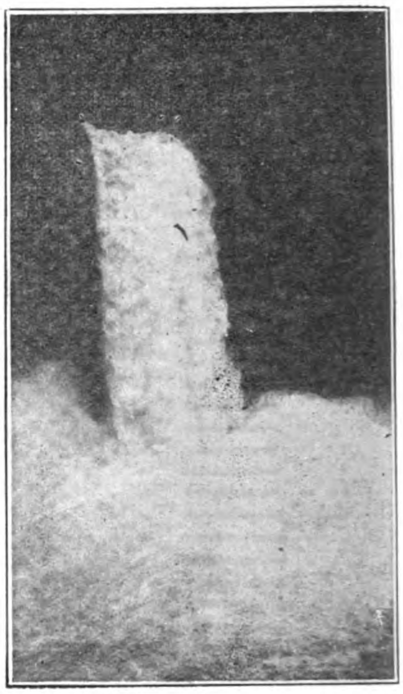
Fall in Tji Mahi, near Tpisaroena, West Java

## ASAHAN RIVER





Near Gala-gala, Sumatra

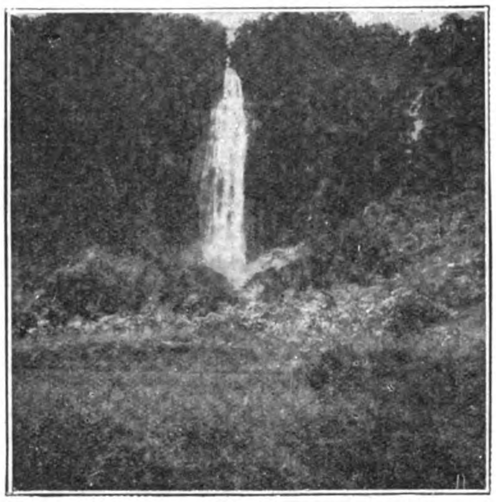


Left: Fall of Aek Tonot, near Tangga, Sumatra    Right: Asahan Falls, near Tangga, Sumatra

railway development may be had when it is realized that this island maintains a mile of track for each seventeen square miles of its area as against a mile for each twelve square miles in the United States.

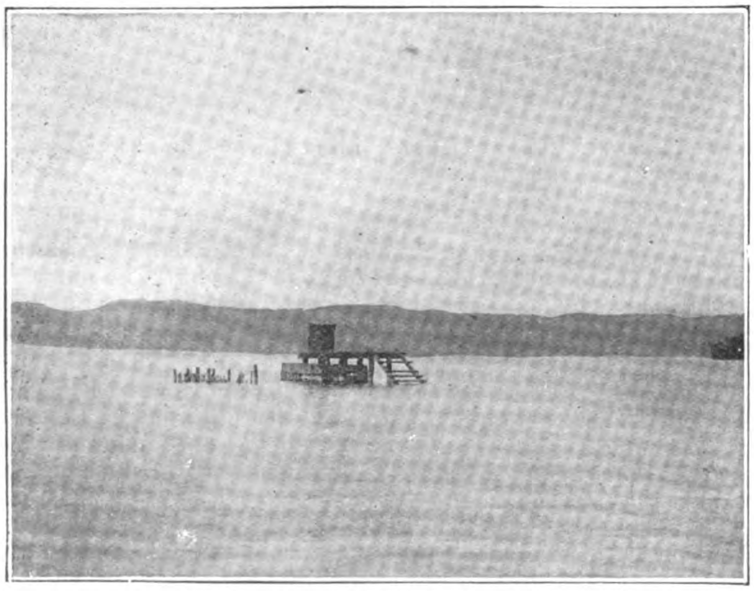
Java is about 600 miles long and has an average width of something less than 100 miles. For fully half of its western length it is traversed by two railway lines, which are approximately 60 to 80 miles apart, while its eastern end is served by a single main line. Throughout the island there are many branches, running north and south, which connect important sections. The roadbed is excellent, the service is good, and the companies are prosperous. At present it takes a day and a half to travel from Batavia, on the west, to Surabaya, on the east. For economic reasons, unknown to the writer, Java trains do not run at night; and a through passenger is, therefore, obliged to spend the night at some city en route.

Asahan River, Sumatra

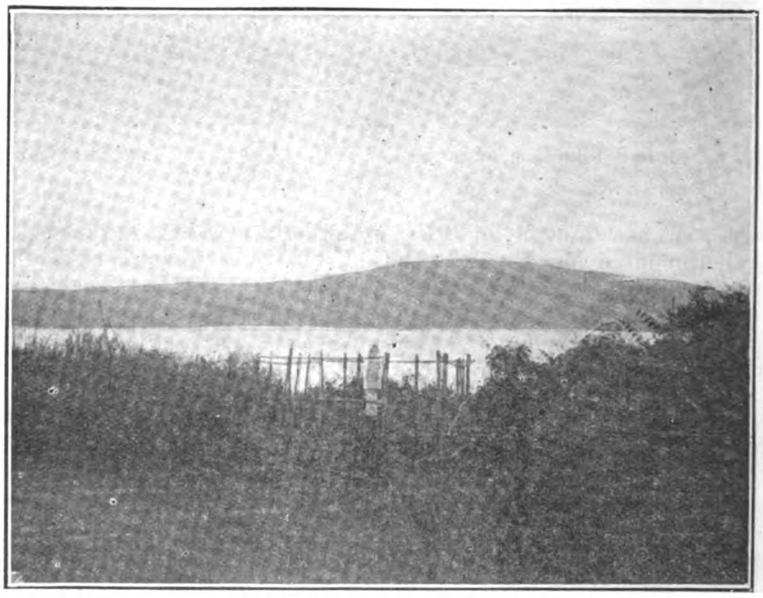


Fall of the Ack River, near Tangga, Sumatra

The department of public works estimates that if the available water power were developed to capacity—50,000 h.p., it would be sufficient to operate the entire railway system and to leave, besides, a surplus for industrial and public-utility uses. A carefully worked out plan has been prepared looking to that end which, it is hoped, will be fully realized in about ten years, or sooner, should financial conditions warrant. In this manner the Dutch East Indian government hopes to be able to stop the importation of coal—thus saving that product for other uses and for export.



Autographic Water Stage Register in Lake Matano, Celebes



Rain Gauge, near Lake Matano, Celebes

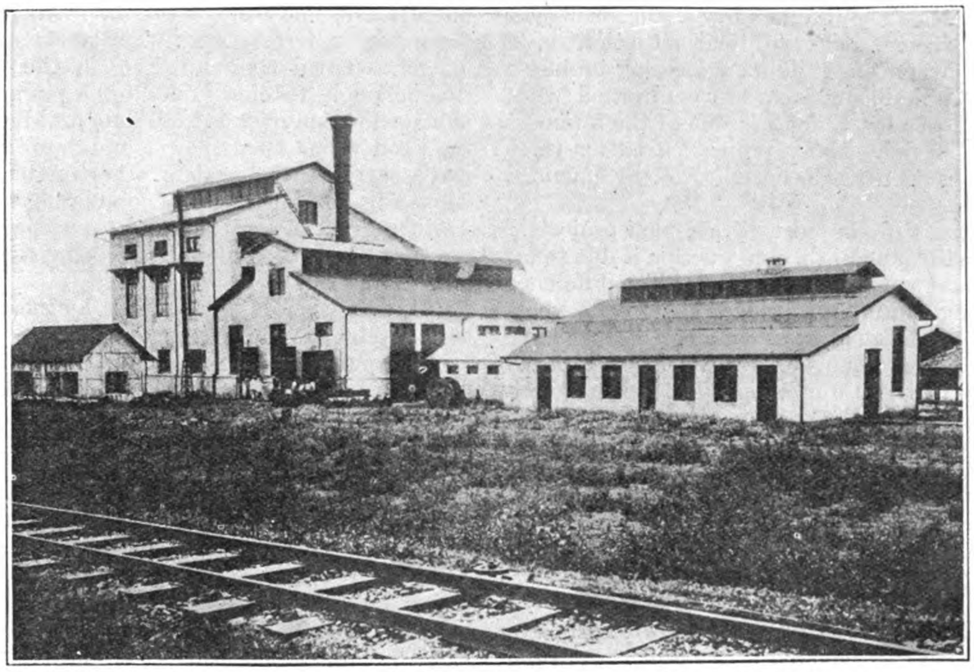
In the nature of things, however, Java's water-power resources are small. The drainage basins are restricted in area because the streams all flow in a generally north or south direction—the short way of the island. This deficiency is partly overcome by a very heavy rainfall—which ranges from an average of 120 to 160 inches annually and reaches, occasionally, as high as 320 inches in the more mountainous regions—and by the high head of many of the steams as they tumble down the steep slopes.

Java's dry season occurs in May, June, and July, while its period of greatest precipitation is in November, December, and January. The normal average flow of the streams is rated at 175 second-feet—reaching 700 second-feet at times. It is estimated that the largest single source of water power is capable of developing about 50,000 h.p. The majority of the prospects, however, are rated at from 1,000 to 5,000 h.p. Most of the developed and undeveloped hydro-electric resources are in western and central western Java.

The principal activity in Java's water-power development is centred, at the present time, in the westernmost end of the island where two power stations are being constructed—a portion of the current there generated to be utilized in operating the existing railway line running from the harbor of Tandjong Priok, through Batavia, Weltevreden, Buitenzorg, thence southerly and easterly toward Bandong, a total distance of about 60 miles. The larger of the hydro-electric stations is at Tji Anten (*tji* meaning river), some twelve miles west of Buitenzorg, and has a capacity of 25,000 h.p. The smaller one at Tji Tjatih, about 30 miles south of Buitenzorg, has a capacity of 15,000 h.p. It is expected that these stations will be in full operation, and the railway lines electrified, some time in 1923, thus forming the first link in the chain of electrification which will extend eastward, 500 miles, to Surabaya. The work is in charge of Dr. J. N. Van Der Ley, who succeeded Mr. Roelofsen in this branch of the service.

The primary power developed at each station is of 70,000 volts, 3-phase, 50 cycles. For railway use the current is transformed to 1,500 volts for distribution and further transformation. Much of the equipment for the power houses and transmission lines is being purchased in the United States. This includes 60 galvanized-steel towers, each 75 feet high, equipped with three cross-arms for a double 3-phase line. Upwards of 900,000 pounds of hard-drawn copper cable has also been bought in America. This cable is of two sizes, that is, 50 and 70 square millimetres, and each is composed of seven wires. Furthermore, the United States will furnish much of the smaller power-house and transmission-line material. There was lively competition between Europe and the United States to get the contracts for much of the larger equipment, and in this bidding the homeland, Holland, obtained a preferential, sometimes as high as 15 per cent., over other countries, notwithstanding the long-established free-trade policy of The Netherlands and her colonies.

In addition, there are under construction state hydro-electric stations on Tji Kapoendoeng, near Bandong, to be of 3,000 h.p. capacity, and on the Tji Saroewa, near Pangalengen, of 4,500 h.p. Farther east two small stations are being built—one, an auxiliary plant of 400 h.p. on the Tji Hapit, at Bandong, and another of about 1,000 h.p. for radio purposes south of Bandong. All the stations already built or under construction have been planned to fit into the general developmental scheme of the island, and are to be so interlinked that they will be able to assist one another in times of need.



**The N.E.I. Government Steam Central Electric Power Plant at Dajeu-kalot**

Perhaps the most important of the hydro-electric plants already operating in Java is that in the Tjatoer valley, near Madiun. At Madiun are located the extensive shops of the government railway; and the increased traffic in 1911 and 1912 made the enlargement and remodeling of these shops a necessity. In 1914, therefore, the government decided to make the improvements and extensions, and adopted the recommendation of Director Roelofsen that they be electrically equipped throughout. Previous to this time the available water power of the Tji Tjatoer had been fully investigated, and work on the project was started. Since March, 1917, this station has been in continuous operation, and may be briefly described as follows:

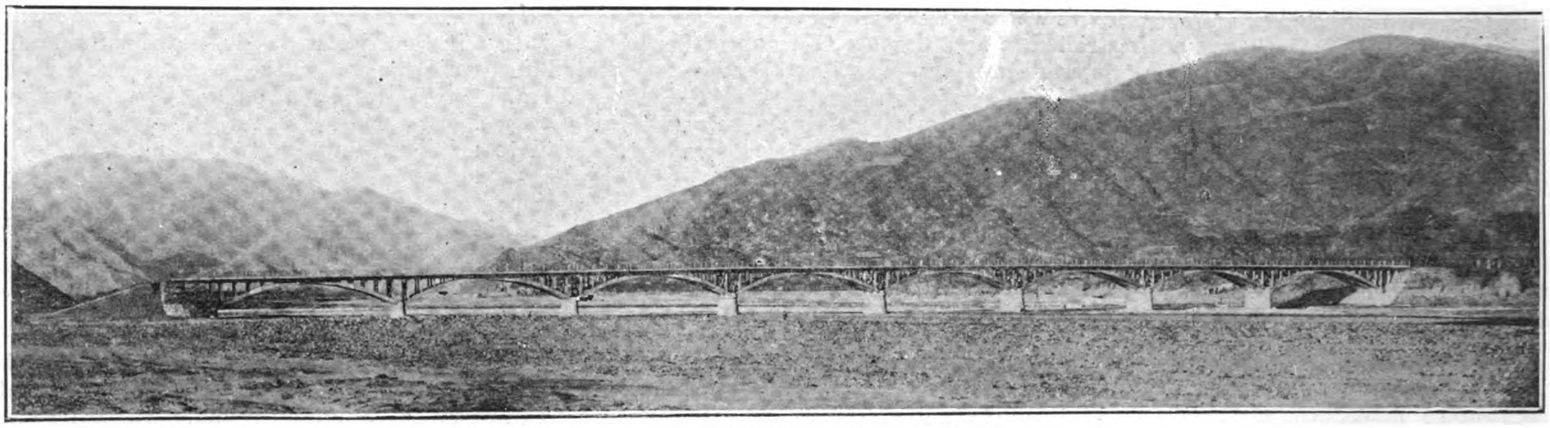
The Madiun plant generates current at 6,300 volts, transformed to 26,000 volts for transmission to town. The transmission line is seventeen miles in length, and the steel towers, which are 128 feet apart, are arranged to carry two 3-phase circuits. The net head, after deducting all losses, is about 100 metres, and the entire plant is capable of supplying 2,000 h.p. from two turbines when sufficient water is available. Six years of observation and stream gauging have determined that the full capacity of the turbines could be relied upon for but 6½ months in an average year; and the station is now operating under these conditions. The department, however, expects to augment the capacity of the plant at some future date so that 2,000 h.p. may be delivered continuously the year round. It has not yet been determined, however, whether this will be done by installing a steam auxiliary or by building storage reservoirs farther upstream. At present, power is supplied only to the railway shops. As soon as the maximum current of 2,000 h.p. is available throughout the year, the city of Madiun will be provided with electricity for lighting.

One of the problems in designing water-power plants in Java is that of silt and gravel which these mountain streams carry in their tumultuous course. This has been solved on the Tjatoer, and at the other plants, by building sedimentation reservoirs where the velocity of the water is checked and the sediment is allowed to settle. From thence it can be readily removed.

A concession has been granted to the General Netherlands Indian Electric Company and construction has been begun by them on a hydro-electric plant of 2,200 kilowatt capacity at the falls of the Tji Toentang south of Samarang, the purpose being to supply that city and Salatiga with light and power. This company has further plans which include power developments and irrigation projects on the Rawa Pening, near Ambarawa.

In addition to the plants described there are many small water-power installations in Java which are owned and operated by private companies. These are principally found in the western part of the island and supply energy for various factory and agricultural purposes. Some of these power plants have been in operation 60 or 70 years, and there may still be seen many of the old wooden abreast and uudershot wheels, attaining at times a diameter of 30 feet, with direct engine coupling used to drive rubber, tea, and coffee machinery, and rice hullers. Gradually, however, these ancient and inefficient wheels are being supplanted by modern turbines. In all, there are said to be about 160 of these small plants. In re-equipping them, a standardized plan has been largely adopted so that, when the general scheme for the expansion of the use of elec-

*(Continued on page 535)*



The Western Hills Bridge Near Peking

# Reinforced Concrete Bridges in North China

*By J. J. Svagr, C.E.*

IN its present condition China offers few inducements for constructing engineers. The political situation is a barrier to the solution of pending engineering problems European and Chinese engineers are confronted with. The construction of new bridges is one of the foremost questions to be solved. Many projects exist for these improvements but then execution has been defeated by financial difficulties.

Reinforced concrete is a feature in most of these new projects.

The preference given to this method of construction is due to (1) a cheaper price, and (2) a short construction period. The difference in the latter point is striking: while iron bridges require 2½ years for their fulfillment, some of the reinforced concrete bridges have been achieved within *one* working season, i.e., *seven months*. Besides, there are other advantages in the use of the said material, which deserve to be mentioned: the maintenance is almost nil and the general aspect of such a bridge can be made more artistic, etc.

Characteristic of this type is the Western Hills Bridge near Peking in North China, as shown in the accompanying illustrations. This bridge consists of eight spans, each 100-ft. long; the length of the bridge itself, including superstructures of the abutments, is 870-ft., the width being 20-ft. for the road and 5-ft. for the foot-paths resting upon brackets on each side, a total of 30-ft.

As the water level of this river during the greater part of the year is rather low, two piers only are covered with water; but at the time of summer overflow the river takes in water running from the hills and becomes very dangerous, its rapid current being apt to turn stones of 2-3 tons weight. As a rule, the mountain rivers are supposed to have a solid ground; this was the case for the above river too. In the very depth reached at the exploration, large-grained gravel has been found, which is rather rare for most of the rivers in South China. Therefore the piers have not been sunk to the rock, but placed from 20-ft. to 23-ft. from the river bed.

During the excavation work for adjustment of the first left side pier, the summer floods came on. The water did not rise gradually but a wave, like a huge wall of more than 21-ft. in height swept down with a terrific roar. The workmen, aware of the on-coming danger, warned those working in the pit. The latter had just time enough to climb out of the pit and the last workman just managed to run over a small temporal bridge to firm ground, when the flood water filled the pit and swept away the temporal bridge and a part of the cofferdam. Fortunately the loss was not a heavy one, and caused no delay in completing the bridge.

The piers of the bridge are constructed of reinforced concrete; the part under the ground level being solid concrete, and the upper part, hollow.

The arches rest on the piers by means of hinges (crossed steel bars), system Prof. Mesnager.

In spite of a considerable variation in the summer and winter temperature, the hinges up to now do not show any visible alteration, i.e., *no cracks* in the concrete (admitted by the theory) at the hinge section have been found, even during hard winter frosts.

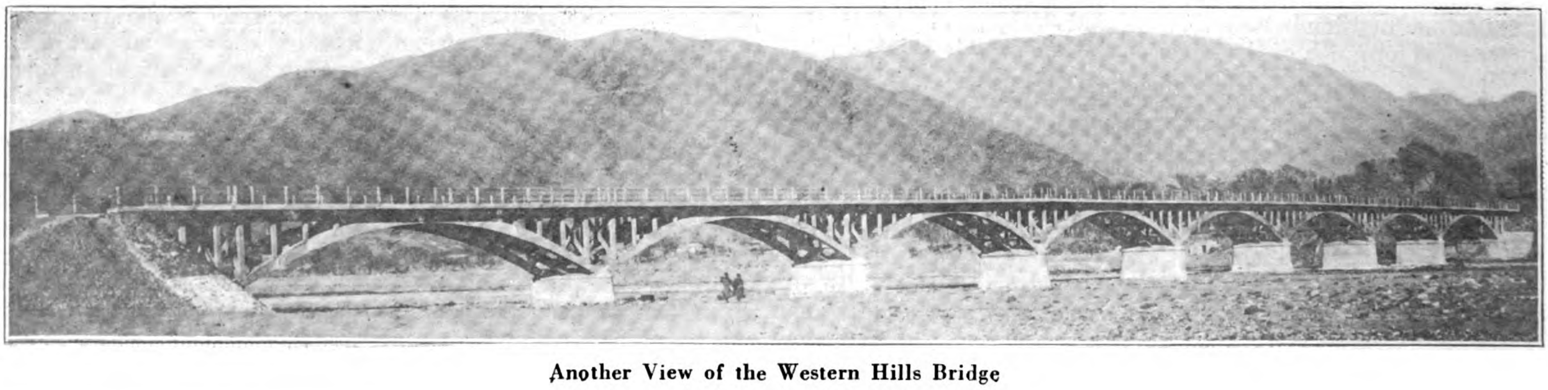
There are three arched ribs in every span; pillars are resting on them supporting cross beams and girders of the superstructure. The end columns of each span are joined by a tie in the form of St. Andrew's cross.

With the exception of bannisters, made of iron-gas-pipes between concrete columns the bridge is all reinforced concrete.

The face of the bridge has no architectural ornaments but in spite of this presents a very attractive aspect. The plain outlines of the arches and the cement hue form a somewhat agreeable contrast with the woodless mountain site.

This bridge was constructed by Messrs. Brossard, Mopin & Co. of Tientsin, to plans drawn by the writer, and the construction work carried out under supervision of a qualified engineer, Mr. Gregoire. Owing to his systematic plan of working, the construction of the whole bridge was completed within seven months.

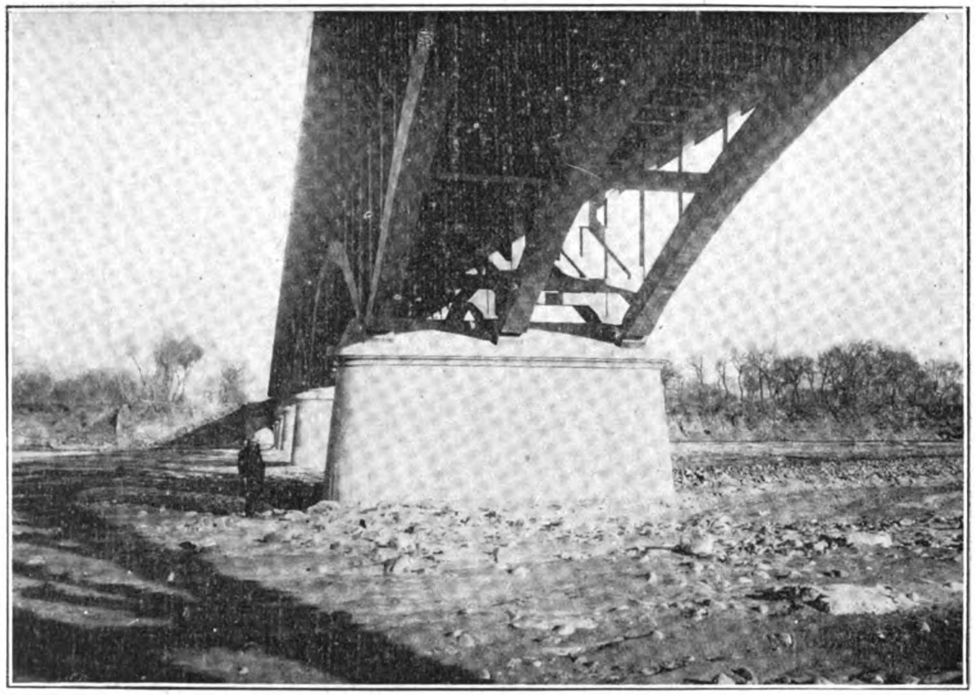
The description of some other bridges of the same type will follow in the next article.

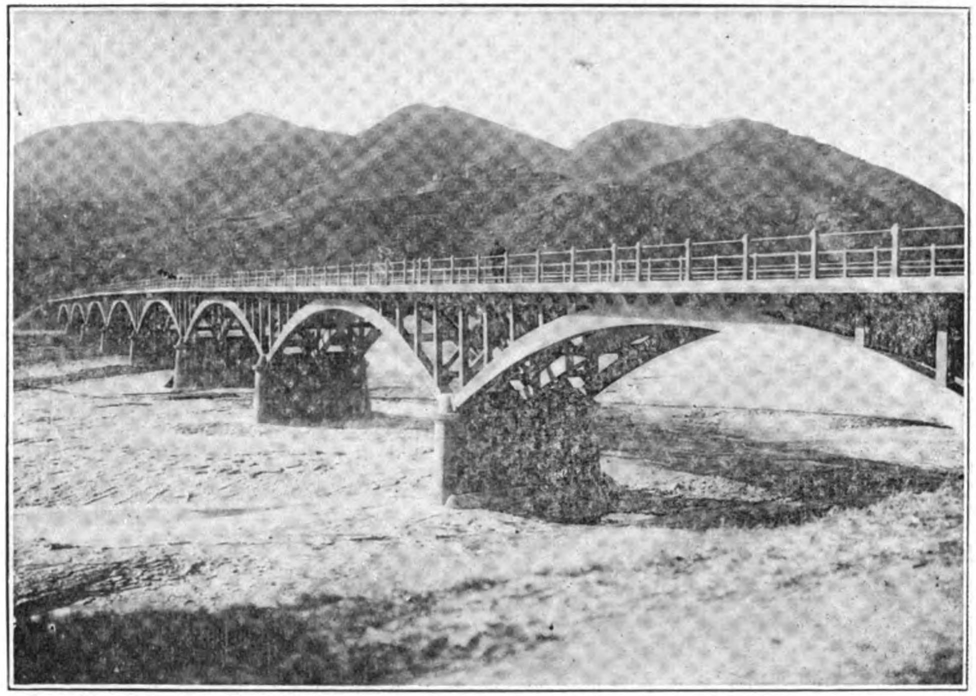


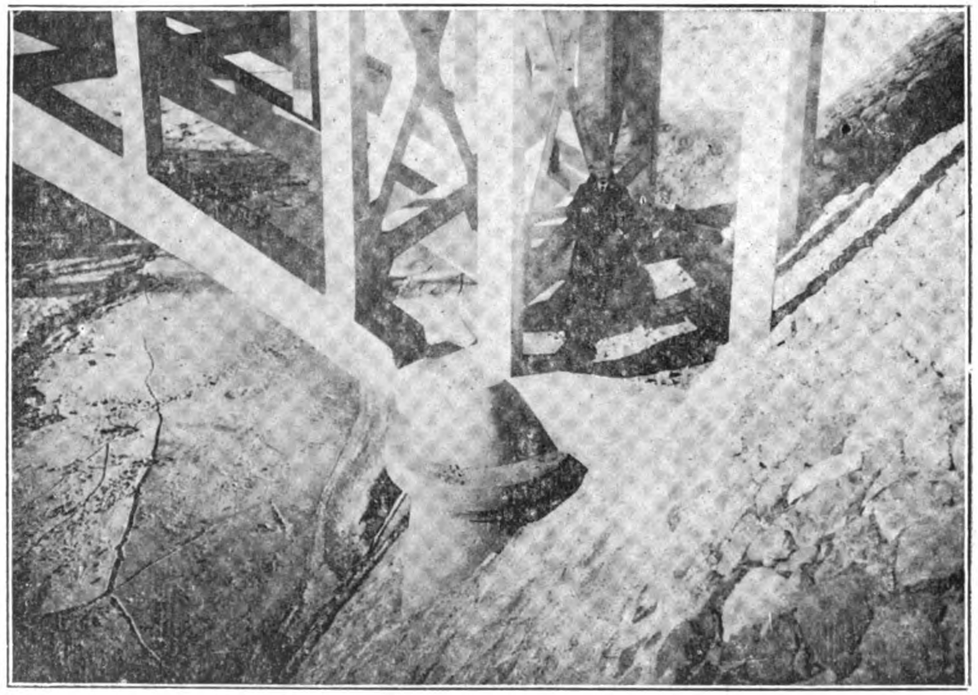
Another View of the Western Hills Bridge

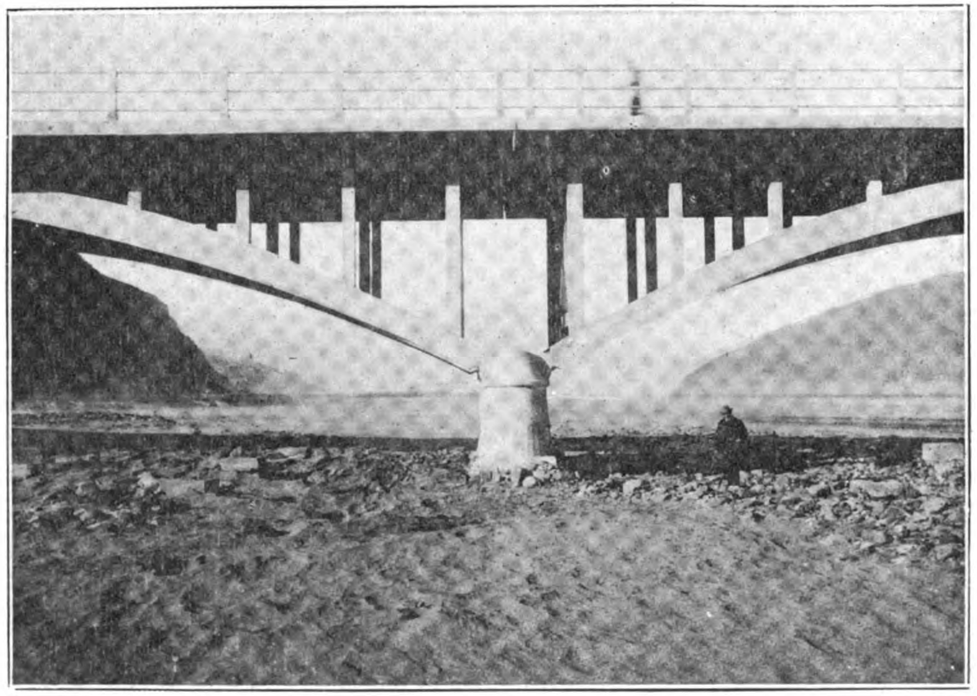
# THE REINFORCED CONCRETE BRIDGE IN THE WESTERN HILLS

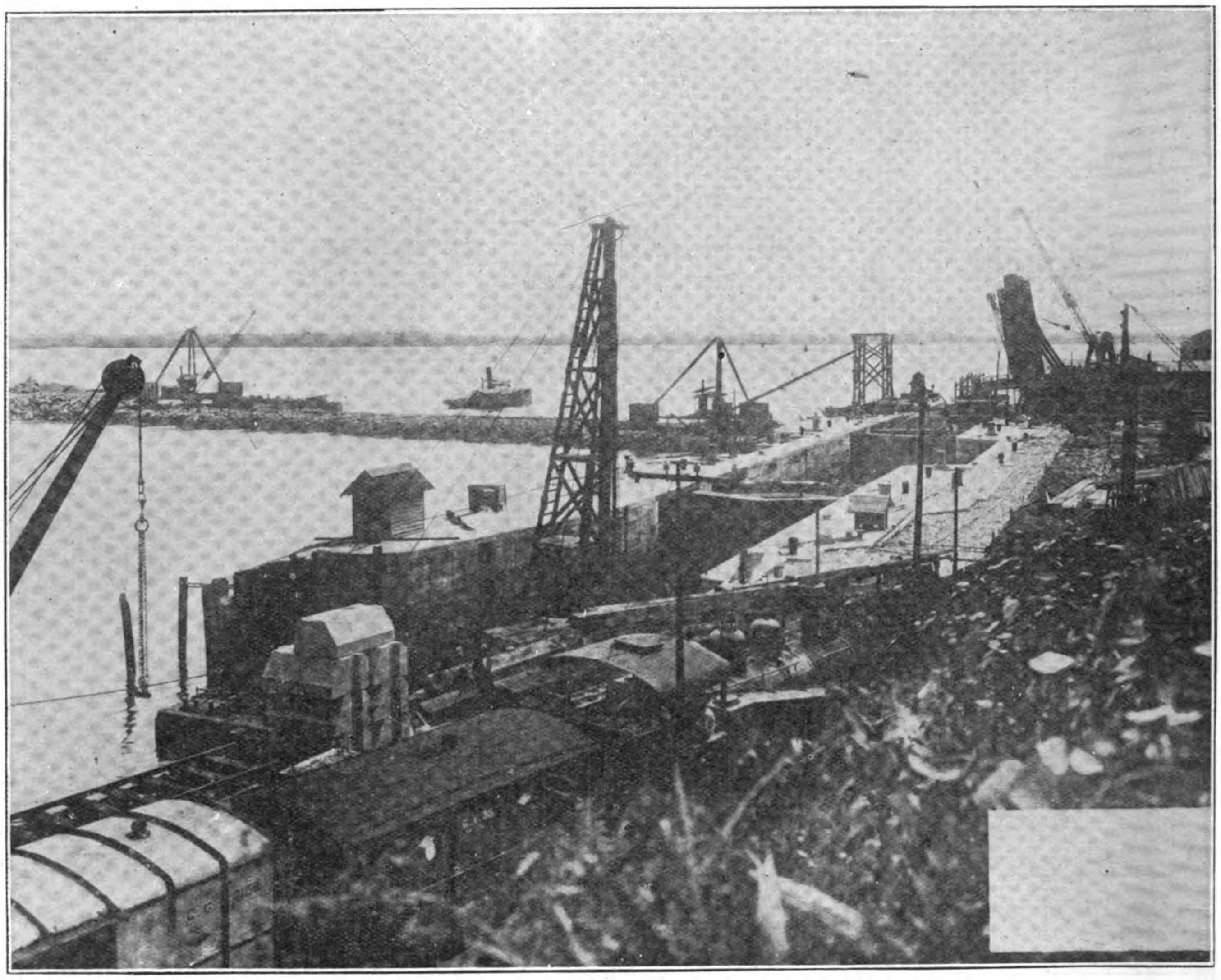
Designed by J. J. Svagr, C.E., and Erected by Brossard, Mopin & Co.











Johore Causeway: Northern End, showing the Lock for Passage of Coasting Vessels. This Lock is now in use. Photo taken December, 1922

# Johore Causeway

*By D. Paterson, Assoc. M. Inst. C. E.*

SINCE the completion of the Johore State Railway in 1909 railway traffic has been carried on between Singapore and the Malay states across the Johore straits, which separate Singapore island from the mainland, by a system of ferry launches for passenger and luggage traffic and by train ferries for goods traffic.

In recent years this traffic has increased to such an extent that it has been a difficult matter for the railway departments to keep pace with the requirements. In 1921 in addition to passenger traffic, 58,402 trucks were transported across the straits, as compared with 44,226 in 1916, and further increases in the volume of traffic may be looked for when trade again becomes normal.

In order to avoid the present costly and cumbersome methods of handling traffic and the delays and inconvenience incidental to the process of transhipment, it has, for some considerable time, been the aim of the Federated Malay States Railways to obtain an unbroken line of railway across the straits, the original proposal being to cross by means of a bridge, but owing to the war and the consequent high price of steelwork, the impossibility of obtaining it while the war lasted and the uncertainty of delivery afterwards it was finally decided to construct a granite rubble embankment or causeway, a very important factor influencing this decision being the fact that at Pulau Ubin, which is only 16 miles distant by sea, there was a quarry in existence which contained more than sufficient stone suitable for the work.

In view of the great advantage to be obtained by linking up. Singapore island and the mainland by road as well as by rail it was arranged between the various governments interested that the embankment should be made sufficiently wide to carry a roadway as well as the railway.

The scheme having been favorably reported on by the consulting engineers to the government, Messrs. Coode, Fitzmaurice, Wilson & Mitchell, after careful investigation of the site and the data available as to tides and currents in the locality and other matters affecting the work, the contract for the construction of the works was secured by Messrs. Topham, Jones and Railton, Ltd. about June 1919.

### Causeway

The causeway crosses on a line slightly oblique to the centre line of the straits, thus affording easy approaches to the railways on each shore.

It runs from Johore Bahru station on the mainland to a point on the Singapore side about 350 feet north-eastwards of the existing railway jetty, a distance of about 3,465 feet from bank to bank, in an average depth of water of 47 feet at low water.

It is 60 feet wide at formation level affording room for a double line of railway on the eastern side and for a 26 feet roadway on the western side of the bank.

The greater portion of the mound forming the causeway consists of granite rubble of all sizes up to five tons, deposited as it comes from the quarry.

On each side of the bank commencing at the level of 15 feet below, and extending to a height of 4 feet above, L.W.O.S.T. a

coating 10 feet thick of heavy rubble, of stones ranging in weight from 10 cwts. to 5 tons, is deposited and finished off to a slope of 2 to 1, the upper surface being brought up to form a berm so as to provide against possible displacement of the upper portion of the work through wave action.

Blocks of 6 : 1 concrete are laid at the back of the berm to form a toe for the granite rubble pitching which is laid to a slope of 1½ to 1 on the upper slopes of the causeway.

The roadway consists of a bed of 9 inches of granite rubble closely hand packed on edge on which a 6 inch layer of granite metalling is thoroughly rolled and consolidated. It is protected on the west on sea side by a concrete-in-mass parapet and on the railway side by a wire fence carried on reinforced concrete posts. The roadway is drained by a side drain discharging at intervals through the parapet.

Ten culverts are provided at the Johore end of the causeway, in order to prevent the accumulation of floating refuse in the vicinity of the lock.

These culverts are circular in cross section and are 5 feet in diameter the level of their inverts being L.W.O.S.T. They are formed of 6 : 1 concrete moulded in segments which are toothed into each other both horizontally and vertically. Outfalls are formed at each end of the culverts in the heavy rubble berm and pitched with roughly dressed stones.

## Lock

In order to provide a safe passage through the causeway, after its completion, for the vessels using the straits it has been found necessary to construct a lock on the Johore side of the straits, and it may be of interest to refer briefly to the conditions which render the construction of a lock necessary.

Careful observations of the tides and currents in the Johore straits and around Singapore island indicate that, as on the completion of the causeway the straits will be divided into two estuaries each filling and emptying on the rising and falling tides through its own entrance, not only will differences be found between the levels of the water on either side of the causeway but at one period of the tide the water may be higher on the east side and at another period higher on the west side.

As a difference of level of say 6 inches would cause a current of about four miles per hour in any open channel through the causeway, which would render navigation risky and at times impossible, a lock through which vessels can be passed is necessary and as the differences of level will oscillate from one side to the other, double sets of gates have to be provided to deal with these conditions.

The Johore side of the straits was chosen for the site of the lock both on account of its affording more suitable approaches than Singapore side, and because it rendered it possible to carry out the work without interfering with the existing ferry arrangements.

The lock is 510 feet in length with a length between the sets of gates of 170 feet, a breadth of 32 feet and a depth of 10 feet on the sills at low water.

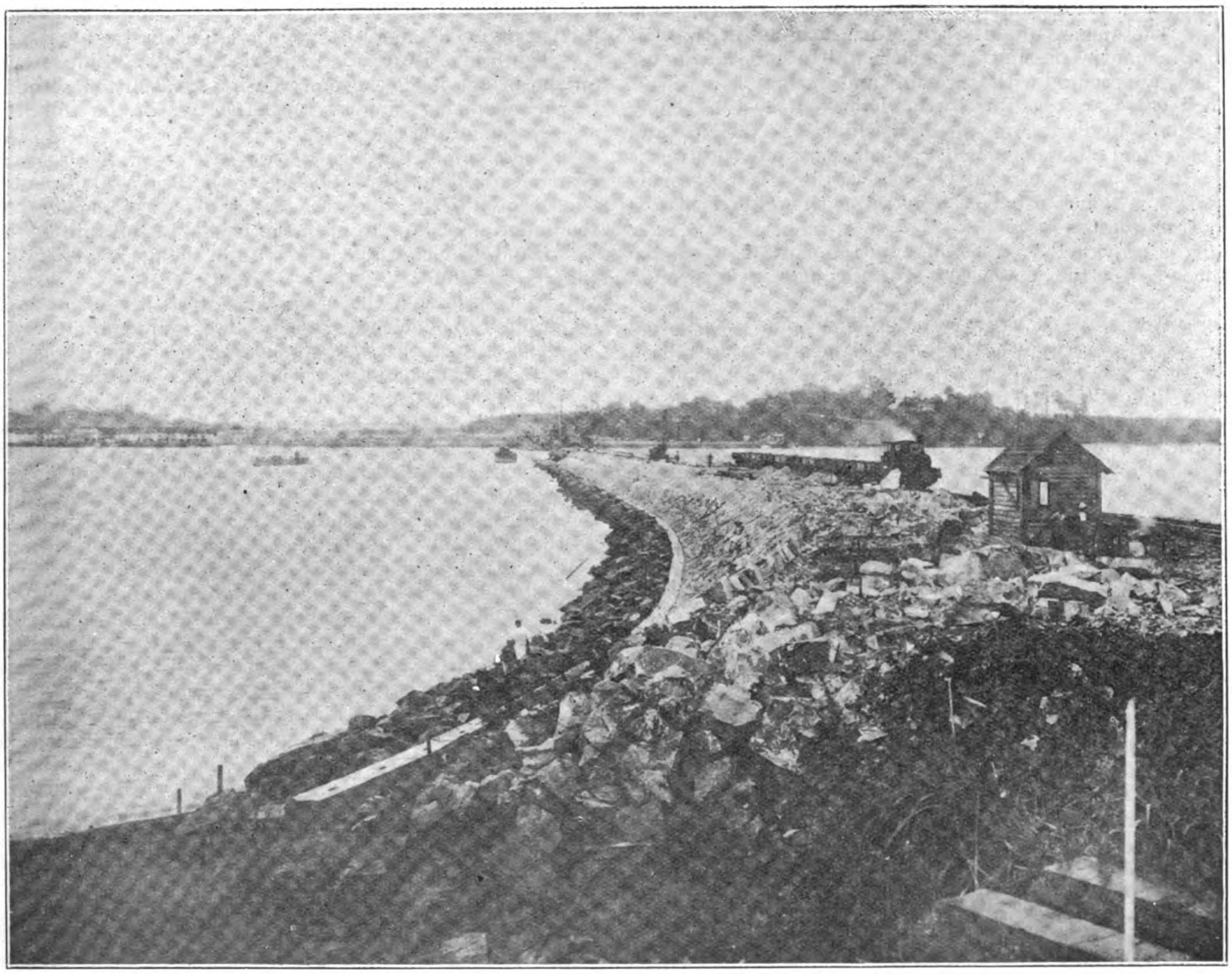
These dimensions are based on the size of the largest commercial craft at present using the straits with a moderate increase to allow for future requirements.

The lock inside the gates is widened to 45 feet so that say three tongkangs or a large number of smaller craft could be passed through at one operation.

The north wall of the lock is continued eastwards and westwards for distances of about 330 feet and 270 feet respectively forming the east and west wing walls of the lock, the west wing wall being set back 40 feet from the line of the north wall to permit of vessels lying alongside this wall for discharging or loading without interfering with craft entering or leaving the lock.

The material in front of the wing walls is shown to be dredged to a depth of 12 feet at L.W.O.S.T. out as far as the 2-fathom contour line to give access to the lock.

The wing wall foundations are protected from possible scour or undermining by an apron of granite rubble 2 feet 6 inches in thickness extending for 20 feet in front of the walls. This apron



**Johore Causeway: Southern End. Town of Johore Bahru in the Background. The causeway will be opened for traffic on October 1st, 1923**

is carried round in front of the lock entrances for the same reason.

The side walls, gate platforms, invert and aprons of the lock are formed of 6 : 1 concrete in mass the side walls being faced with a 12 inch thickness of 4 : 1 concrete deposited simultaneously with the concrete behind it. The wing walls are formed of 7 : 1 concrete-in-mass without 4 : 1 facing. The copings to the walls are 4 : 1 concrete blocks and the surface of the walls, except where machinery pits and manholes, etc., occur, is finished off with granolithic paving.

The material on which practically the whole of the lock and also the west wing wall are founded is soft clay of various descriptions, and bearing piles had to be driven over this area. These consisted of ballow piles about 15 inches diameter driven to a 1 inch set with four blows with a 2-ton hammer falling 4 feet.

Firm clay was encountered in the east wing wall foundations and piling was not necessary over this length.

For the regulation of the water level in the lock, when working the same, a culvert is provided in each side wall of the lock. These are 5 feet high by 3 feet wide and the water is admitted or released by cast-iron sluices with gunmetal faces, worked by hand power. From the culverts, there are on each wall five openings into the lock 2 feet 6 inches by 2 feet in cross section and in addition in each of the recesses, into which the gates swing when opened, 3-12 inch outlets are placed for flushing purposes to remove any deposit of silt which might occur and cause trouble.

The lock gates are built of steel and are 24 feet in height 20 feet long and 3 feet 6 inches wide at the centre, the outer skin plates being curved to a radius of 22 feet.

They are subdivided into seven decks with the usual diaphragms and stiffeners. The heel posts, mitre posts and sills are greenheart of the best quality procurable, carefully dressed to dead accurate lines so as to make a perfectly water-tight joint with the granite quoins against which they fit.

Each gate leaf rests on a cast steel pivot sunk into the granite heel post stone and is secured at the top by a " U " bolt passing round the upper pivot and secured to the anchor quoin by adjustable connections. The anchor quoins are in turn fastened in the wall by 3 inch dia. anchor ties passing through the wall into the anchorage pits where they are secured with large nuts and washers.

The lock gates are operated by hand worked capstans, being opened and closed by means of a steel joist hinged to the gate and to which a cast steel rack is fastened. This beam is moved inwards or outwards by a pinion driven through suitable level gearing from the capstan, the gate being easily opened or closed in two minutes by from four to six men.

A clutch is provided for disconnecting the capstans from the gate machinery so that they may be used for warping vessels through the lock.

At each entrance to the lock a chain defence has been placed to prevent vessel entering the lock until the gates have been opened for their reception. These consist of a main chain of $1\frac{1}{4}$ inch stud link chain stretched across the entrance, to each end of which about 40 feet of $\frac{5}{8}$ inch short link chain is attached. The chains pass through cast iron hawse pipes built into the walls, then through a stopper block, and are led to electric winches one on each wall. The stopper block secures the $1\frac{1}{4}$ inch stud link chain in the required position for closing the entrance, depending on the height of the tide, and is opened or closed by a hand lever. When a vessel is to be admitted to the lock the stopper block is opened and the chain allowed to run out until it rests on the floor of the lock.

The usual equipment of bollards, fairleads, boatsteps and adders is provided along the lock and wing walls where necessary.

By arrangement with the municipality of Singapore a subway is provided under the lock near its western end to take the water mains which will be laid at some future date to supplement the water supply of Singapore from reservoirs in Johore.

The subway is 11 feet 6 inches wide by 8 feet high both roof and floor being arched and the vertical shafts being 11 feet 6 inches by 10 feet.

It is formed of 6 : 1 concrete-in-mass with an inside lining of 4 : 1 concrete 12 inches thick and 18 inches thick on the arch, a lining of 1 inch of Syssel asphalt being laid on the 6 : 1 concrete in three layers before applying the 4 : 1 concrete lining.

The shafts are provided with steel ladders and are covered with chequer plate covers carried on steel joists of sufficient strength to carry ordinary wheeled traffic.

The railway and roadway are carried over the lock by a rolling lift bridge 57 feet wide with a clear span of 32 feet feet, the weight of the moving portion of the bridge being 570 tons.

As this type of bridge is new to this part of the world a few particulars as to its design and method of working may be of interest.

In rolling lift bridge the structure, instead of moving on trunnions or a pivot, as in bascule or ordinary swing bridges, rolls backwards and in so doing lifts upwards, the advantages claimed for this type being that no pit is required for the counter-weight and rear portion of the bridge when the bridge is raised, and that owing to the rolling back of the bridge, a shorter length of girder is required to span the opening than would otherwise be required.

The bridge consists of three main plate girders carrying the roadway and railway portion 38 feet long and 5 feet deep carrying cross girders spaced 7 feet apart to which are attached the longitudinal rail bearers and floor troughing.

At the rear end of the main girders segmental girders curved to a radius of 14 feet $1\frac{1}{2}$ inches are connected which carry the ballast box 9 feet by 7 feet 6 inches extending the full width of the bridge and filled with concrete and pig iron in the proportions required for the correct balancing of the bridge, the whole structure being additionally braced by portal girders.

The segmental girders rest on massive level track girders which are carried on beam grillages anchored into the solid concrete of the lock wall and the whole concreted up to the level of the track girders. The length of roll of the bridge is 20 feet the track plates of both the rolling segments and the track girders being accurately machined to provide smooth rolling surfaces. The track plates have projections 6 inches by 3 inches by 2 inches high which engage with slots in the segmental girders to prevent any motion of the bridge apart from the rolling motion.

In order that the bridge may be in equilibrium in all positiens between the " open " and " closed " positions the centre of gravity of the whole structure must coincide with a line passing through the centres of the arcs of the rolling segments. The balancing of the bridge has therefore to be very carefully calculated and carried out. The final balancing is done by trial and error.

The bridge is operated electrically by a 35 h.p. motor carried on the bridge itself the power being transmitted through gearing to the operating pinions at the centres of the rolling segments at each side of the bridge.

These pinions engage in two cast steel spur racks bolted to girders carried on trestles bolted to the bridge abutment, having a length equal to the roll of the bridge 20 feet this being the travel of the pinion necessary to open the bridge to the full extent.

Hand gear is provided for use in the event of a failure in the supply of current.

It is estimated that, against a fresh breeze, $3\frac{1}{2}$ minutes will be required to open the bridge by power and 19 minutes by four men.

The motor is fitted with a powerful solenoid brake which can be released when hand power is used for operating.

The bridge is provided with two nose lock bolts, one at either side of bridge. These bolts will be opearted by a suitable hand gear situated in the control cabin. On either side of the bridge at the nose end an adjustable pneumatic buffer is placed to absorb any shock when the bridge is closing and to assist in bringing the bridge slowly to rest on the bearing blocks in its final portion. At the nose end of the bridge the bearing blocks will be provided with guide flanges designed to ensure the bridge aligning itself properly when closing. The railway track rails are also provided at this point with a similar arrangement with finer limits for adjusting the line of rails on the bridge with the permanent way.

The control of the bridge electrically will be of a semi-automatic nature. The speed operation will be under the control of the operator and will be entirely dependent on him up to the point where rheostatic braking is automatically applied. The railway signals, level corssing gates, nose locking bolts, and operating machinery will be interlocked so that they can be actuated in proper sequence. Limit switches will be fitted to control the rheostatic braking and supply of current to operating motor. An indicator controlled by tappet switches will be provided in the control cabin showing five positions of the bridge. These will be 1 inch closed, 2, 3, and 4 intermediate, and 5 "open." The operations of opening and closing the bridge would be performed as follows :—

1. The signals must be at " Danger " in which position the level crossing gates may be closed.

2. When the level crossing gates are closed the signals are locked at "Danger" and the nose locking bolt gear free to operate.
3. The nose lock bolts are withdrawn. This locks the level crossing gates in the closed position and allows current to pass to the bridge operating gear controler.
4. The bridge is opened by the operator, its position being shown by the successive steps on the bridge indicator. At a position decided on a limit switch is actuated. This automatically introduces the rheostatic brakings, independently of the operator, and gradually reduces the speed of the bridge, so that it approaches the end of its travel slowly, and is finally brought to rest by the last limit switch cutting off the current, and applying the solenoid brake.
5. The bridge is closed by the operator in a similar manner. Its position being shown on the bridge indicator, the rheostatic braking being introduced and the solenoid brake applied exactly as for opening.
6. When the bridge has been closed. The nose lock bolt is operated, this isolates the main operating gear and unlocks the level crossing gates.
7. The level crossing gates are opened. This prevents the nose bolt from being unlocked and releases the signals.
8. When the signals show that the line is "clear" the level crossing gates are locked in the open position and the whole sequence of operations therefore isolated until the signals are again returned to "Danger."

## Construction of Works

*Causeway.*—The contractors Messrs. Topham, Jones and Railton, Ltd. commenced work in Johore and at Pulau Ubin quarry in the latter part of 1919 and the depositing of stone in the causeway was commenced in March 1920.

Owing to delay in the delivery of plant from England and the large amount of work entailed in the opening up of the quarry progress was somewhat slow at the commencement.

In order to obtain railway communication across the straits as early as possible, the construction of the roadway portion was first put in hand and work has been concentrated on this portion up to the present. As soon as this half width bank is completed a temporary single track will be laid over which traffic will be conducted until the remainder of the bank is completed and the permanent rails laid, after which the traffic will be diverted and the temporary track removed and the roadway. etc., completed.

The reason for this procedure is that if the railway half of the causeway was constructed first the roadway portion would then be cut off from the Pulau Ubin quarry unless the barges were brought through the lock which would cause delay and inconvenience.

The rubble forming the underwater portion of the work is brought up to the level of about 5 feet below L.W.O.S.T. by depositing from hopper barges of the usual type with opening bottoms, These barges, which have a capacity of about 300 tons, are loaded at the quarry jetty, towed up from the quarry by powerful seagoing tugs, moored in the required position by ropes attached to heavy moorings, and then discharged. The depositing of stone in this manner was continued from both ends of the work, an open channel being left for navigation in the middle of the straits.

When the channel had been narrowed down to about 1,000 feet wide the currents had attained a velocity of about five miles per hour and then, in order to prevent scouring away of the bottom, stone was deposited all over the channel but will not be brought up to the height sufficient to interfere with navigation until the lock is opened for traffic.

When the bank had been brought up as high as possible by depositing as described, short lengths, sufficient to permit of the erection of a derrick crane, were built up by a floating crane.

These derrick cranes then proceeded to build the superstructure outwards stone being brought to them by lighter barges carrying about 300 tons, and in addition set the toe blocks, culverts and finish off the heavy rubble coating and berm.

In addition to the supply of stone from Pulan Ubin, the 7th mile quarry at Bukit Timah was opened up in the early part of 1922 from which stone is brought by rail in trucks which are run out ahead of the derrick crane on the woodlands end and side tipped into the work.

The chief items of plant employed on the depositing of stone in the causeway are four tugs, ten hopper barges, three lighters, two floating cranes, three steam derricks, one locomotive crane, and one locomotive, in addition to the plant employed at the quarries.

The estimated amount of rubble required to complete the causeway is 1,528,000 cubic yards, the quantity in the half width at present being built being 1,050,000 cubic yards, of which up to the end of October 1922, 842,223 cubic yards had been deposited.

The average amount deposited per month during the year 1922, when the quarries had attained their full output was 46,300 cubic yards, the maximum month's work being 55,000 cubic yards an output which reflects great credit upon the organization and equipment provided by the Contractors.

*Lock.*—The construction of the lock was commenced towards the end of the year 1919 the north wall, situated as it was on ground above water level, being the first portion of the work to be undertaken.

The construction of the lock necessitated the removal of the railway landing stage and covered way to the station to a site clear of the works.

A new stage and covered way was erected and traffic was diverted in August 1920.

While the north wall and east wing wall were in progress the remainder of the sit of the lock was enclosed by a watertight cofferdam and the construction of the south wall was commenced.

All the walls were built in timbered trenches in lengths or generally 60 feet, the concrete deposited in one length being solidly keyed into the lengths previously built. Generally speaking, little trouble was experienced in keeping the trenches dry, the chief difficulty encountered was the presence in the ground of a large amount of old timber in the upper layers of the excavation, the greater part of the work being on the site of an old sawmill. Logs of all sizes up to 3 feet diameter were found in the trenches, causing trouble not only in driving piles for the cofferdam and trenches, but they had to be cut through or removed when excavating for the walls, and as the majority were in good preservation (a sample is exhibited for inspection) this was a matter of some difficulty.

The trenches for the subway portion of the lock walls were about 45 feet necessitating extra heavy timbering and in spite of this a certain amount of movement occurred in these trenches due to the soft natuie of the ground and the great depth. This was successfully checked by additional timbering and excavating to the final level and concreting the bottom in short lengths.

On the completon of the north and south walls the material between the walls was excavated to about 5 feet below L.W.O.S.T. in the open, and the gate platforms, invert and floor of the lock were completed in short cross trenches.

As soon as the gate platforms and granite sills were completed the erection of the gates was put in hand. On the completion of the gates and the dressing of the granite quoins and sills, the gates, which had been erected a few feet away from their final positions, were jacked into place, lowered on to their pivots and anchored in position.

All the excavated material was removed from the trenches and site of the lock by five-ton derrick cranes which were also employed for the depositing of concrete in the walls, etc.

All concrete was machine mixed being deposited in 1 cubic yard skips with opening bottoms which were run from the mixer to the crane by petrol locomotives.

The total quantity of excavation removed exclusive of dredging is 52,000 cubic yards, and concrete in the lock and wing walls amounts to 36,000 cubic yards.

When the lock with the gates and other works had been completed to the full extent possible within the cofferdam, water was admitted to the lock and the removal of the cofferdam and dredging of the entrances was put in hand.

The dredging is done by grabs operated by 2-10-ton floating cranes the excavated material being removed in hopper barges and deposited in deep water about 1½ miles from the works.

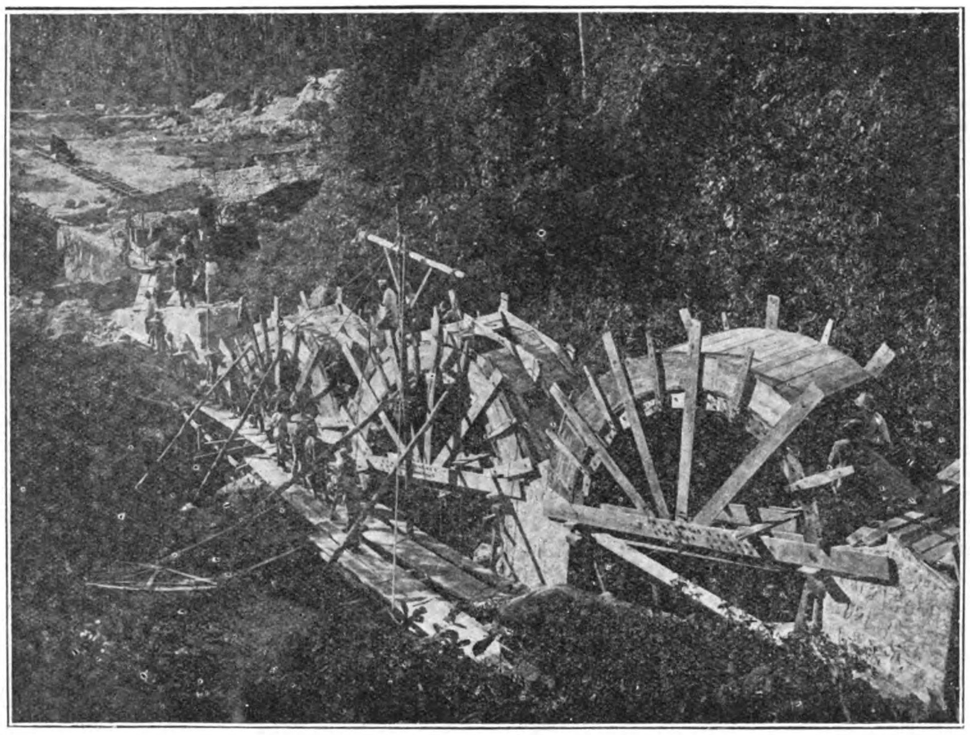
In conclusion the author desires to express his thanks to Mr. James Brown, the chief superintendent engineer, Prai River wharves and Johore causeway, for the preparation of the large scale drawings illustrating the works.

# Penang's Hill Railway

By A. R. Johnson, Assoc. M.I. Mech. E.

THE conditions governing the lay-out and equipment of a steep cable railway are entirely different from those obtaining in the case of an adhesion or rack line. In laying-out the latter, after the general route, ruling gradient and minimum curvature have been decided upon, considerable elasticity is permissible in the detailed location, and the surveyor, in running his trial lines, can go back upon his route and modify it if he finds himself getting into too difficult country. The location of any particular portion of the line is independent of that of any other portion, and tangents, curves, and gradients may be combined and succeed each other in an endless variety of ways.

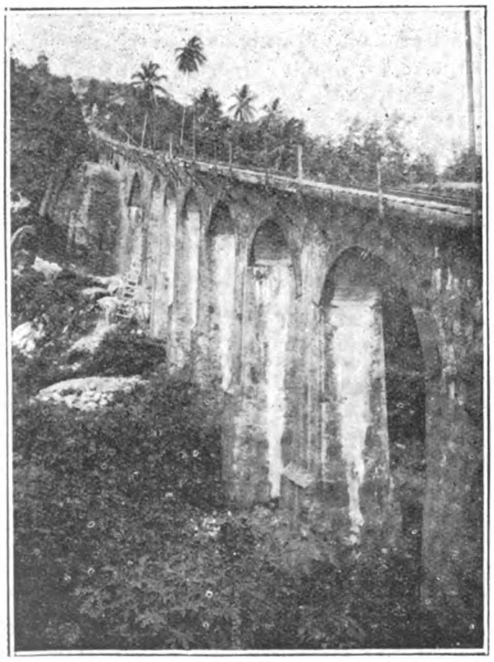
In a well-designed cable line, any portion is not only dependent upon those which immediately proceed and follow it, as in an adhesion line, but upon the whole lay-out from beginning to end; and it is impossible to introduce local deviation either in gradient or planimetric position without affecting the entire location of the line.



Upper Section Viaduct: Under Construction

This stringent condition of design will be clear from the following considerations :—

The cars are not self-propelling but connected by the haulage rope, hence their motion is interdependent. The haulage rope has to be moved as well as the cars, and its weight may be as great as that of the cars themselves.



Upper Section Viaduct Completed

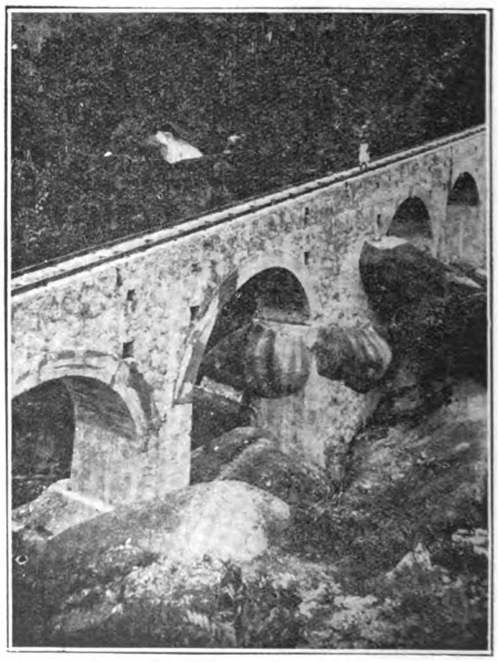
The theoretically correct profile consists of a parabolic curve of which the axis is vertical and of which the variation in gradient is such that the tractive effort to be exerted by the haulage engine is a constant. It is of course advisable to avoid horizontal curvature as in an adhesion line, as far as possible, but the introduction of such curvature even in a marked degree does not involve any serious interference with the theoretical efficiency of the line, if the correct profile is maintained. I do not propose to enter into a detailed investigation of the calculations necessary but to give a general statement of the form of the problem. The arrangement of the cars and the position of the haulage engine on this line are those generally adopted on modern lines of this type.

The haulage engine is placed at the top of the line, and there are two cars attached to either end of the haulage rope, which is led up the line from one car, over the drums of the engine and thence down the line to the other car. In this case the line is divided into two separate and independent sections, but as they are both identical in principle, I will consider only one section.

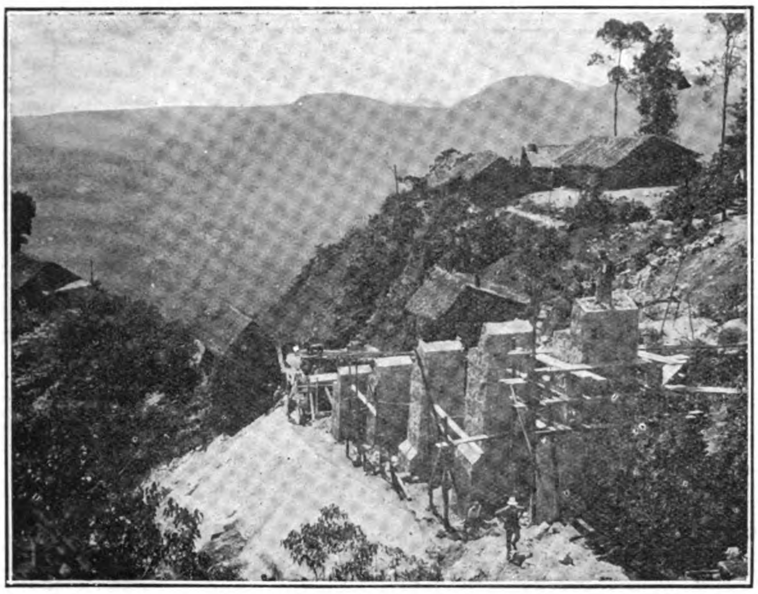
In the figure, let us call the ascending car A, and the descending car B. The cars pass each other at the middle point of the line C. Let us assume that the system is in motion. If the motion is uniform there must be equilibrium between the forces producing it and those which retard it.

The forces producing motion are firstly, the tractive effort of the engine, and, secondly, the components of the weights of the descending car B and the portion of the rope between B and the top acting in the plane of the line. The forces retarding motion are firstly the components of the weights of the ascending car A and the portion of the rope between A and the top acting in the plane of the line, and, secondly, the frictional resistances of the whole system to motion.

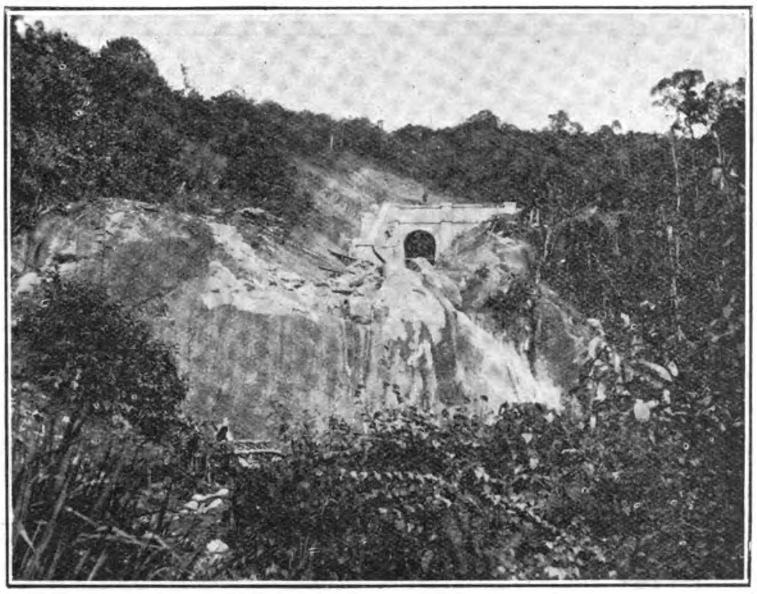
It is clear that, with the cars in the position shown, the engine has to haul up the rope to which car A is attached in addition to the car, and that as the car ascends this load continually decreases. The portion of the rope attached to car B is similarly continually increasing.



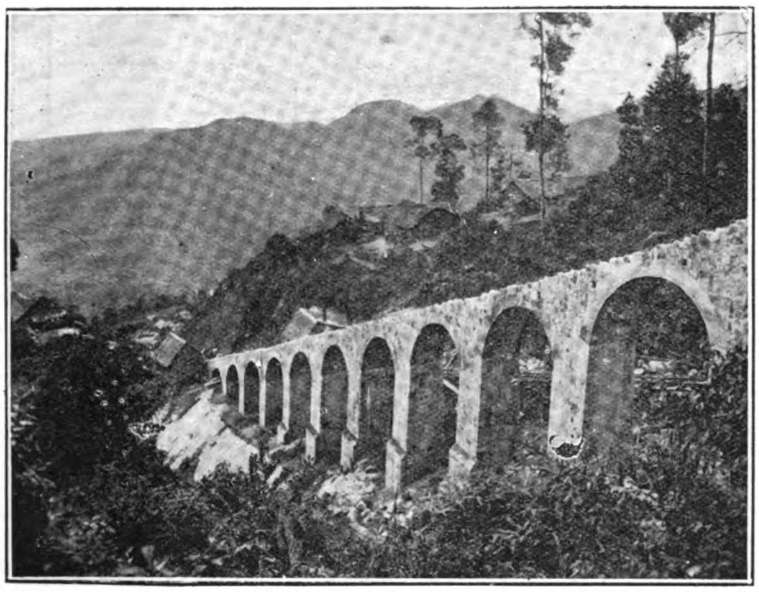
Second Viaduct on Upper Section, height, 1,340 feet



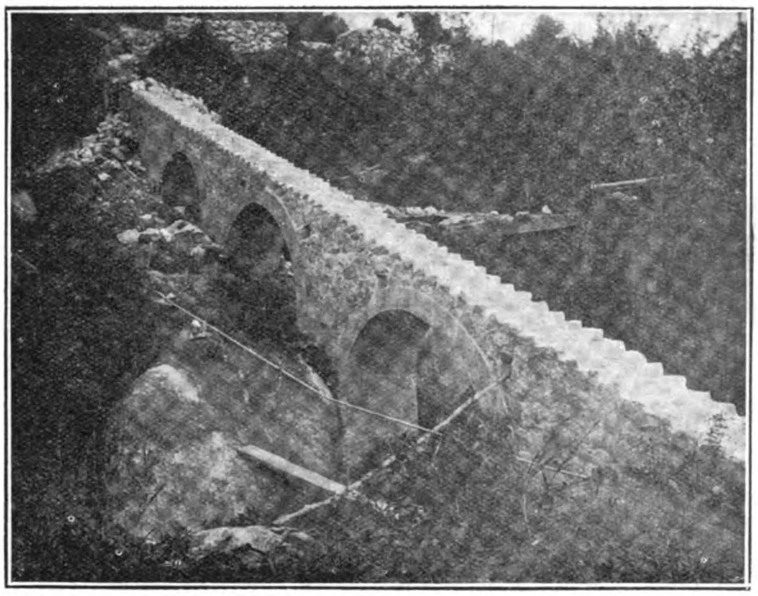
Fourth Viaduct on Upper Section under construction; height 1,880 feet above sea level



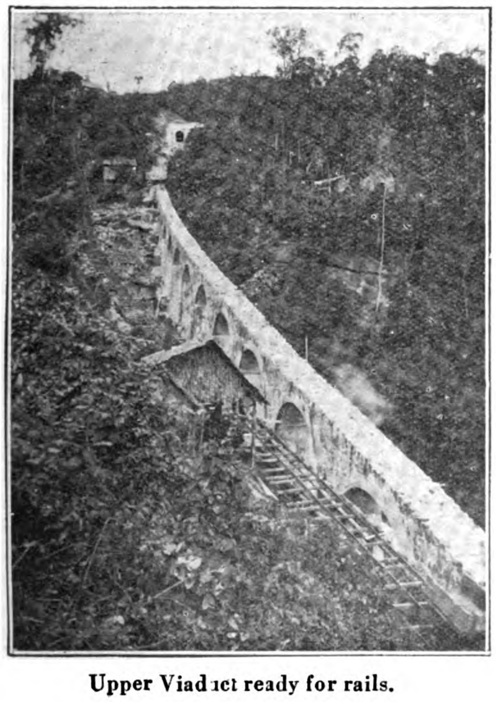
Upper Section lower face of tunnel



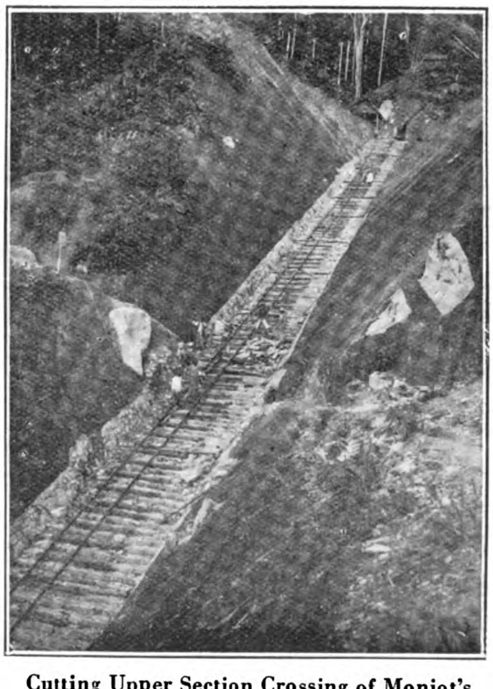
Upper Section Viaduct, looking down; ready for rails.



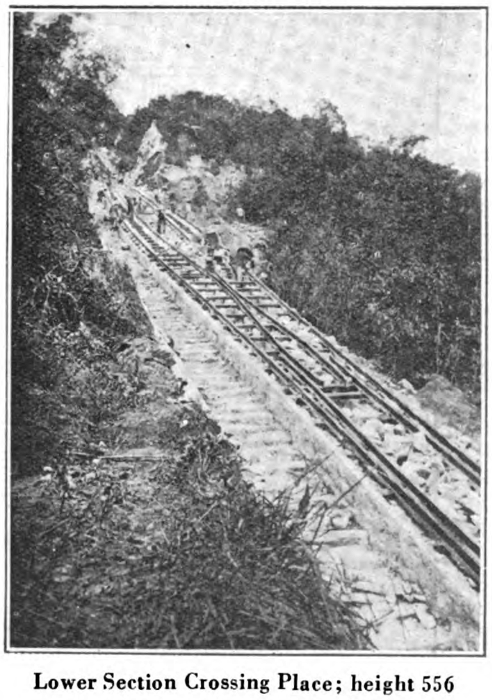
Upper Section Viaduct ready for Rails.



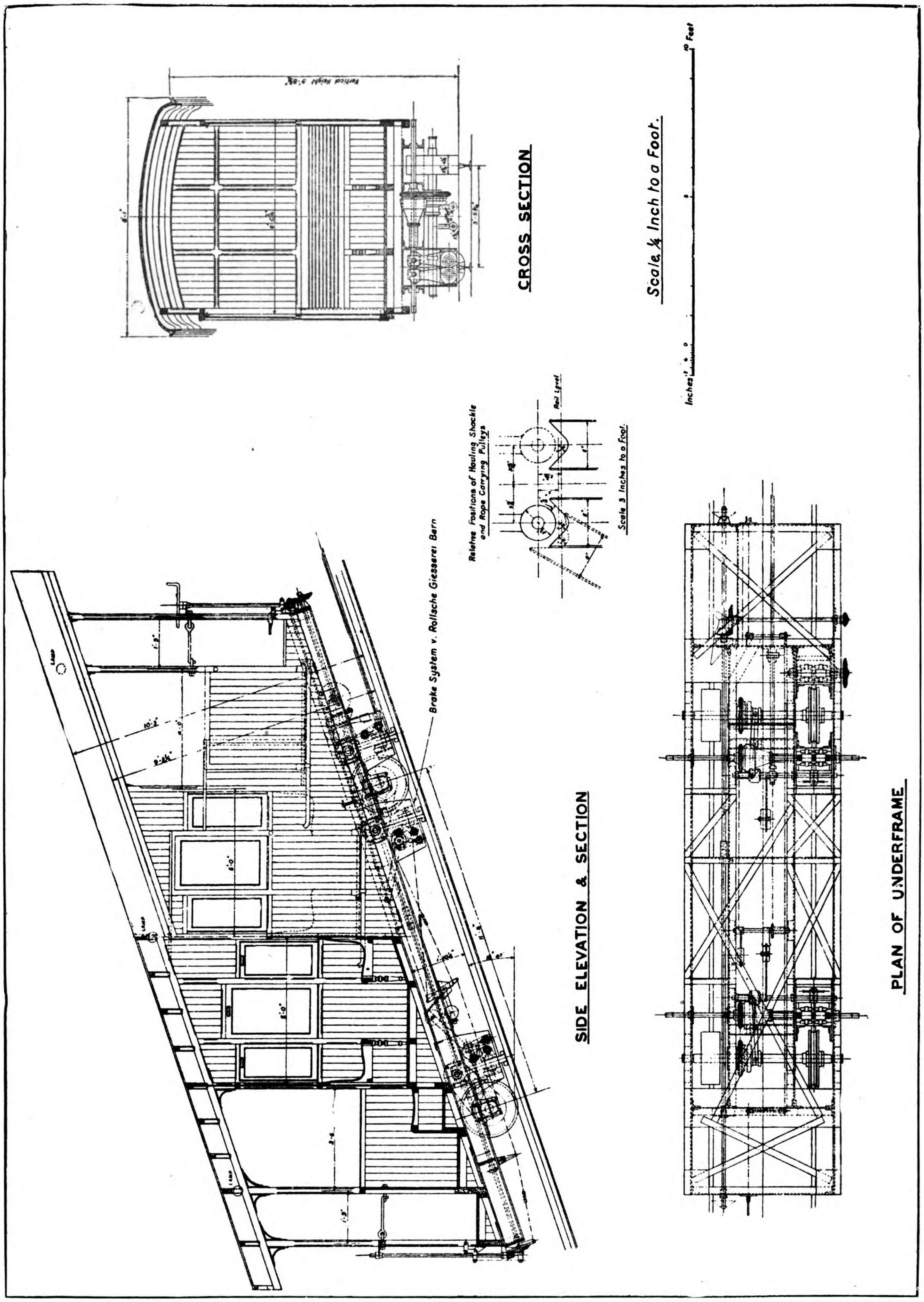
Upper Viaduct ready for rails.



Cutting Upper Section Crossing of Moniot's Road; height, 1,720 feet



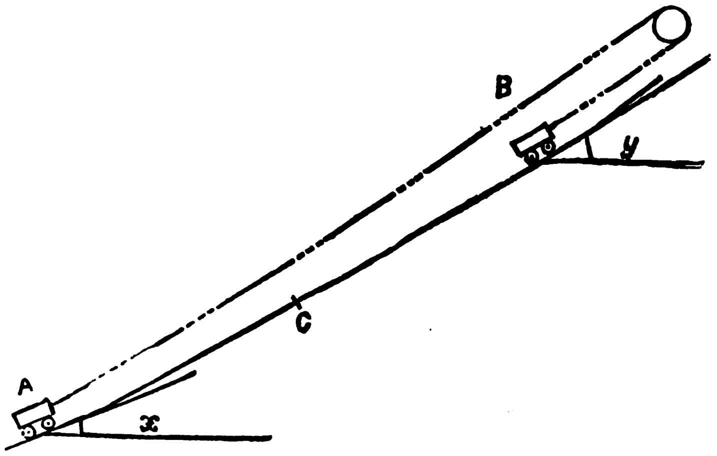
Lower Section Crossing Place; height 556


CROSS SECTION
Scale ¼ Inch to a Foot.
Relative Positions of Hauling Shackle and Rope Carrying Pulleys
Scale 3 Inches to a Foot.
Rail Level
Brake System v. Rollsche Giesserei Bern
SIDE ELEVATION & SECTION
PLAN OF UNDERFRAME
LAMP

When the ascending car A is below the middle point C of the line, the weight of the portion of the rope between the positions of the cars at any moment is acting against the engine, as the two ends above the upper car are equal in length and mutually balance. When the ascending cars has passed the middle point C, the descending rope is the longer and the weight of the difference in length is assisting the engine.

When the cars cross at the middle point C, the load due to the weight of the rope vanishes as both ends are the same length.

From this it is clear that if we could have a weightless rope, in order that the tractive force might be a constant, the profile would be a straight line, that is a uniform gradient throughout, and the tractive force exerted by the engine would be the difference in the components of the car weights acting parallel to the gradient plus the resistances of the system.




But as a weightless rope is impossible, in order to keep the tractive force constant, it is necessary so to design the profile that the difference in the load components at any pair of given car positions varies in a certain ratio dependent upon the varying ratio between the rope ends.

The general condition of equilibrium to be fulfilled may be expressed in algebraical form as follows :—

If A be the weight of the ascending car.
B be the weight of the descending car.
$x$ the angle made by the tangent of the profile to the horizontal at car A and,
$y$ that at car B.
$p$ the weight per unit length of the rope.
H the difference in height between the cars.
R the total resistance to motion of the system
and T the tractive force to be exerted by the engine.

Then $A \text{ Sin } x - B \text{ Sin } y + pH + P = T$.

The term R is so small in a well-laid line and its variation so inconsiderable that although it is not a constant, it is legitimate to take it as such.

The terms A Sin $x$ and B Sin $y$ are the components of the car weights acting parallel to the line, and producing the pull on the rope.

The term pH, although not obvious at first sight, can be shewn to be equal to the summation of the weight components of unit lengths of the rope acting in the plane of the line, and is positive or negative according as it is assisting the engine or tending to retard it. From this equation it is clear that any variation in the weights of the cars A and B or of the rope p produces variation in $x$, $y$, and H, and that any variation in only one value affects the value of T, and hence that as T is to remain constant and A, B and p are fixed values for any proposed profile $x$ and $y$ must vary in a definite ratio.

Hence any alteration in the tare weight of the cars, in the loading of either of them, or in the weight of the rope produces an alteration in the theoretically correct profile for any given values of these elements. Having fixed their values, from an analysis of equations similar to the one I have given, it is possible to obtain a parabolic equation for the profile which will give a constant load on the engine, and this is what is to be aimed at in the design. As, however, the relative values of A and B may vary with every trip, according to the number of passengers ascending or descending, it is necessary to assume values which will make T a maximum, and this condition obtains when the ascending car A is full and the descending car B is empty.

It might appear that it would be advantageous to use the lightest possible rope consistent with its not rising out of its carrying pulleys at any point when under its maximum tension, but this is not necessarily the case, as the difference between the values of A and B and $x$ and $y$ may be such that when A is nearing the summit of the line, the component of its weight pulling on the rope is so great that the component of B plus the component of the descending rope is not sufficient to prevent the tractive force continually rising in value. This is the case in this line and it has been necessary to use a rope of a size and weight considerably in excess of those required for safety only, in order to balance the large component pull due to the steepness of the upper part of the profile.

With regard to the resistances which I have grouped under the term R, they are more accurately expressed by the terms $Af \cos x + Bf \cos x + R$ in which f is the co-efficient of rolling resistance per ton of the cars on a level line and R is made up of the resistance to motion of the rope over the carrying pulleys plus the resistance of the rope to bending around curves and over the haulage drums of the engine. None of these components are capable of accurate evaluation as they all depend upon more or less indeterminable factors, such as the lubrication of the car wheel journals, the condition of the rail head, the wear of the wheel treads, the construction and internal condition of the rope, etc.

They may be calculated by analysis, if certain assumptions to cover the unknowns are made, and when this has been done an outside figure is taken to cover them all. Their total value is only a small percentage of the total tractive effort of the engine, probably about 10 per cent. As the speed of the cars is low and their weight comparatively small, very slight variation is produced in the rolling resistance during the periods of acceleration and retardation.

Further as about the same number of carrying pulleys are being rotated at any time during a trip, there is practically no variation in their total resistance at any moment. The resistance due to the bending of the rope is not dependent upon its velocity and hence is invariable when the system is in motion. From this it will be seen that it is quite legitimate to take the resistances under uniform motion as a constant.

With regard to the question of acceleration the speed of the cars being low, 5.25-ft per second on the upper and 4.28-ft per second on the lower section, it can be obtained in a very short distance, and an acceleration of one-tenth of the full speed per second has been adopted. The engine during acceleration has to impart the maximum momentum to the whole system, and the weights of all parts being known its value can be obtained. As it is theoretically possible to start infinity slowly the load on the motor need not rise above the maximum, but as this is not practicable the starting gradient has been eased to permit of a reasonable speed of acceleration without the load so rising.

Further points to be considered in the design which are dependent upon the form of the profile, are that the rope will always remain throughout in the treads of the carrying pulleys under the maximum tension to which it may be subjected, and that the distance apart of the pulleys may be such that it does not touch the ground or have too great a sag between them when under its minimum tension. The latter condition may be fulfilled by having the pulleys very close together, but this is not only uneconomical in material, but introduces unnecessary resistances into the system, and the correct distance should be calculated from an investigation of the varying tensions in the rope. As the tension increases continually from the bottom to the top of the line, the pulleys may be fixed at correspondingly increasing distances apart as the gradient increases.

From this general outline of the problem, it will be clear that the location has to be considered as a whole, and that it would be a waste of time to attempt to lay out a trace in the usual way by trial lines run from some selected starting point, without any knowledge of the ground in the front.

The method I adopted was as follows. The most suitable locality for the line had first to be determined. The conditions governing this selection were that the slope of the hill chosen

must be a comparatively short one and uninterrupted by isolated summits, that the starting point of the line must be as near as possible to a main road, and that the upper terminus must be at a point easily accessible from the existing roads and buildings on the hill.

These conditions determined the general position. I then made a contour survey of the portion of the hill side which lay within this general area.

Contours were run at 50-ft. intervals and were referred to a base line laid out straight from the bottom to the top. The total length of contours so surveyed were about 24 miles. A large scale contour map was then drawn.

I found the whole slope of the hill extremely broken and uneven. Precipitous faces of rock, some of great height, were common on the upper slopes, while the lower were intersected by numerous gorges filled up with boulders of all shapes and sizes piled on top of each other. Some of the boulders are of enormous size; one which the line crosses on a viaduct, I estimate to weigh over 12,000 tons.

The line passes over several of the gorges, which appear to be in some places of great depth. There is an arch of one of the viaducts thrown over a roughly circular hole, down which I let a hundred feet tape to its full length without touching bottom and I could hear the box knocking against the dry sides of the boulders as it swung from side to side.

I investigated about sixty different locations by means of the contour map. Even slight deviations in planimetric position produced remarkable effects upon the quantities of substructure works. A lateral alteration in position of twenty or thirty feet would change a cutting into a fill and *vice versâ*, almost throughout the whole length of the line, and if a deviation was introduced to avoid an exceptionally heavy work, it inevitably involved the introduction of another above or below it.

Thus location became a question of selecting a route in which the work was as small as possible and horizontal curvature reduced to a minimum at the same time that the profile for given values of car weights and rope was adhered to. If it was found that a particular profile was impossible to get through, these values had to be modified and a profile of another form tried.

When I had brought the best location within narrow limits of deviation, cross sections were taken throughout and the final exact location arrived at by nothing the effect of small deviations thereon.

The line is in two separate and independent sections, both of which have theoretically correct parabolic profiles for the greater portion of their lengths, but as I previously stated, in order to compensate for starting resistances and to adjust the ends to convenient positions, the gradient of the lower portion of each is eased by the introduction of a short circular curve tangent to the parabola. Horizontal curvature had to be introduced on both Sections, that on the lower consisting of a short curve of 1,500-ft. radius at the bottom, and there are two curves on the upper section, the radius of the sharper of the two being also 1,500-ft.

It would have been possible to obtain a location in a single section, but to have approximated to the best conditions, it would have had a great deal of horizontal curvatuie, very high viaducts and probably several tunnels; it would have been more costly to build, work and maintain, and its carrying capacity would have been less than that of the location adopted.

The total length of the line measured along the formation level is 1 mile 435 yards and the total rise in this distance 2,270-ft. The mean gradient is slightly less than 1 in 3 and the maximum 1 in 1.98 on the lower and 1 in 1.93 on the upper section. The centre of the upper station is 2,381-ft. above mean sea level.

With regard to the details of design and construction, owing to the steep slopes and destructive possibilities of heavy storm water, no attempt has been made to support the formation upon earth fills. The whole line is carried on masonry throughout and no loose stone ballast is used, the track being built into the masonry and anchored by long bolts at suitable intervals. The bottoms of all cuttings are also pitched in step formation throughout.

The track through the cuttings is carried on a raised masonry bed in the middle, leaving a three foot table at each side for storm water and service purposes. The permanent way is specially designed to prevent creep of the rails down-hill, and the latter can be taken up and relaid without removing the sleepers from the masonry. As the sleepers are steel angle irons, their renewal will only be required at very long intervals. The rails are of a special section with a wedge-shaped head, to provide a suitable grip for the car brakes.

Owing to the plentiful supply of granite and the difficulty of transporting and finding suitable working sites for materials or machinery on the slopes, I decided to build all the viaducts in rubble masonry with concrete arches. All sand and cement has to be hauled up from the bottom, but the stone is broken as near to the site as possible. I found an arch of 16-ft. span worked out as the most economical per 100-ft. of viaduct, and this has been adopted throughout, except where the line crosses some very large boulders near the bottom where I am building two forty feet spans. The arches are two centred and of two radii, the smaller radius being on the upper side. Owing to the gradient of the formation and consequently unevenly distributed dead load, better resultant thrusts can be obtained with an arch of this form than with a symmetrical one of any shape, and there is a considerable saving in the amount of backing over the upper haunch. The maximum height of the viaducts is 50-ft. from top of footings.

The line intersects a precipitous spur of the hill near the top of the upper section and as a cutting at this point would have had a maximum depth of about 80-ft. on the centre line and a side slope of about 185-feet, besides removing a huge mass of earth buttressing the Summit of Strawberry Hill, an outlying shoulder on the edge of which the line terminates, I decided to tunnel it.

The tunnel is 258-ft. long on the formation line, and on a gradient of 1 in 2.04.

The lower heading is in fissured rock and is being taken out to nearly full section; at the upper end, as hard red earth was first met with, separate headings for each side wall were driven, and these are being built first before driving the arch heading. Both these upper headings have now struck rock about 50-ft. in, and I anticipate that the remainder of the work between will be in more or less solid rock. Owing to the steep gradient, the design of the tunnel possesses many peculiarities, and special methods of construction have had to be devised.

The cars are each capable of carrying about 40 passengers seated and standing, and as one trip can be run every quarter of an hour, the maximum carrying capacity of the line is about 150 passengers in each direction per hour.

They are built to the mean gradient of the line and are divided into four compartments and two end platforms for the car attendant, all of which are stepped one above the other so that the floors are level. As only a single track is used throughout the line except at the crossing places, where the track is double, a special arrangement has been used whereby the cars automatically pass each other at the centre of the line. Let us assume we are looking up the line from the bottom and as before, call the cars A and B.

Car A is fitted with double flanged wheels on the right-hand side and flangeless wheels on the left. In Car B the double flanged wheels are on the left and the flangeless on the right. At the crossing place the outside rails of each track are uninterrupted throughout and form a continuation of the right and left hand rails of the single track above and below the crossing. The inner rails are interrupted to permit of the passage of rope.

The double flanged wheels of both cars follow the continuous outer rails on either side and the flangeless wheels ride over the breaks in the inner rails. Hence Car A always takes the right hand track and Car B the left hand at the crossing place automatically and without the use of any switches.

Each car is fitted with three emergency brakes, two of which are automatic and each of which is capable of pulling up the car fully loaded on the steepest gradient in a distance of 5 to 6-ft. Each brake consists of a pair of forged jaws which embrace the specially shaped rail head and are normally adjusted with a clearance of $\frac{1}{16}$in. on each side thereof. These jaws are pivoted to an extension of the car frame a short distance above the rail head and are extended upwards in two arms which embrace a pair of heavy right and left hand nuts on a shaft carried in the car frame. The travel of the nuts caused by the rotation of this shaft gradually applies the jaws to each side of the rail head. The shaft is provided with a spur wheel which is thrown into gear with the car wheels by means of a saw tooth clutch. Under normal conditions this clutch is kept open by the tension of the rope, but if this fails from any cause and the car commences to run

down the hill, its failure causes the fall of a heavy balance weight. The arm to which the balance weight is attached is fixed on a shaft which carries a cam, the rotation of which on the fall of the weight throws the clutch into gear with the car wheels.

By this arrangement the rolling of the wheels down hill supplies the motive power by which the brakes are applied, and any tendency for the wheels to slide instead of rotate is counteracted by the from of the rail head and jaws, as the latter tend to slide down the faces and hence increase the pressure between the rail surface and wheel treads. A slight deformation of the car frame immediately ensues which materially assists in jamming the car on the track.

Special provision is being made for dealing with goods traffic in loads up to about 2½ tons. Such traffic is quite unusual as a general service in lines of this type ; but in this case it is essential to permit of an economical development of the Hill. As it is imperative that the attachment between the rope and the passenger car be of a form to preclude possibility of interference or negligent handling it is made permanent and only capable of detachment under responsible supervision. Hence it is necessary for the passenger cars to be hauled up the line with every load of goods, and as the latter cannot be loaded in the car, a special wagon is provided which when loaded is lifted on to the rails by a crane and placed in front of the car, which propels it up the line. On arrival at the top it is transferred to a siding by another crane and hand shunted to a convenient position for unloading. At each trip the passenger car forms a non-paying dead load, but the design of the line is such and the gradients are so steep that it is absolutely essential to leave no chance of accident from negligence in the fixing of the rope attachment.

The motive power of the line will be electricity which it is proposed to obtain provisionally from the municipal power station in Penang.

The haulage engines are of the Whiting type with three sheave drums of 12-ft. 6-inches in diameter in the treads. The drums will be fitted with Walker differential rings to take up unequal stresses in the rope due to wear in the treads. Such stresses become very great if they are not compensated for, if the grooves wear unevenly after a period of use, and a very slight difference in diameter is quickly appreciable in drums of this size.

The emergency brake is directly attached to the main haulage drum. It consists of a cast steel tread, accurately turned, embraced by a pair of heavy post brakes. It is operated by means of a weight normally held in the " of " position by means of a locking bolt held up against a spring by an electrically energised solenoid. The brake is tripped under any of the following conditions :—

(*a*) When the speed of the drums exceeds 15 per cent. of the normal haulage speed.

(*b*) When the ascending car reaches a pre-determined position at the top of the line.

(*c*) Failure of the current through the tripping of the main circuit breaker either by overload or through cessation of supply.

(*d*) By an emergency hand operated switch on the control platform.

In addition to this brake, each haulage engine will be provided with a mechanical hand brake, an electrical hand brake and an automatic electric brake. The main haulage drums are driven by speed reduction gearing arranged on three motion shafts, the motor being direct coupled to the first.

As the cars are started simultaneously by the driver of the haulage engine, who cannot see any hand signals given by the car men, a special signalling installation is provided, whereby the driver exchanges both bell and visual signals with the stations, and which are so interlocked that he cannot despatch the starting signal until he has received the ready signal from both stations. In the event of the car man requiring to stop on the line through obstruction or other cause, he is provided with a telephone earthed through the car frame and wheels on one side and provided with a contact fork on the other with which he can close the circuit by touching a singal wire arranged in a convenient position throughout the full length of the line. The closing of the circuit rings a larger warning gong in the engine house, on the sounding of which the driver immediately stops the engine.

## Hydro-Electric Developments in N.E.I.

*(Continued from page 523).*

tricity on the island of Java is completed, these power plants will fit properly into the system.

The aforementioned constitute about all the developed hydro-electric plants and those under construction in Java. The government, however, in connection with private enterprise, has ambitious plans for the immediate future which include the installation of 18,600 h.p. in light units at different points in the Tji Mandiri territory ; 43,700 h.p. at ten sites on the Tji Sangkoeg ; 31,500 h.p. in four units on the Tji Laki ; and 30,000 h.p. at seven places in the Tji Manoek territory. In these four districts, which are in the west, there will ultimately be provided 123,900 h.p.—equal to about a quarter of Java's potential development. These stations, as well as projected and well-designed plants in central and eastern Java, will be constructed and utilized primarily for generating power to operate the railways ; but it is believed that there will be sufficient energy remaining to supply current for many other uses—industrial and municipal.

Java is justly proud of its railway system and of the fact that it is apparently going to be the first tropical Asiatic country to modernize it by the introduction of electric traction. The local government is proud, too, that it has been able to work out the financial questions in connection with the electrification without the aid of the home government.

The railways of Sumatra, Borneo, and Celebes have not yet assumed an importance which justifies electrification. When they do, however, ample water power awaits them. The power possibilities of south Sumatra are so great that it has been suggested developing some of the sources and transmitting the current to Java under the narrow Strait of Sunda—about eighteen miles wide —which separates these two islands. Sumatra has a considerable number of small hydro-electric plants at work. These vary from several hundred to 3,000 or 4,000 h.p., and are used, largely, to to supply power for mining and agricultural operations.

In regard to the island of Celebes, which is credited with a potential 1,000,000 h.p., it was stated last year that the famous nitrate syndicate had received a concession to develop water power there and that it would shortly erect a 200,000 h.p. plant for the manufacture of fixed nitrogen and metallurgical products.

## Conservancy Work in North China

*(Continued from page 545).*

From the point of view of river regulation it should also be possible to construct retaining reservoirs in the hilly area whence the rivers flow at a comparatively small expense, and these should be of immense value to agriculture from the possibilities of irrigation thus presented.

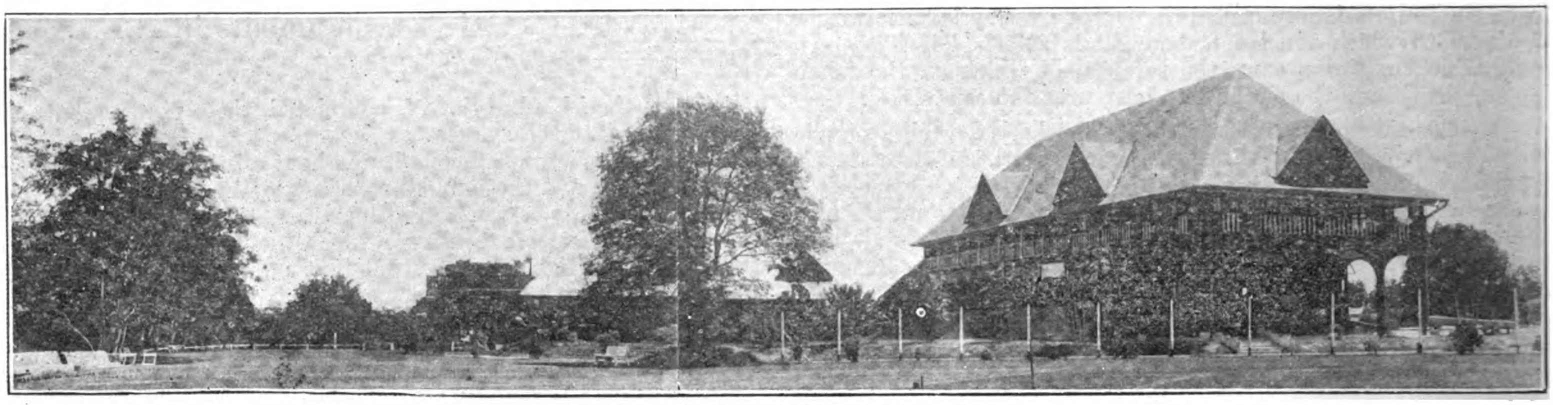
In conclusion, one point which has frequently come under the writer's observation is that which is raised by the difficulty of bridge building in China.

The rivers in this country run at one-tenth of their capacity for six months in the year, but during the rainy season of July-August they rise both in level and velocity with the most surprising rapidity.

It is perhaps natural that engineers who have not been long resident in China should fail to realize this possibility, and therefore neglect to plan their bridges accordingly, but it is inexplicable that the Chinese themselves should persist in the construction of bridges on the pattern of the well-known Marco Polo bridge with its narrow arches, though indeed the capacity of that is far greater than of many others which the writer has seen in different districts.

The new concrete bridge at Yangtsun on the Pei Ho is an example of choking the course of a river which should be a sufficient object lesson to all who have seen it, while the numerous timber bridges built in various localities by the natives themselves are annually destroyed by the pressure of flood water.

This, however, is but a minor point to be noted in passing, and in no way affects the trend of this article, which is intended to point out the vast possibilities latent in China for the development of scientific engineering in all its branches, providing that the government of the country can be stabilised, and a sense of national and public welfare inculcated in the minds of the people.



Government House and Grounds, Sandakan

# North Borneo

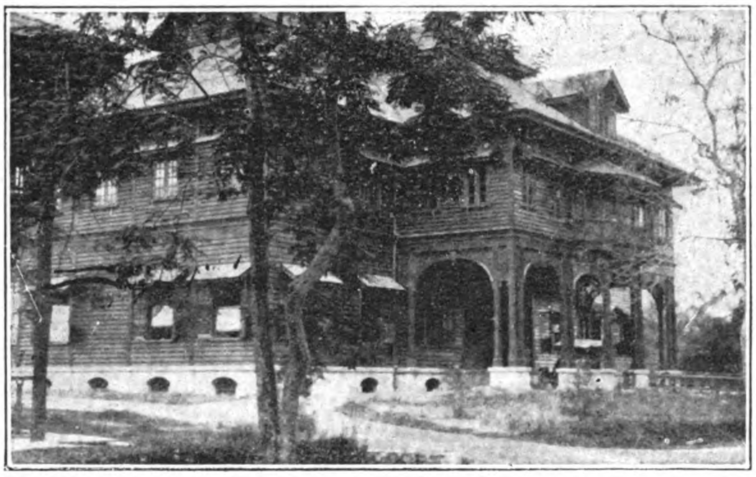
## Her Capital and its Relations to the Trade Routes of the Far East

*By G. C. Irving*

IN previous articles we have dealt with North Borneo as a new country in which some of the excess population of China may find good homes and profitable work, we have discussed the country's economic condition and outlook and have given a general idea of development in the form of railways and roads. This article will be devoted to our principal town and port, that of Sandakan.

Sandakan Bay, a magnificent inlet of the sea is situated on the east coast of North Borneo, in latitude .07 and longitude 118. The pioneers of the Chartered Company quickly realized the immense value to them of such a harbor and, in the earliest days of the Company's rule, established a station on the southern side of the bay which they named Elopura. The site was ill-chosen and was subsequently abandoned for the situation on the opposite side of the bay where the town of Sandakan now stands.

In those days and for many years afterwards Sandakan continued to be little more than a settlement. The protection afforded by the armed forces of the Company gradually attracted Chinese traders who began to push their influence towards the interior from which by means of barter they were able to coax the products of the jungle, rattans, wild rubber, camphor, beeswax, gums, edible birds' nests and the hides of wild animals from the tribes who inhabited the principal rivers, the Kinabatangan, the Labuk and the Sugat. Other settlements gradually came into being on the east coast, the principal being Lahad Dato and Tawao.



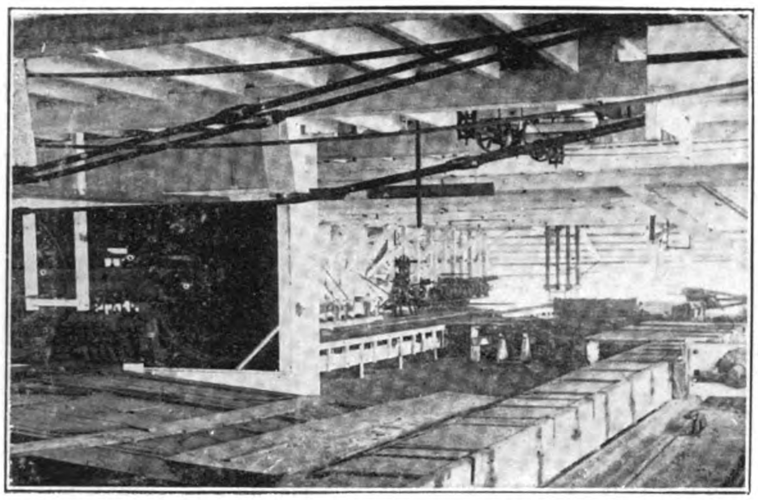
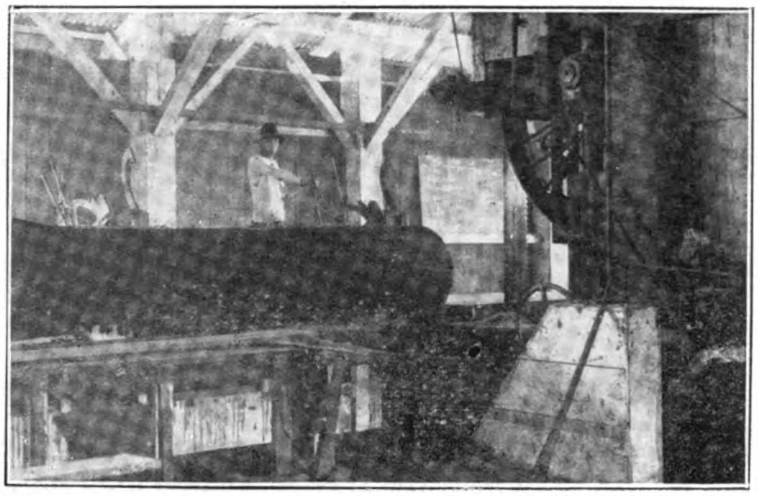
The Secretariat, Sandakan

It was some years before European capital came in, which it did eventually for planting wrapper-leaf tobacco, and working timber out of the vast forests of the east coast. The influence of capital brought with it European competition in import and export trade, and, particularly during the boom in tobacco planting, there was a great deal of money passing hands in the markets of the newly fledged town. Sandakan has experienced all the vicissitudes of an infant city; born of the energy and enterprise of the old-time pioneer, the temporary home of the creator of wild-cat schemes, the world rover and the beach-comber, she has passed through all the stages and has developed into a flourishing and progressive little city with a population of 11,000 which takes itself and is business with the great world very seriously.

The population in the census of 1921 was returned at 93 Europeans, 34 Eurasians, 9,052 Chinese, 1,153 natives

The Town of Sandakan

A Sandakan Street

SANDAKAN INDUSTRIES—British Borneo Timber Company's Mill

of Borneo, 1,191 natives of the Malay archipelago and 305 of other races.

In 1921 the total volume of the trade of the port was $7,686,305.00 which makes an interesting comparison with the first year of the war. The imports increased from $1,880,663.00 in 1914 to $4,083,627.00 in 1921 and exports from $2,097.57 to $3,602,678.00. As 1921 marked the beginning of the slump and was a bad year in comparison 1920 one may reasonably look for a great improvement as soon as conditions are bettered. Before dealing with Sandakan's trade relations with other countries we will make a similar comparison with the above as regards shipping. The tonnage in and out of Sandakan in 1914 was, inwards 187,059 tons and outwards 186,939 tons of which 75,952 tons were German. The figures for 1921 are inwards 349,290 and out 349,325, of which 219,913 were British, the only competitors to the British flag being the Japanese who entered and cleared 67,000 tons of shipping.

These figures should be a sufficient reply to people who are inclined to regard North Borneo as a disappointment to those who have been interested in her development.

In 1921 Sandakan sold 31,000 tons of coal, mostly for bunker, exported 1,600,000 cubic feet of timber, 19,000 pikuls of copra, 50,000 pikuls of coconuts, 16,000 pikuls of dried fish, 800,000-lbs. of estate rubber, 200,000-lbs. of tobacco and 13,000 pikuls of rattan, to name her leading exports.

Our timber finds its principal market in Hongkong but is also pushing its way into Australia, England and Singapore.

The dried fish trade is principally with Hongkong as is that of rattan. Rubber goes to London and estate tobacco to Amsterdam.

The capital is particularly well situated as regard trade routes as will be seen by a glance at the map. There is direct steamer communication with Singapore, Hongkong, Manila, Zamboanga, Sydney and the Java ports.

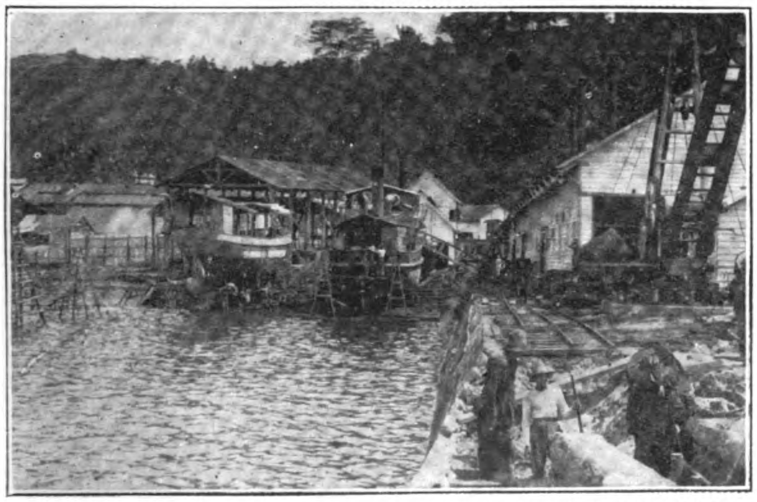
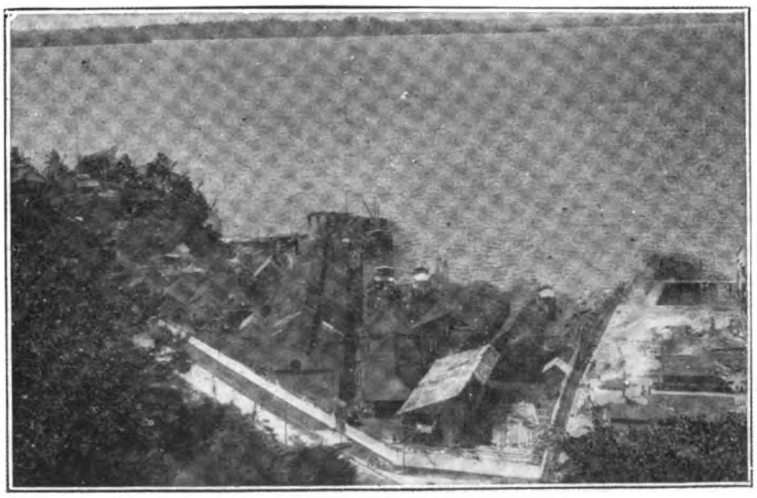
The government maintain two lights on the east coast, one at Tawau and one at Tanjong Unsang which serve for shippng making the Borneo coast from the southern and eastern routes. There is, or shortly will be, erected a third light on the island of Taganac which lies 18 miles of the entrance to Sandakan harbor. This light will assist all steamers approaching the harbor from any direction.

Though there is little at present of a modern nature in the means for docking steamers or handling cargo, the government have schemes for improving the wharfage, increasing the water supply and extending the reclamation of the foreshore to meet the growing demand for space. The latter scheme has actually been put into operation as will be seen by the illustrations to this article.

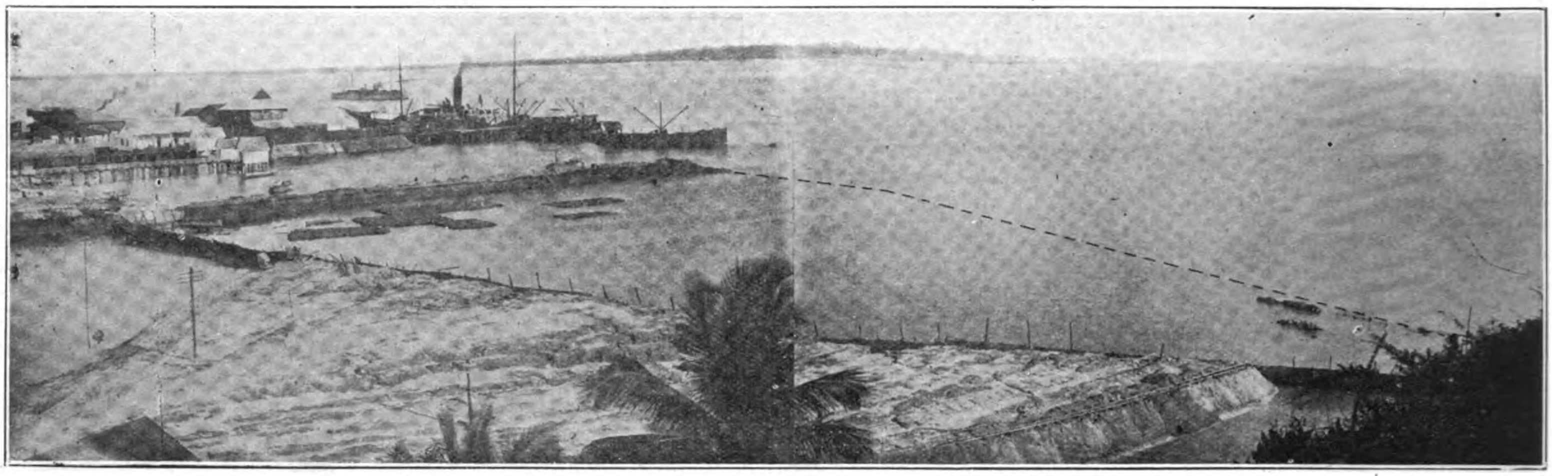
In addition to this they are building a road which will open up agricultural lands and provide settlements for immigrants especially Chinese whom it is hoped to attract.

The present governor of North Borneo, Major General Sir William Rycroft, K.C.B., resides for part of each year at Sandakan where the government has recently built new offices to accommodate the secretariat.

British enterprise is represented in the Capital by Messrs. Harrisons & Crosfield (Borneo) Limited who acquired the flourishing business of Messrs. Darby & Company, the British Borneo Timber Company Limited to whom have been granted a monopoly to export timber, without interferring however with the free rights of former concessionaries in this trade, the principal of whom is the North Borneo Trading Company Limited whose business in timber and engineering is of long standing. The Bakau Company Limited deal exclusively in the preparation of Cutch from the bark of the mangrove tree and there is a well equipped slipway and engineering yard under the management of Messrs. Harrisons & Crosfield.

SANDAKAN INDUSTRIES—Slipway and Engineering Yard



**General View of Sandakan Harbor Reclamation. Dotted line shows approximate position of Sea Wall**

The capital is well lit and supplied with ample electrical power for its present needs by the Sandakan Light and Power Co. who have recently installed a complete new generating set. This Company was floated in Hongkong by Messrs. Shewan, Tomes & Co. and has been an immense boon to the city.

The Chartered Company opened in 1921, the North Borneo State Bank, and there are agencies of the Hongkong and Shanghai and Chartered Banks.

There is a cinema company which went into the moving picture business some years ago but it does not appear to have aroused much enthusiasm among the people or collected much profit to itself. We seldom if ever see a modern or popular film which the Company cannot afford to lease with their present returns.

The motor car has of course come to stay, though Borneo with her lack of roads logged far behind other countries. The Borneo pony, the Hongkong chair and the lordly victoria owned by a previous governor have disappeared and in their place there is an ever-increasing number of cars, all of an American make. Last but not least Sandakan, which in years gone by was connected with the cable station at Labuan by the tender thread of a single wire stretched across 300 miles of jungle, now forms one of a series of wireless stations the value of which with her growing trade and shipping is of the greatest value.

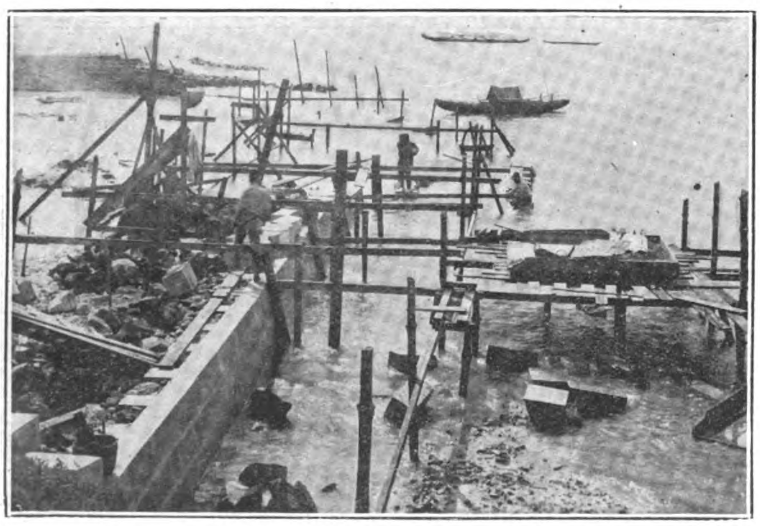
How and to what extent Sandakan is going to expand in the future is a question for which it is not so very difficult to find an answer in the light of what has been done in the last ten years. Though the progress in immigration is likely to be slow it has every chance of being sure and, given the required type of Chinese agriculturist, the lands opened up by the road should quickly be taken up. Sandakan at one time produced considerable quantities of pepper and might again compete in that market through her small holders.

By the terms of the British Borneo Timber Company's agreement their output has to be an annually increasing one until it reaches the region of 4,000,000 cubic feet a year. The timber trade of Borneo has always held its own and our hard woods have for years been firmly established on the Chinese market. They are steadily finding a footing in other markets and it appears to be only a question of time for the country to be able to sell all that her companies can produce.

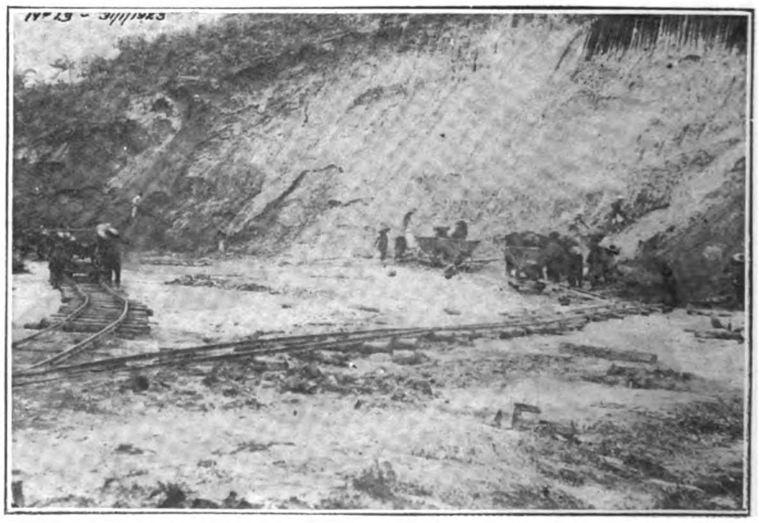
Copra and rubber are both increasing and there is no lack of suitable land for expansion in these respects. The government are making their terms for coconut land more attractive, a policy which is dictated by the slow growth of the palm and the long time between the planting and the productive stage.

An experiment has already been started in the production of alcohol from the stem of the Nipah Palm (nipa fructicans) an industry which is already a flourishing one in the Philippine Islands. This palm grows in profusion on the banks of most of Borneo rivers and the only use to which it is put is the manufacture of thatch from the leaves. The successful development of this industry will mean a great thing for Sandakan where the alcohol will find a sale and means of export.

Though at present of small proportions and comparatively little importance Sandakan is destined sooner or later to take her part in the advancement of trade in the Far East. The pace of development has been slow but it has been exceedingly sure. It is only a matter of forty years since it was little better than an insignificant trading station, laboriously collecting the products of the jungle. To-day it possesses the complete equipment of a modern government and a trade which is making a continual demand for improvements in accommodation and trading facilities.



**Sandakan Reclamation: Close View of Sea Wall**



**Sandakan Reclamation: Excavation for fill**

# Industrial Survey of Turkestan

ACUTE financial difficulties characterized the operations of all industrial undertakings of the Turkestan republic in 1921 and 1922.

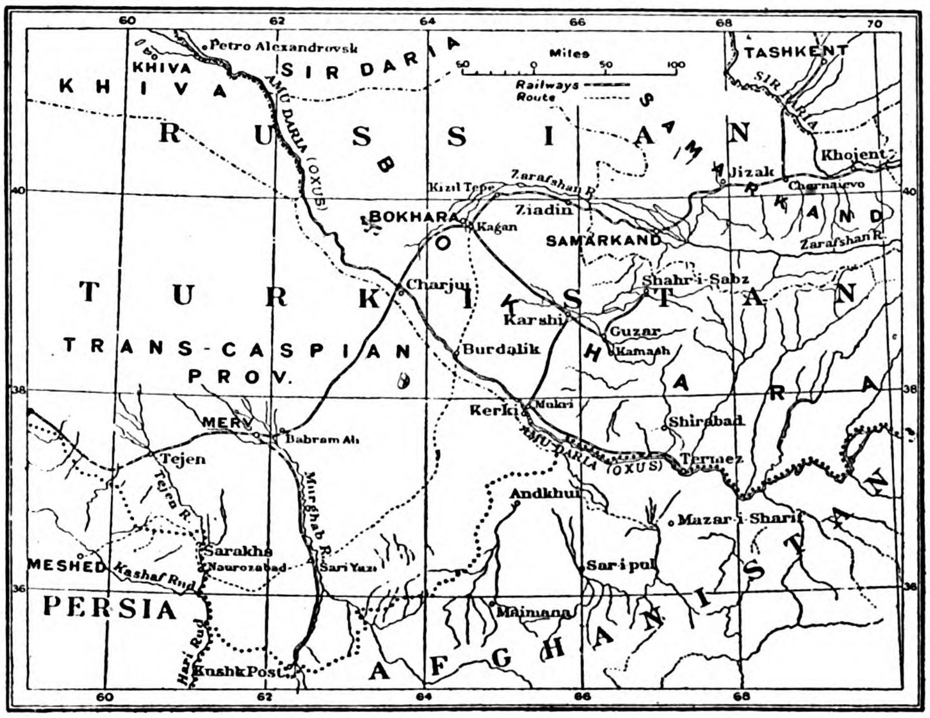
At present the total productivity of all industrial undertakings in Turkestan is estimated at a little over 21,000,000 gold rubles (1 ruble=$0.51), employing a total of 9,000 workmen. A majority of these enterprises are combined into state "trusts."

The central council of national economy of Turkestan is planning to narrow down considerably the basis of nationalized industry, reserving for itself only those branches capable of self-sustenance or essential for the government and turning others over to private management or closing them.

## Mineral-Fuel Output —The Wine Trust

The largest trust (known as the "Coal-Naphtha") comprises the four coal mines of Kizil-Keya, Sulucta, Lenger, and Kok-Yanzak and the two oil fields of Santo and Chemion. The output of the coal mines is insignificant. During the first four months of the current year 85 to 90 per cent. of the minimum program was fulfilled, which was set at 2,500,000 poods, of coal (1 long ton=62 poods). Low wages, lack of funds, and civil strife in the region of the coal mines, as well as bad condition of transport, prevent any improvement in the coal-mining industry. The output of the oil fields is somewhat more satisfactory. For the first four months of 1922 about 400,000 poods of oil were produced.

The second important "trust" is that of "Turk-Wine," whose administration is located at Samarkand, the centre of the vineyard region. This "trust" includes 13 alcohol distilleries, 7 wine-distilleries, and 9 vineyards. The program for the annual 1921-22 production has been set at 74,100,000 gallons of wine, 7,191,600 gallons of alcohol, 1,300,000 gallons of cognac, and 8,125,000 gallons of vinegar. The season commenced in the fall of 1921 after delivery of the grapes. Up to May 1, 1,716,000 gallons of alcohol and 286,000 gallons of cognac had been distilled. The work of the "trust" was developing normally, with the entire production being consumed locally, until the sudden imposition of an inordinately high excise duty by the central Soviet government curtailed the sales and now threatens to kill production.

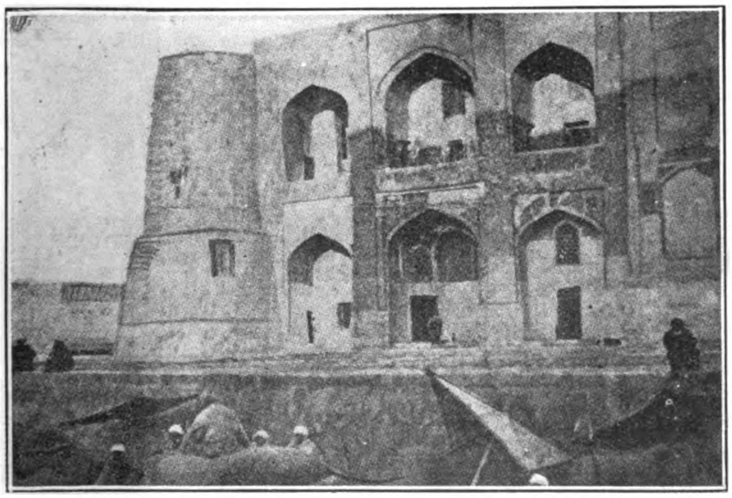



Map of Russian Turkestan.

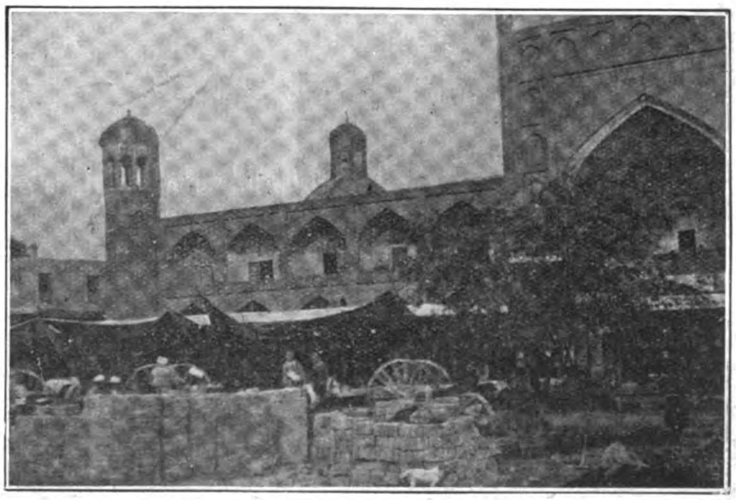
## Cultivation of Cotton—Cottonseed Oil

Compared with 1913, the area planted in cotton decreased to one-tenth in 1922, while the collection of cotton fiber, estimated at 1,000,000 poods in 1922, was less than one-twentieth of that in 1915. During the past season only 18 cotton gins, of the 280 prior to the war, were in operation. The cotton-ginning season of 1921-22 gave net results of 290,000 poods of fiber and 666,000 poods of cotton seed. The works were operated at only a fraction of capacity, by reason of slow and irregular deliveries of cotton by the growers, which caused the gins to shut down intermittently. Not more than 100,000 poods of raw cotton are left at the gins throughout Turkestan and not more than 10 gins are scheduled for operation in the coming season.

Two oil-crushing plants have been in operation for the past season—one at Khokan and one at Bairam-ali. At the first-mentioned plant 242,000 poods of cotton seed were crushed, while the second plant worked up 258,000 poods. In view of the fact that the best oil-crushing plants were situated in the Ferghana



Cotton Yarn Depot at Bokhara.



The Mosque and Market at Kokand.

The Russian Consulate at Bokhara.

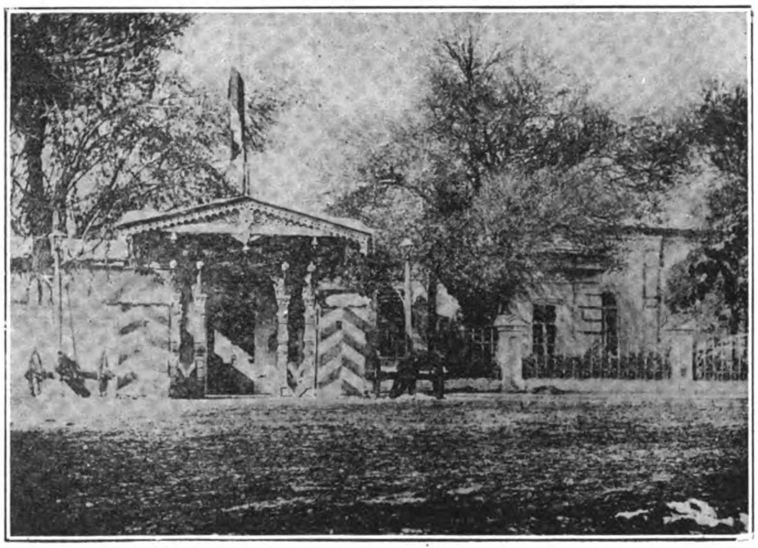
St. Kagan Railway Station, Bokhara.

province, which was desolated during the civil war, new oil-crushing plants are necessary, and have been planned in more advantageous points of Turkestan. The Kaufman plant has been completed and is in operation, having worked up 100,000 poods of seed. The Khokan plant will not be in operation during the coming season.

## Silk Production Developing

In 1914 the breeders of silkworms received 190,000 boxes of eggs; in 1919, only 11,163 boxes. In 1920 the number of boxes increased to 30,612, and in 1921 to 34,000. In 1922 there were 52,500 boxes distributed by government nurseries and trading institutions and 5,000 by private growers. Of the 1922 total, 40 per cent. was received from the home production and 60 per cent. was imported from the adjacent countries of Persia and Afghanistan. The abolition of state monopoly on silkworm breeding and trading stimulated the industry. This year's harvest amounts to from 120,000 to 150,000 raw cocoons, valued at between 2,000,000 and 2,500,000 gold rubles.

The yearly requirements of the Russian silk mills before the war amounted to 110,000 poods of raw silk, while Turkestan was able to produce 15,000 poods at the most, with the aid of mechanical contrivances for unwinding of cocoons. The maximum production of Turkestan, with mechanical unwinding, could amount at present to only 7,000 poods of raw silk; but as most of this operation is being done by hand, the actual amount obtained will be much smaller.



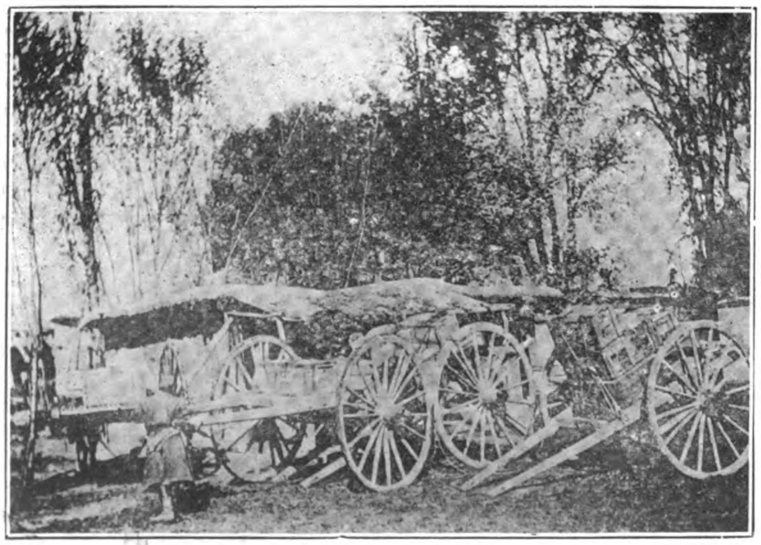
Russian Government House at Tashkent.

## Tashkend Wood-Pulp Plant—Sugar Industry

During the war construction of a huge wood-pulp plant along the most up-to-date lines was commenced at Tashkend. After the revolution difficulties arose in connection with the deliveries of machinery and other technical equipment, which has been proceeding very slowly. The same situation exists in regard to the paper factory, which forms a part of the complete plant. All building construction is complete.

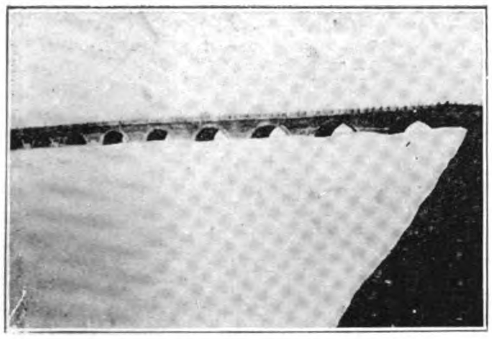
## Completion of Semiretchensk Railroad

The most vital problem affecting the economic life of the Turkestan republic and, indirectly, that of Soviet Russia, is the completion of the Semiretchensk Railroad. Construction on this line was commenced toward the end of 1913, and in November, 1920, service was opened on the section from Arys (terminal) to Owliay-Ata (Aulie-Ata)—a distance of 155 miles. At the present time construction of the roadbed has been completed from Owliay-Ata to Pishnek, but further work is suspended for lack of rails, ties, and part of the bridge work. This last section will serve three of the most fertile districts of Turkestan—Pishnek, Vernen, and Przevalsk (Karakol).

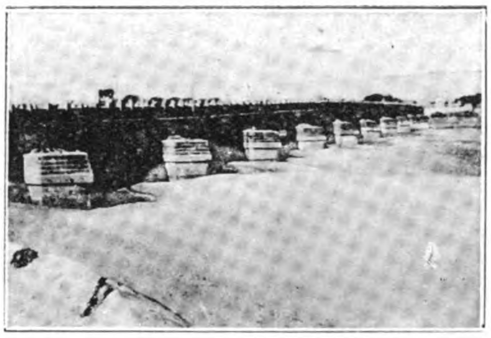


Central Asian Transportation, the Kirghis Cart.

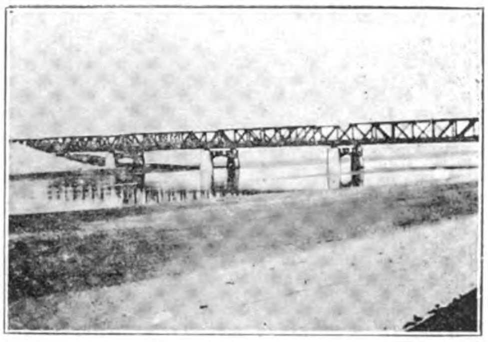
Camel Market at Tashkent.



The lower side of the Marco Polo Bridge on the Hun Ho, showing the silting of the channel



The upper side of the Marco Polo Bridge, showing the confined space for the passage of flood water



The railway bridge at Lukouchiao, showing the wide spans, a con rast to the usual Chinese practice in bridge construction

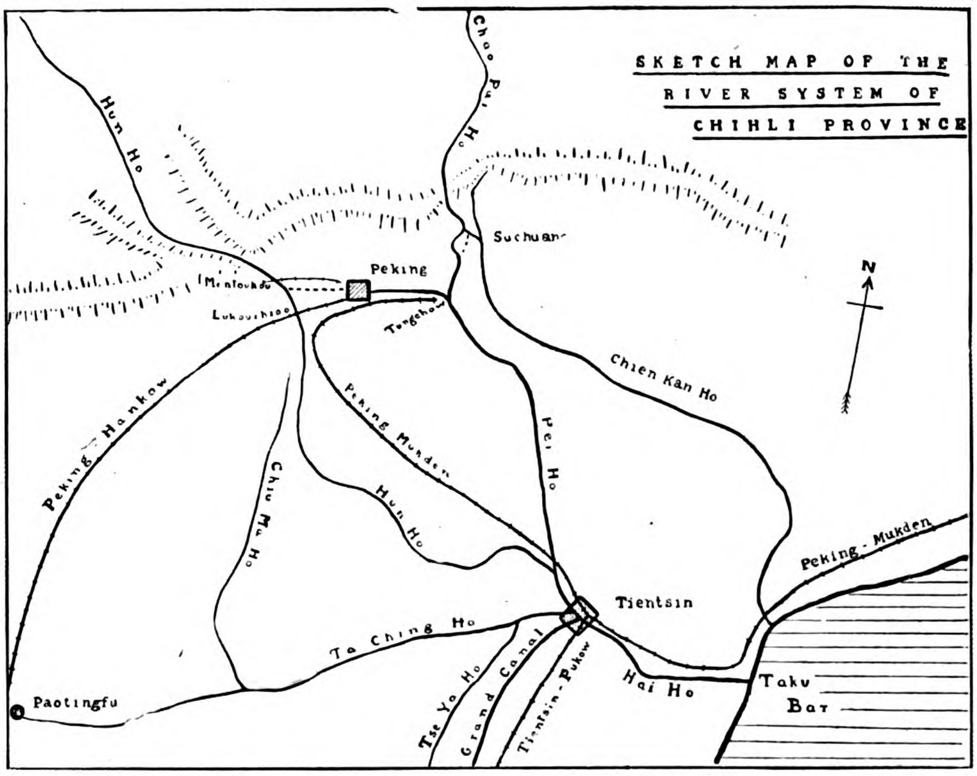
# Conservancy Work in North China

*By Laurence Impey, A.M.I.M. and C.E.*

IT is probable that there is no country in the world that has suffered more greatly in the past from the misdirected energies of her rivers than has the so-called "Celestial Kingdom" of China ; and it is therefore with the greater interest that one studies the conservancy work carried out there in bygone days and compares it with that executed abroad at the present time under the guidance of modern engineering science.

It would appear to the writer as a result of this comparative study that either the Chinese as a nation have lost the engineering skill which is exemplified in the construction of such works as the Grand Canal, the Marco Polo Bridge, the old drainage and canal system of Peking, and the dikes which used to guide most of the important rivers of China ; or that they are become a people which is no longer interested in the public welfare and whose executives are incapable, venial, or both.

Hardly a year passes without reports of disastrous floods in several provinces being forwarded to the central government, floods which could easily have been prevented by engineering investigation and constructive action on the part of the provincial authorities, if these gentry had been willing to exert themselves sufficiently, but which as a result of their criminal negligence inundate large stretches of farming land and destroy crops, live stock, houses, and even entire villages.




As an example of conservancy work of the old and the modern school one cannot choose a better study than that afforded by the river and canal system of Chihli province, for the network of waterways draining that area cover a very large portion of North China itself.

This river system is the more important in that it affects the area between and around the important cities of Peking and Tientsin, both draining the surrounding country and serving as water communication between the last named treaty port and the sea.

In bygone days this water transportation was of such an order that the tribute barges and ships used to proceed as far as Tungchow to discharge their merchandise intended for the imperial capital, whither it was then conveyed either by canal or by road.

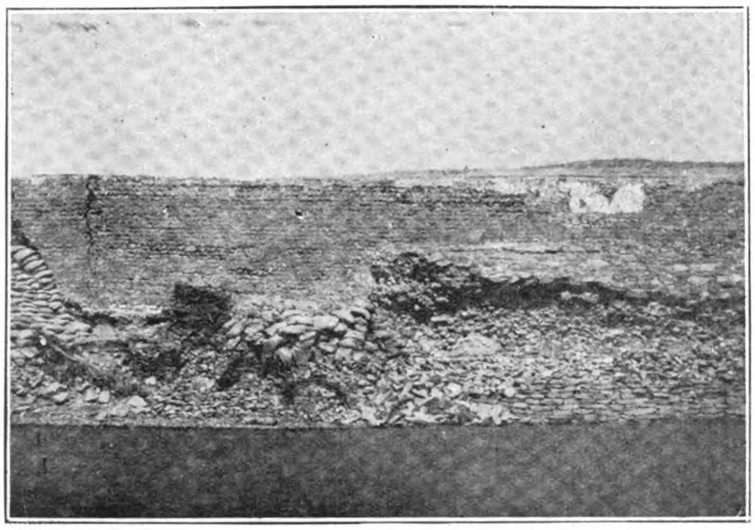
Now, however, all this is changed, the vast stone wharves are sliding into ruin, and the very bed of the river itself is almost dry, largely as a result of lack of maintenance and in attention to regulating works on the waterways concerned.

Not only this, but every ten years or so there is a disastrous flood somewhere in the area between Peking and Tientsin, seriously threatening the latter city, usually caused by the breaking of the dikes of the Hun Ho (sometimes known as the Yung Ting Ho) as a result of inattention to maintenance work.

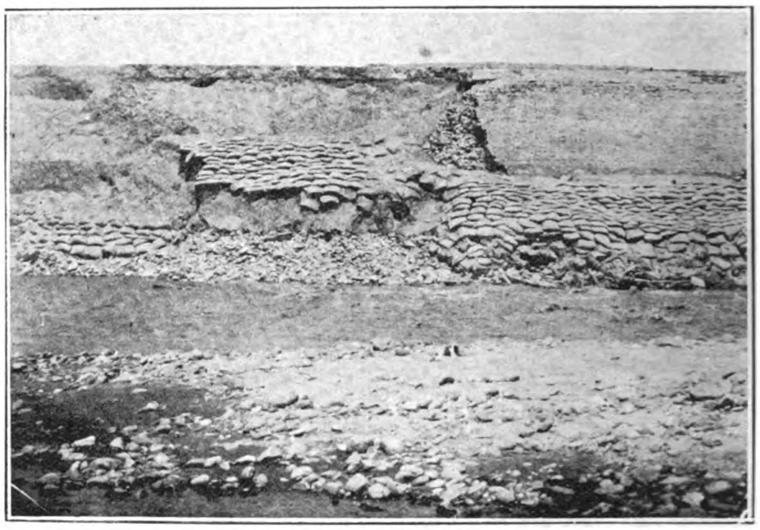
The Hun Ho (Yung Ting Ho) has a drainage area of some twenty-two thousand square miles in all, from its source in the mountains of Shansi to its junction with the Pei Ho above Tientsin, but, as is common with Chinese rivers it is practically dry during six months of the year, having a depth of only two or three feet previous to the coming of the rainy season.

Owing partly to the precipitous nature of its catchment area in the hills and partly to the lack of trees or other vegetation in that area, the scour is considerable and it has been estimated that during the flood season the Hun Ho carries down some twenty-five per cent. of solids in its course.

This accumulation has a natural tendency to settle as soon as the current becomes less swift, and as a result the bed of the river has actually risen over six feet above the level of the surrounding country in its lower reaches, and is therefore only controlled by its system of dikes.



The rock facing higher up, showing sandbag and wattle reinforcement, both equally inefficient.



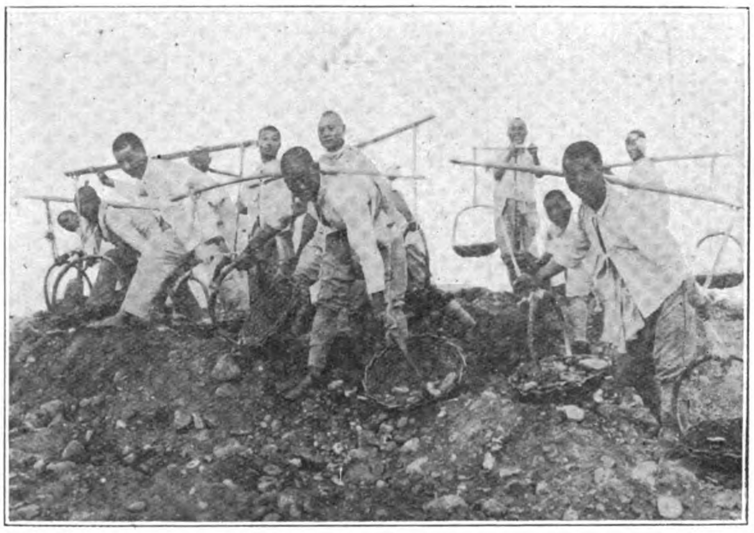
The ruined rock facing at the lower end of the work, showing the shallow nature of the river in the dry season

These dikes were solidly constructed in the first place, the stretch from the hills in the neighborhood of Mentoukou down to the Marco Polo Bridge or Lukouchiao being defended by masonry of great strength, which only time and neglect have combined to undermine in certain places.

The engineers appointed under the old imperial regimé placed their retaining dikes some six hundred yards apart in most places, so that the channel is of such a capacity as to be almost dry as a rule, and it was only at the entrance of the Hun Ho into the Pei Ho that they adopted another formation.

Here the river was allowed to expand into a delta, covering some four hundred square miles in all, upon which the silt brought down in the flood season could be deposited in some measure, instead of forming an obstruction in the channel of the Pei Ho.

This proved effective to a certain extent, though the construction of the bridge at Lukouchiao, famous through its mention in the annals of Marco Polo, proved an obstruction sufficient to serve as a cause of consider able silting, as may be observed in the accompanying photographs.



General Feng Yu-hsiang's soldiers as transporters of earth. They were paid merely their subsistence rates on the work

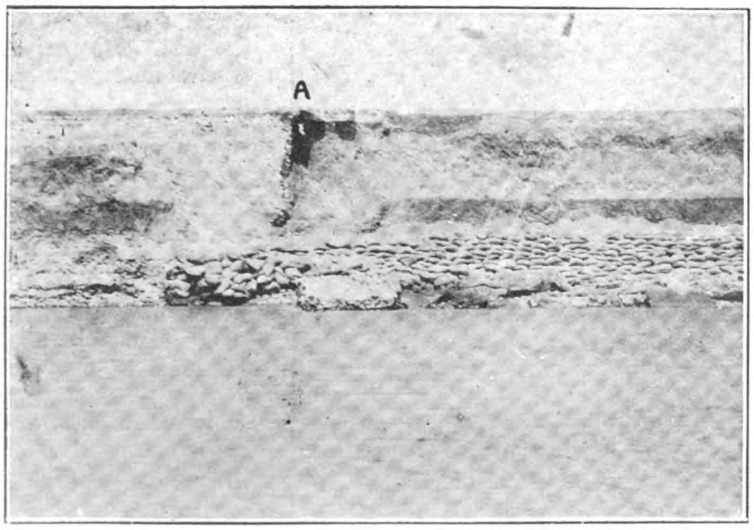
The sand deposit has gradually risen above and below the bridge, until the arches can only accommodate the flood flow with the greatest difficulty, as can be realized when it is noted that it is registered at 105,000 cubic feet per second as in the flood season of 1922.

The railway bridge immediately above this point has a wide span, and it seems unlikely that it will ever be either seriously threatened or prove an obstacle to the flood current, sufficient to cause any large deposit of sediment.

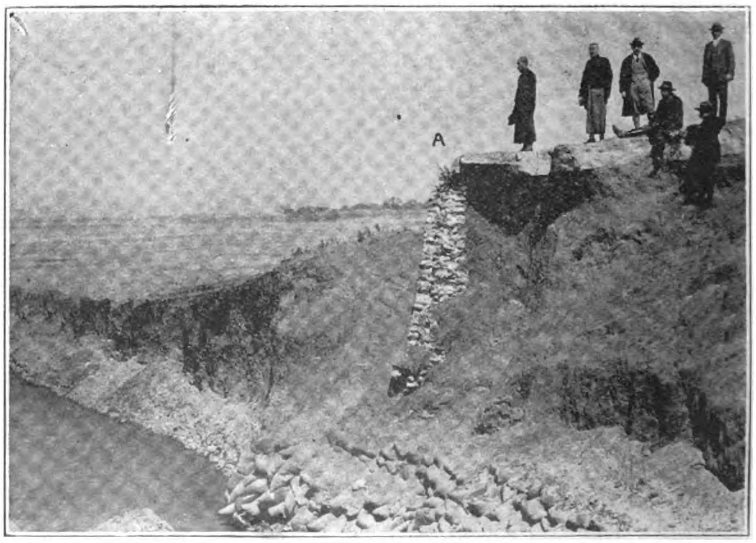
In 1922 the river rose to such an extent as to threaten a disaster, and it was with the utmost difficulty that the dikes were maintained during the short rainy season of July-August, very considerable damage being caused to the rock facing of the levee in various places.

So threatening was the situation that the ministry of the interior alloted $110,000 to the conservancy board responsible for the maintenance work, though reports state that this payment has never been made owing to the financial difficulties of the government.

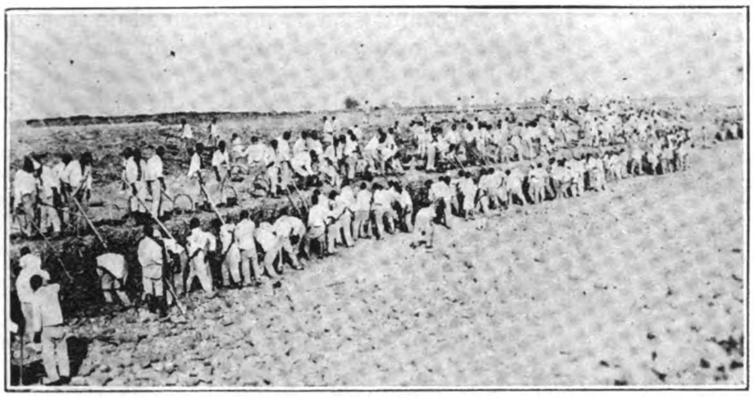
The conservancy board borrowed $60,000 at 8 per cent. repayable in eight months from the Peking committee of the China




The levee at the point indicated in the other sectional photo, where the wall has entirely collapsed




A section of the wall, showing its lack of foundation, and giving an idea of the flat country surrounding the river until it reaches the hill



View of the diversion channel, note the military discipline

The construction of the dam prior to the diversion of the river

international famine relief commission, guaranteeing to maintain the Hun Ho dikes during the 1923 floods with this sum.

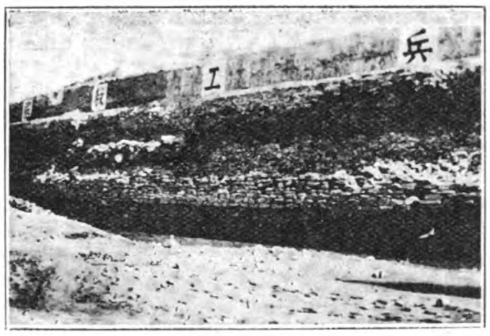
The most dangerous point on the river was decided to be one on the north bank between Mentoukou and Lukouchiao, where the flood current last year had attacked a spot at the junction of some new and old masonry facing and undermined the rock protection of the dike over a distance of some twelve hundred yards.

Estimates for the repairs vary considerably, one engineer suggesting that $10,000 would be sufficient, while another stated that it would require the full $60,000, the writer's opinion is that a satisfactory job can be done for $40,000 approximately.

In the first place, on commencing work, it was found necessary to divert the depleted river from its accustomed course at the foot of the dike, in order that the footings of the new wall could be excavated, and this was accomplished by the construction of a temporary diversion dam above the threatened point and the passing of the water into a previously prepared canal.

This work was all undertaken by General Feng Yu-hsiang, whose soldiers were quartered in the vicinity of Peking, and who allotted some five thousand of them to this task under military supervision but subject to the instructions of the engineering staff of the conservancy board.

The channel was dug in rather less than six weeks, a temporary dam made of wattle piers filled with boulders, fronted with sandbags and backed with earth, was thrown across the old course of the stream, and the construction site was cleared for operations.



General Feng Yu-hsiang's motto "Military Labour will save the Country"

The rock facing is now under course of construction, as shown in the photos some of the stone being carted from the neighboring hills at a cost of about $9 a *fong*, and some of the boulders being taken from the old bed of the river itself.

As can be realized from the photographs, the work had been temporarily reinforced previously, but the lack of foundations had caused a complete subsidence, sandbags, masonry, and wattle work all collapsing together under the extreme pressure of the flood tide of 1922.

In the opinion of the writer this use of troops for constructive work is the most encouraging sign which has been seen in China for several years, and it is to be hoped that other military leaders will follow the patriotic example thus set them by General Feng Yu-hsiang.

As far as the actual construction work is concerned, the diversion canal and dam serve their purpose satisfactorily, as shown in the plan, but it is somewhat unfortunate perhaps that the protecting wall should have been rebuilt in the previous style, as there is no protection for the footings allowed, and in that case a sloping face which will settle gradually and prevent scour is preferable to a vertical wall which has no protection against undermining.

The present scheme, however, should prove suitable to the existing conditions in relieving the immediate danger, and meanwhile the whole question of the Hun Ho (Yung Ting Ho) conservancy work is under the consideration of the Chihli river commission at Tientsin.

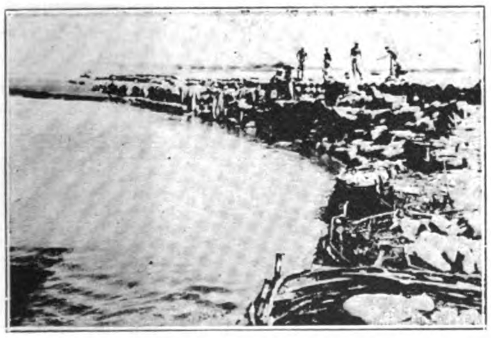
This body has made extensive surveys over the whole area, and has several designs under discussion, though the engineering and executive departments find themselves considerably handicapped by the difficulty of obtaining sufficient funds for their plans in the immediate future.

The scheme which they appear to favor includes the construction of a regulating dam on the Pei Ho and the passing of the water from the Hun Ho into a new channel on the far side of the Pei Ho, thus allowing it to reach the sea without danger of silting up the river approach to Tientsin.

The total cost of this is estimated at $1,500,000 Mex., including the necessary bridges for the Peking-Tientsin railway and road, and it would seem that it is the most economical and soundest scheme available at such reasonable expenditure.

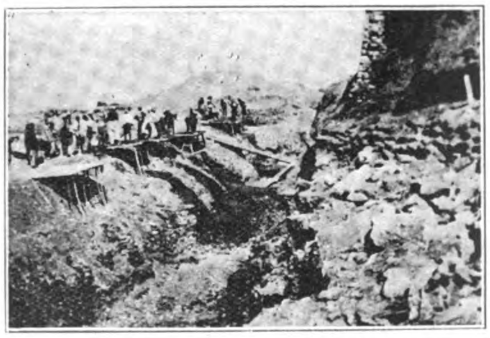
It is also possible that a diversion scheme might be practicable on the upper reaches of the Hun Ho, whereby part of its flow would be directed through a new channel at a point below Mentoukou towards the city of Peking, into whose system of waterways it would eventually flow.

This, while necessitating a far greater expenditure, would greatly benefit the city, which at present suffers greatly through

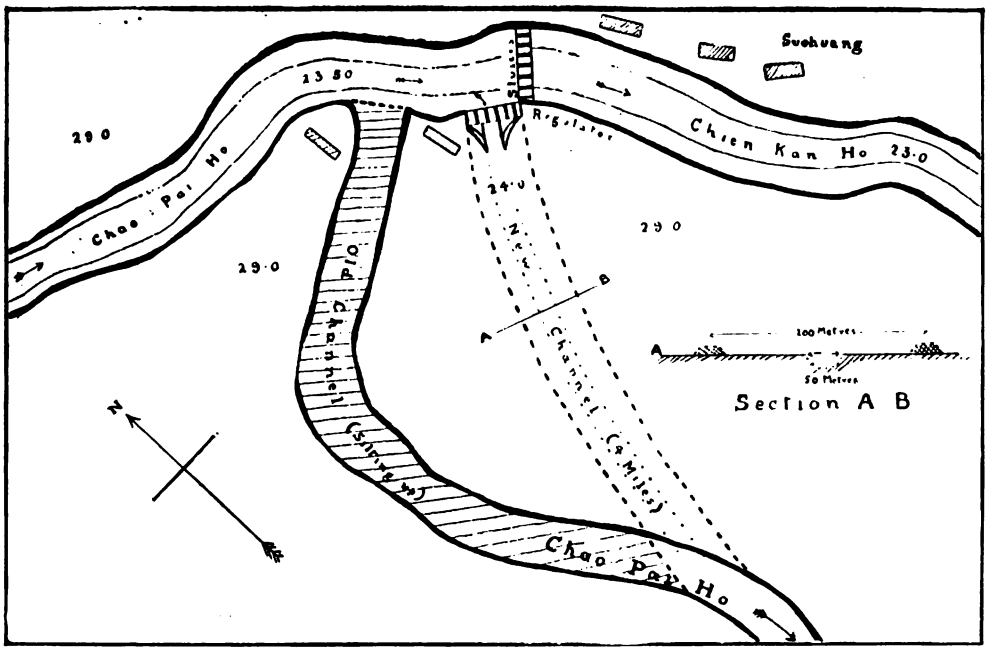


The dam after completion, with the river successfully diverted into its new channel, note the wattle reinforcement and sandbag facing

Working parties engaged on excavating the foundation of the new wall, note that there is no mattress or riprap protection



Working parties mixing and filling in the concrete for the facing of the river wall




Chao Pai Ho Conservancy Work, Suchuang, Chihli Province

A commission is now formed to consider the conservancy work necessary on the Yangtze, plans have already been put forward for improvements to be executed on the Yellow River, the commission for the Hai Ho at Tientsin was constituted in 1897 and has been functioning ever since, but in spite of these bodies and their best endeavors it must be admitted that little has as yet been accomplished.

Therefore it is the more gratifying to study the work of a body which has only recently come into existence, but which shows every sign of a successful career if one may judge from the work already being put through.

In saying this there is no intention to disparage the work done on other conservancy schemes, it is merely a record of the fact that this particular scheme happened to come under the notice of the writer, and he cannot but express his appreciation of the fact.

The commission for the improvement of the river system of Chihli was formed subsequent to the great floods of 1917, and immediately set about an organized survey of the whole of the area covered by the rivers shown on the accompanying map, a task which is now well on the way to completion.

lack of water, and it would also rehabilitate the Peking-Tungchow canal, which is now practically disused, but the locks on which could be put in working order at a reasonable cost.

A flood channel might also be provided into the Chiu Ma Ho at a point below Lukouchiao, which would enable the conservancy engineers to handle exceptional floods on the Hun Ho more satisfactorily, besides improving the navigating possibilities of the Ta Ching Ho as far as Paotingfu.

All these projects call for financial assistance, and in the present state of the country it is uncertain as to when and where such help can be obtained; but in view of the fact that, in spite of this difficulty, the Chihli river commission are still carrying on construction schemes it would appear that there is still a possibility of success.

The government is inert or impotent, but the chambers of commerce and the Chinese people themselves are alive to the danger which threatens their prosperity, and are willing to co-operate as far as may be, as has already been evidenced in the carrying out of other schemes in various parts of the country.

The militaristic policy of the *tuchuns* has been and is the chief obstacle in the way of success, and General Feng Yu-hsiang has correctly interpreted the situation in the gigantic Chinese characters which are painted on the river wall of the Hun Ho conservancy work, and which read—"Military Labor will save the Country."

# The Suchuang Conservancy Scheme Chao Pai Ho, Chihli, China

*Chief Engineer*: Mr. F. C. Rose, C.S.I.
*Field Engineer*: Mr. R. D. Goodrich
On behalf of the Commission for the Improvement of the River System of Chihli, China.

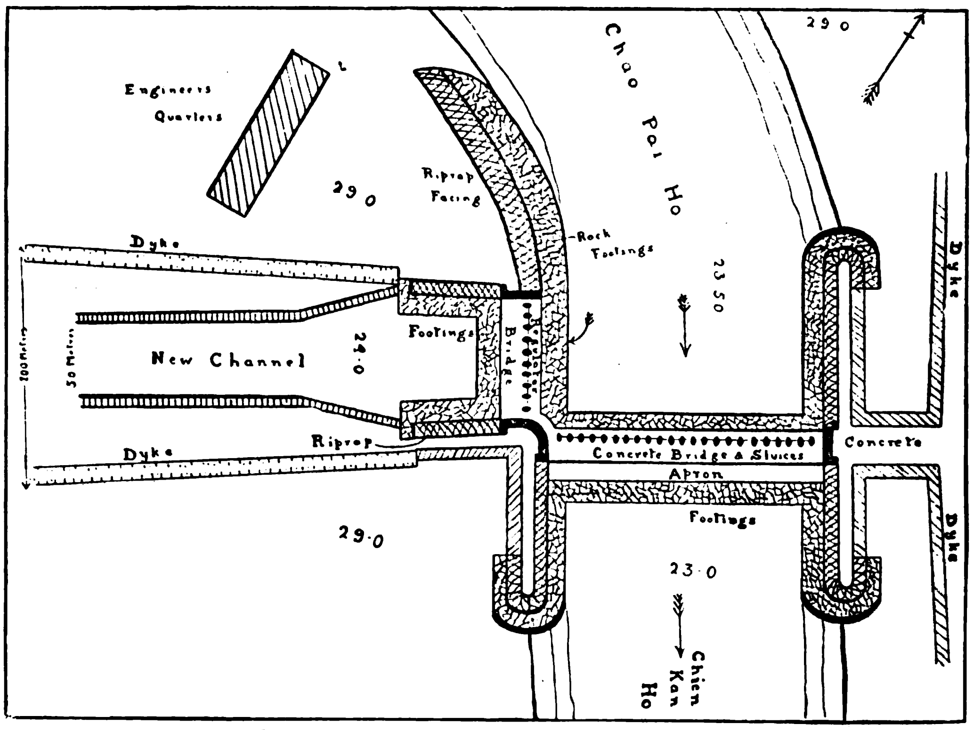
It is only within recent years that any definite project has been put forward for the handling of the various problems arising from the rivers of China, rivers which are alike the salvation and the curse of the country.

The salvation, because without them the entire transportation of the empire would fall to pieces and the farmers lose the use of at least one-quarter of their present lands, the curse, because through gross neglect and veniality the rivers are allowed to alter their course and flood vast stretches of arable land throughout the country.

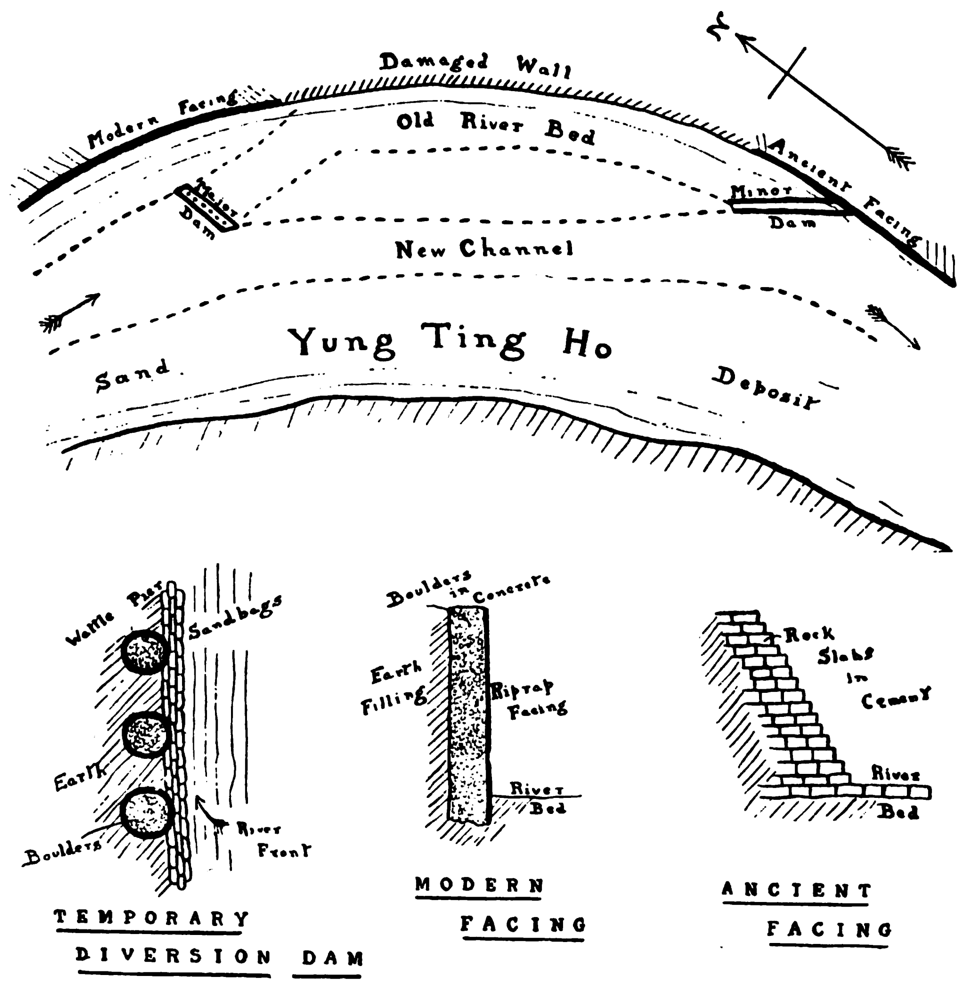
The Hai Ho from Tientsin to the sea had been suffering from an excess of silt deposited in its channel by the Yung Ting Ho and other rivers, and upon investigation it was judged that this was largely due to the fact that in 1912 the Chao Pai Ho, which previously had drained into the Pei Ho and assisted in scouring the channel of that stream and the Hai Ho, had broken its retaining dike and found a way into the channel of the Chien Kan Ho.

This enabled it to flow direct to the sea at a point some distance above the Hai Ho outlet at Taku, and the resultant loss of some 10,000 cubic feet per second in low water rising to as much 105,000 cubic feet per second in flood period caused a large amount of silting, besides lowering the navigating value of the Hai Ho and Pei Ho channels very considerably.

Therefore it was decided that a reversion scheme on the Chao Pai Ho was advisable, and the necessary funds having been obtained, the work would have been commenced in the summer of 1922 if the engineers had not been hindered by the civil war between the Chihli and Fengtien forces during the possible working season before the rains.




Chao Pai Ho, Suchuang Sluices and Regulator



Yung Ting Ho Conservancy: Plan and Details

However, in the spring of 1923 all the arrangements were completed, and the right of way was purchased to enable the construction of the new channel to be commenced.

This is the more worth remarking in that on other construction schemes in China the unfortunate peasant has usually been expropriated by the authorities without due compensation, and from fear on this account the strongest opposition to the scheme had been put forward by the local farmers.

The payment of $180,000 for the land was an unprecedented event in their experience, and immediately overcame any previous objections which they had put forward, for they themselves fully realized the benefit of the proposed conservancy work to their own district, once their dread of expropriation was vanished.

Considerable numbers of these farmers were engaged on sub-contracts to dig and carry the earth from the new channel and to build the dikes required, while others found employment on the stone transportation and riprap work.

The total cost of the new channel was estimated at $200,000, and this appears to be approximately correct now that the work is more than half completed.

The entire scheme may be most easily comprehended by reference to the appended sketch map, whence it will be seen that a dam is to be thrown across the escape into the Chien Kan Ho, thus diverting part of the waters of the wandering Chao Pai Ho into the newly constructed channel leading to its old bed some four miles away.

At the present time the Chao Pai Ho delivers some 110,000 cubic feet per second into the Chien Kan Ho, and it is intended to divert only 20,000 cubic feet of that amount into the new channel, though as that is improved with time it is expected that its capacity will increase to nearly 40,000 cubic feet per second if required.

The sluice across the Chien Kan Ho outlet has a total width of over seven hundred feet, and will contain twenty-eight sluice gates, each twenty feet in width, twenty-three feet in height, and made of 5/16 inch steel plate.

A similar, though smaller, regulator will function for the new channel of the Chao Pai Ho, having a width of about two hundred and twenty feet and containing ten gates of similar proportions to the above.

The total cost of both sets of sluices is estimated at approximately $850,000, while the whole scheme will attain a total of nearly a million and a half dollars Mex. when completed.

The piers for the regulator and the sluice are built of local brick set in concrete, and are twenty-five feet in height, six feet thick, and thirty feet in depth, as illustrated in the photographs of the site.

The riprap facing is on a slope of slightly less that 1 in 1, and is protected at its base by a footing of rockwork in wire cages extending well out into the river bed.

These wire cages are six feet by six feet by three feet, and are built on the spot by skilled workmen brought from Shanghai, at a cost of $4 per cage, which is extremely reasonable considering their value for the work.

Transportation is, of course, one of the chief difficulties, as the steel work comes by ship to Tientsin, as do 18,000 barrels of cement from Hongkong, thence by rail to Tungchow, and so overland fifteen miles by cart, while the rock is quarried in the distant hills and brought down by cart or by native sampan to Suchuang.

It will be noted that the new channel is being constructed with a width of fifty metres only, while the excavated earth is used to build dikes some two hundred metres apart, it being expected that the first flow in the new course will only fill the first named channel, and that it will gradually form its own bed between the two retaining dikes later on.

A time estimate for construction work is always a little difficult, but Mr. Rose hopes that the earth work of the new channel will be completed by August 1923, the regulator by the spring of 1924, and the sluices across the Chien Kan Ho by the spring of 1925, while the riprap and foundation work shown in the photographs will be completed by the autumn of 1923 unless an exceptionally high flood prevents.

The engineering quarters on the west bank are practically finished, and the staff hope to be in occupation by August, after which they will be in constant use, for it will be necessary to leave a resident engineer to supervise the sluices after the work is closed down, both in order that no danger may threaten them and that complete records of flood conditions may be taken on the spot.

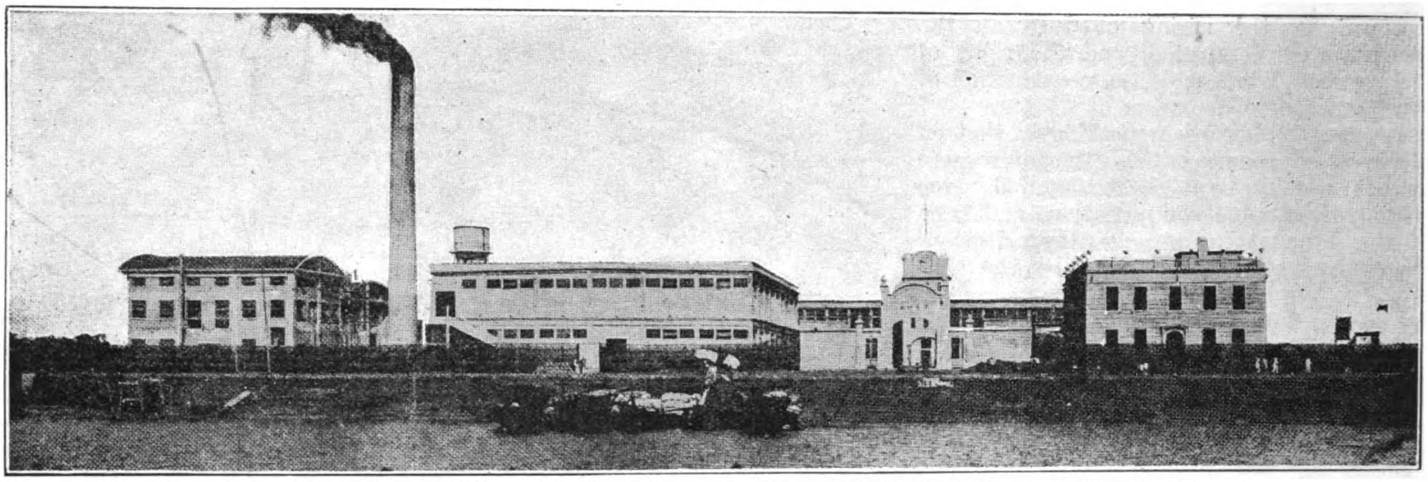
It will be seen from the foregoing summary what an important piece of conservancy work is now going forward at Suchuang, for if it is successful, and there seems no reason to doubt that it will be, it will set an example which will be followed throughout China when in the future the full utility of works of public importance is realized.

The engineering staff of the Chihli River commission is entitled to full credit for the execution of such a piece of work under great difficulties, and it is worth while mentioning here that they have not only this in hand but have now placed before the public further schemes of river improvement entailing an expenditure of an additional five million dollars Mex., which would enormously benefit the greater part of Chihli province, and particularly the important port of Tientsin.

At the same time the writer would like to draw attention to the enormous importance of some scheme of afforestation in connection with these rivers, for while they cover a total area of over eighty-eight thousand square miles, no less than sixty thousand square miles of this is in hilly country, where the importance of vegetation cannot be overestimated as a means of preventing denudation, and the consequent silting up of the beds of the rivers concerned.

China had vast forests in the past, and there is no reason why she should not regain them in the future, providing that the government can be induced to take the requisite steps to promote enterprise in this direction and the people prevented from cutting every available tree for firewood.

(*Continued on page 535*)



The Hua Feng Cotton Mill at Woosung: Designed and Erected by the Wah Chang Trading Co.

# China's Cotton Industry.—1

## A General Survey of Cotton Production and Manufacturing Industries in China

*Theodore Chen, B.A.*

"ONE will suffer cold, if a woman does not weave," says an old Chinese proverb. Back even in B.C. 3957, according to our historical records, people were taught the art of spinning and weaving by Mih Hsi Sze. For thousands of years, however, weaving was carried on but only in the "individual handcraft system." Even down to the last days of the Manchu dynasty, the art had been improved only to such an extent as "household handcraft system." Not until during the reign of Kwang Hsü, when machine spun cotton yarn was first imported into China from India, did a few farsighted Chinese begin to realize the importance of the modern method of cotton manufacturing and deem indispensable the establishment of modern cotton spinning and weaving mills. Within a period of only three decades (1890-1923) the cotton manufacturing industry in a modern sense has grown up in China from the zero mark to 120 mills with 3,550,108 spindles and 27,514 looms.

Progress in cotton cultivation is marked with the same degree. Although cotton raising has been carried on very extensively for centuries by the Chinese farmers, the average production has nevertheless, only been sufficient for household handcraft spinning and weaving and to fill the needs of bed-coverings and winter clothes. As a matter of fact, the production of cotton has not been encouraged to any great degree and consequently no special effort has been put forth by the people. The recent rapid growth in the number of mills and the increasing consumption of raw cotton have made cotton raising a very profitable pursuit for the farmers. The mill owners on the other hand have also encouraged the output of raw cotton for their own end; and have thus stimulated much the increased production of cotton in China. In 1918, it was reported that more than 31 million *mow* of land was under cultivation with a total yield of 10,965,530 piculs of cotton. It would be easy for China to extend her cotton acreage to 150 million *mow* with a yield of 40 million piculs.

There is every evidence to prove that China is the most hopeful country of the world in the cotton manufacturing industry. The present is only the beginning of what will be a greater and more rapid development in the near future. The market is ready for the consumption of whatever the mills can turn out, labor is cheap and abundant for full operation of mills and raw cotton will be available for the full running of the mills. China's cotton manufacturing industry, therefore, offers an interesting subject for study in both its agricultural and its manufacturing phases. Its tremendous potentialities and possibilities in the future and its marked success and development in the past years have drawn much attention not only from the Chinese but from the foreigners as well.

### 1. Cotton Production in China

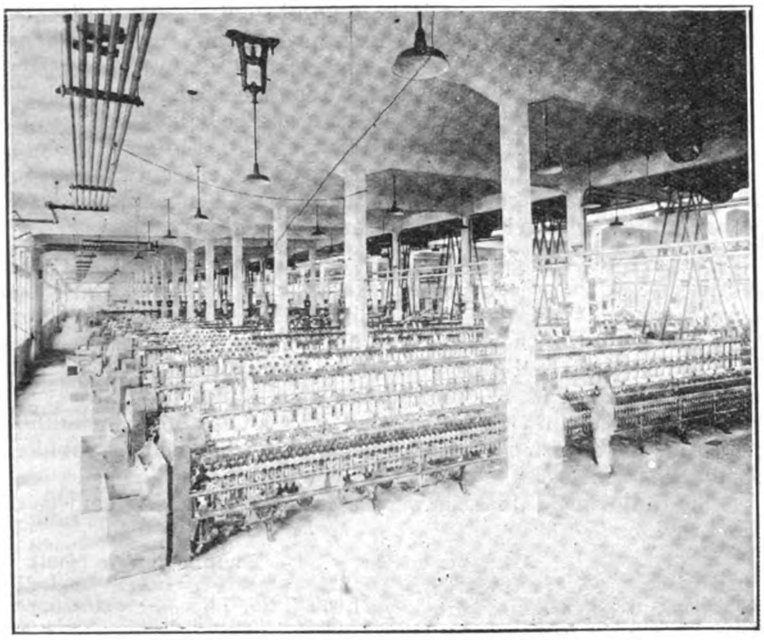
Although there is a lack of accurate statistics, it is generally supposed that China ranks third in the world's production of cotton with an annual output of two million bales (four piculs per bale), India being second with four million bales and America first with an annual yield of fourteen million bales. It must be admitted that very scant care has been given to cotton cultivation in China. Only recently have Chinese cotton merchants been encouraging the cotton growers to improve the quality of their product and to increase the quantity thereof. Experimental work in the introduction of American seeds and the improvement of native crops are being carried on very effectively by the Chinese cotton mill owners' association, the ministry of agriculture and commerce and the missionary educational institutions. According to the latest investigation, there were in China more than 31 million *mow* of land under cultivation with a yield of more than ten million piculs of cotton in 1918. As a result of flood in the Yangtze Valley, the 1919 cotton crop was greatly decreased to only 9,316,390 piculs. In 1920, there were not only floods in Kiangsu and Chekiang provinces, but also drought in the north, the cotton crop was, therefore, again decreased to only about seven million piculs.

The following figures will show the general trend of cotton production in China from 1918, the crown year of production to 1922, the year of slight recovery :—

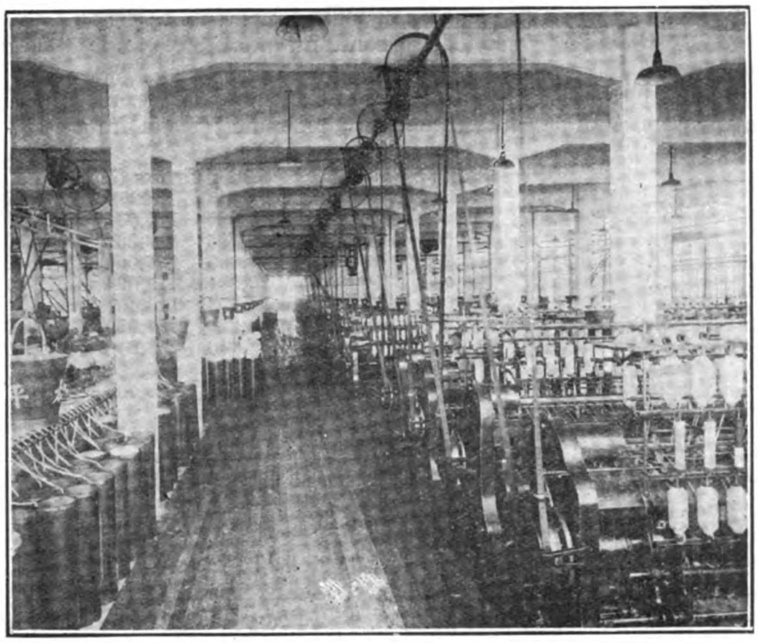
| | |
|---|---|
| 1918 .. .. .. .. | 10,965,530 piculs |
| 1919 .. .. .. .. | 9,316,390 ,, |
| 1920 .. .. .. .. | 6,750,000 ,, |
| 1921 .. .. .. .. | 5,438,000 ,, |
| 1922 .. .. .. .. | 7,342,000 ,, |

The average production within the five years as above stated is over 7,962,000 piculs. Suppose each spindle consumes 350 catties of cotton, and out of 3,550,108 spindles, if 2,200,000 are in full operation, then the yearly consumption of cotton in China will be 7,700,000 piculs. When all the spindles are in full operation 12,425,000 piculs will be required. Furthermore, about four-tenths of cotton production in China are used for filling bed-coverings and winter clothes, so out of the average production of 7,962,000, only 4,776,000 piculs are actually consumed by the cotton mills.

Year after year, China's cotton crop has been greatly affected by flood, drought and other unfavorable conditions. This, however, is only temporary. Investigation shows that the province of Chihli in 1921 leads in cotton production with a yield of 1,819,314 piculs, an increase of 800,000 piculs over the previous year; followed by Kiangsu, 1,283,660 piculs; Hupeh 615,150 piculs; Shensi 429,967 piculs; Chekiang 308,760 piculs; Shangtung 304,077 piculs; Shansi 248,737 piculs; Hunan 219,400 piculs; Anhwei 163,830 piculs;



The Hua Feng Cotton Mill, Woosung, Spinning Machines:
Designed and Erected by the Wah Chang Trading Corporation, Shanghai



The Hua Feng Cotton Mill, Woosung, Roving Frames:
Designed and Erected by the Wah Chang Trading Corporation, Shanghai

and Kiangsi 45,325 piculs ; with a total of 5,348,220 piculs, 1,312,183 piculs less than 1920.

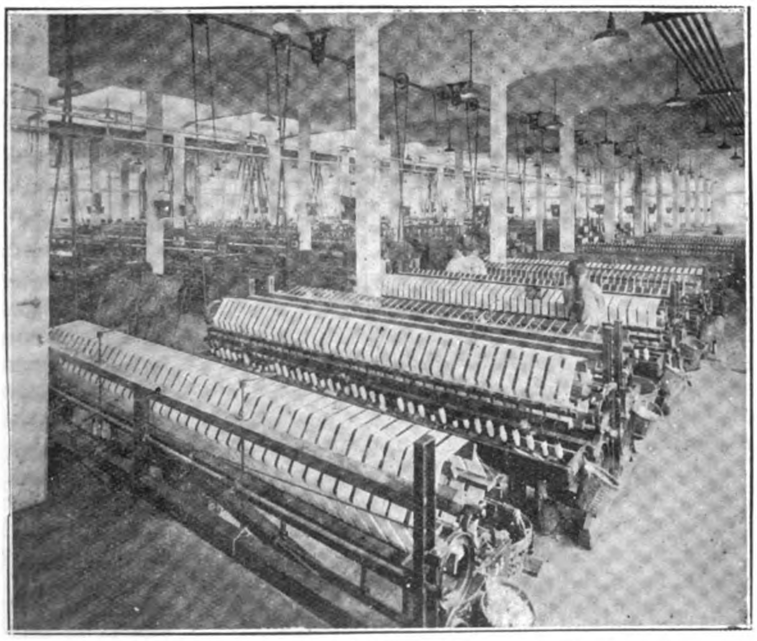
The cotton belts of Huang Ho (Yellow River) Valley scored a great success in growing American seeds, on account of its favorable climate and soil. Accordingly, Shensi produced 428,043 piculs of American cotton, followed by Shansi 104,880 ; Honan 49,800 ; Shangtung 11,768 and Chihli 10,488 ; with a total of 604,979 piculs. In the Yangtze Valley, it has not met with much success.

The following table shows cotton production in the ten leading provinces from 1919 to 1921 :—

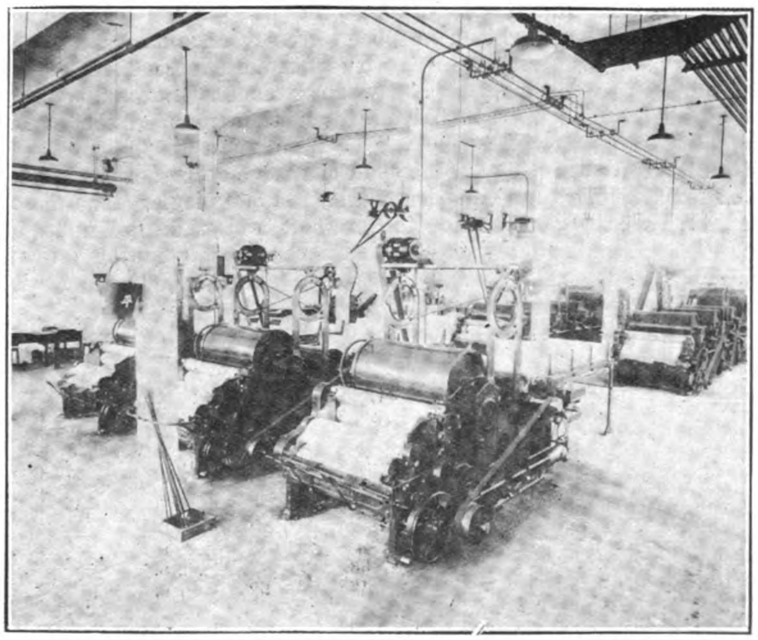
| | Acreage (in *mow*) | | | Production (in picul) | | |
|---|---|---|---|---|---|---|
| Province | 1919 | 1920 | 1921 | 1919 | 1920 | 1921 |
| Chihli ... | 6,397,000 | 4,391,032 | 4,709,963 | 2,683,753 | 1,022,219 | 1,819,314 |
| Shangtung | 3,218,000 | 428,330 | 2,333,190 | 894,558 | 126,070 | 304,077 |
| Shansi ... | 486,320 | 615,240 | 695,025 | 201,851 | 64,996 | 248,737 |
| Honan ... | 1,417,654 | — | 856,000 | 427,633 | — | 219,400 |
| Shensi ... | — | 1,283,650 | 2,405,910 | 643,000 | 293,967 | 429,967 |
| Kiangsu ... | 19,278,307 | 12,474,700 | 11,812,600 | 2,763,160 | 3,022,210 | 1,283,660 |
| Chekiang ... | — | 1,270,100 | 1,199,000 | 264,900 | 251,106 | 308,760 |
| Anhwei ... | 762,600 | 1,195,695 | 1,099,000 | 125,535 | 291,975 | 163,830 |
| Kiangsi ... | — | 398,850 | 256,650 | 105,000 | 97,860 | 45,325 |
| Hupeh ... | — | 6,269,700 | 2,849,100 | 1,207,000 | 1,580,000 | 615,150 |
| Total ... | 31,559,881 | 28,327,297 | 28,216,438 | 9,316,390 | 6,750,403 | 5,438,220 |

1. *Chihli Provinces.*—Cotton in this province is mostly produced in the southern part. The annual production of cotton in Sungchih amounts to over 400,000 catties and in Chinghsien 6,000,000 catties, covering an area of more than 120,000 *mow.* While in Chingting cotton cultivation is the principal occupation of the people. There are more than 208 villages in the district where nearly every farmer devotes eight-tenths of his land to cotton crop. The price for raw cotton was only 7-cts. per catty before the completion of the Peking-Hankow Railway, which has not only raised the price but also encouraged more production of cotton. On account of its vast tract of land devoted to cotton cultivation, Chingting has to depend on Shansi and other near-by provinces for food supply.

There were 4,709,963 *mow* of land in Chihli under cotton cultivation in 1921, an increase of 300,000 *mow* over the previous year. The total yield of the same year was 1,819,314 piculs, an increase of 800,000 piculs. Both the soil and climate of Chihli are ideal for cotton raising. There are many species of cotton seeds, such as grand white, small black, long and short fibres, etc. Wuchih district produces the best quality. American seeds are grown very successfully in the districts of Wuchih, Shenfoong, Yuohlien, etc. Trice is the most common specie grown. The total output of American seed was estimated at 10,488 piculs in 1921.



The Hua Feng Cotton Mill, Woosung, Reeling Machines:
Designed and Erected by the Wah Chang Trading Corporation, Shanghai



The Hua Feng Cotton Mill, Woosung, Picker Room Machines:
Designed and Erected by the Wah Chang Trading Corporation, Shanghai

Tientsin is by far the most important cotton mart of this province with Shichiaochuan second in importance, both being situated on railway lines.

The following table shows its principal producing centres with amounts of production and acreage under cultivation from 1919-1921 :—

| Districts | Acreage (in *mow*) 1919 | 1920 | 1921 | Production (in picul) 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|
| Chaocheng | 500,000 | 540,000 | 391,000 | 209,000 | 111,500 | 156,100 |
| Yunnien ... | 368,000 | 110,000 | 364,500 | 100,096 | 19,300 | 116,680 |
| Chingting ... | 300,000 | 32,000 | 387,000 | 120,000 | 65,000 | 159,320 |
| Wuchih ... | 810,000 | 85,000 | 90,950 | 20,381 | 2,024 | 38,194 |
| Kaocheng | 1,166,000 | 345,000 | 512,550 | 521,574 | 110,400 | 264,030 |
| Chinhien ... | 580,000 | 422,000 | 462,300 | 324,220 | 151,920 | 166,300 |
| Sungchih ... | 120,000 | 110,000 | 220,000 | 51,440 | 36,000 | 79,200 |
| Foongshun | 277,000 | 305,000 | 30,000 | 118,833 | 55,000 | 4,750 |
| Yuohdien ... | 125,000 | 120,000 | 20,500 | 57,420 | 25,000 | 7,200 |
| Other districts... | 2,151,000 | 2,322,032 | 2,231,163 | 1,160,789 | 446,075 | 827,540 |
| Total ... | 6,397,000 | 4,391,032 | 4,709,963 | 2,683,753 | 1,022,219 | 1,819,314 |

2. *Shantung Province.*—Both native and American cotton are very well grown in practically every part of Shantung. American seeds are grown very successfully especially in Tang-ih, Kuan-dao, Kao-tang, Tsing-ping, Hai-fong, etc. Shanghsien, Lingtsing, Kao-tang and Hsia-ching are the chief collecting centres where about 130,000,000 catties are shipped annually. Cotton is the second important crop of this province (first being peanut). Tsingtao was formerly the principal outlet for Shangtung cotton to other provinces and abroad.

Owing to the drought in the first part and heavy rain in the latter part of the year of 1921, a distinct reduction in cotton production was felt. The crop of American seeds, however, was far better than the native. The yield of the former was over 11,000 piculs. The most common varieties of native cotton are purple, long and short fibres, green stalk and silky, etc. Trice is the only American seed that has been grown with marked success. Cotton is first shipped to Tsinan and thence to Hankow or Tientsin, after the supply has been taken by the local people for filling bed-coverings and winter clothes.

The following table shows the leading producing centres of this province :—

| Districts | Acreage (in *mow*) 1919 | 1920 | 1921 | Production (in picul) 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|
| Kaotang ... | 240,000 | 20,000 | 120,600 | 35,000 | 1,000 | 15,150 |
| Litsin ... | 260,000 | 6,000 | — | 50,000 | 6,000 | — |
| Pinghsien ... | 250,000 | 2,500 | 150,000 | 105,000 | 250 | 4,000 |
| Weiming ... | 347,000 | 700 | 55,000 | 10,850 | 110 | 7,015 |
| Tsingping ... | 450,000 | — | 101,000 | 129,600 | — | 11,250 |
| Hsiatsin ... | 400,000 | — | 206,000 | 129,600 | — | 41,500 |
| Lingtsing ... | 240,000 | — | 402,000 | 80,000 | — | 60,400 |
| Tangih ... | 160,000 | — | 280,000 | 51,840 | — | 32,000 |
| Kwantao ... | 220,000 | — | 158,600 | 41,250 | — | 20,000 |
| Other districts | 651,000 | 399,13[illegible] | 880,590 | 261,418 | 118,710 | 127,912 |
| Total ... | 3,218,000 | 428,330 | 2,333,190 | 894,558 | 126,070 | 304,070 |

3. *Shansi Province.*—Although not a famous producing province, cotton cultivation has been greatly encouraged by the officials of Shansi. A large quantity of American seeds was distributed free to the farmers by the governmental bureau. With the excellent yield of 1918-1919, farmers then realized the great profit in cotton growing. There were more than 695,000 *mow* of cotton land in 1921. The total yield of native cotton of that year was 248,737 piculs, and American seeds 104,880 piculs. The most common varieties of native cotton are soft, red stalk, green stalk, etc. Trice, Acala and Kings, etc. are the most common grown American seeds. All the surplus cotton (about 90,000 piculs) is exported to Tientsin and Hankow.

The following table shows the leading producing centres of this province :—

| Districts | Acreage (in *mow*) 1919 | 1920 | 1921 | Production (in picul) 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|
| Hongtung ... | 40,500 | 45,148 | 63,994 | 24,300 | 12,189 | 22,520 |
| Lingleng ... | 37,840 | 43,000 | 43,895 | 20,701 | 11,180 | 13,900 |
| Hotsin ... | 41,128 | 52,677 | 54,000 | 19,740 | 5,795 | 17,200 |
| Yungho ... | 43,529 | 61,966 | 35,693 | 25,591 | 6,596 | 10,000 |
| Lingchin ... | 44,182 | 57,230 | 13,076 | 16,420 | 572 | 12,200 |
| Yungtsi ... | 40,352 | 43,260 | 151,216 | 14,123 | 556 | 72,300 |
| Yuhsiang ... | 43,703 | 53,233 | 44,897 | 15,839 | 3,362 | 11,300 |
| Chiahsien ... | 38,355 | 62,420 | 45,135 | 13,040 | 248 | 8,960 |
| Chüoh ... | 32,474 | 39,463 | 32,642 | 13,639 | 1,578 | 12,820 |
| Other districts | 224,257 | 143,843 | 210,497 | 38,458 | 22,922 | 67,537 |
| Total ... | 486,320 | 615,240 | 695,025 | 201,851 | 64,996 | 248,737 |

4. *Honan Province.*—Cotton is quite extensively cultivated in this province, especially in the districts of Hwai-yang, Hsu-chong, Shang-chiu, and Kwei-teh, etc. American seeds are grown very successfully between Shenhsien and Lingpaohsien. The yield of native cotton is placed at 1,000,000 catties. The bulk of this amount goes to Cheng-teh Spinning and Weaving Co., the surplus being sent to Tientsin or Hankow, Hwang-ho is the chief waterway for the transportation of cotton to Changteh and Chengchow. Cotton grown in Loyang district is of very inferior quality.

At present, the cotton producing belts are divided into two main sections, the western and northern. In the northern section more native cotton is produced while in the western section more American cotton. The 1921 yield of native cotton in both sections was 169,600 piculs and American cotton 49,800 piculs. Chengchow at the cross road of Peking-Hankow and Lung-Hai Railways is the centre of cotton transportation. It handles about one million piculs of cotton from Shansi, Shensi and Shangtung provinces besides its own.

The following tables shows the leading producing centres of this province :—

| Districts | Acreage (in *mow*) 1919 | 1920 | 1921 | Production (in picul) 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|
| Hsinhsiang ... | 72,575 | — | 21,000 | 25,976 | — | 6,000 |
| Wuan ... | 65,671 | — | 57,000 | 20,946 | — | 14,000 |
| Lingchang ... | 69,358 | — | 56,000 | 23,517 | — | 13,000 |
| Anyang ... | 102,866 | — | 84,000 | 31,918 | — | 28,000 |
| Shenhsien ... | 85,000 | — | 92,000 | 35,500 | — | 24,000 |
| Lingpao ... | 111,743 | — | 120,000 | 33,522 | — | 32,000 |
| Venhsiang ... | 111,579 | — | 103,000 | 35,216 | — | 29,500 |
| Yensze ... | 125,869 | — | 70,000 | 37,760 | — | 16,000 |
| Szeshui ... | 99,228 | — | 25,000 | 29,768 | — | 5,000 |
| Other districts | 573,715 | — | 228,000 | 143,510 | — | 51,900 |
| Total ... | 1,417,654 | — | 856,00[illegible] | 427,633 | — | 219,400 |

5. *Shensi Province.*—Cotton is very extensively raised, due to the ideal climate. American seeds are also grown very successfully. Its principal cotton belt is the Wei-ho Valley. In 1919 the yield amounted to 643,000 piculs, but in 1921 it was decreased to 429,967 piculs. Shensi lacks good transportation facilities. Cotton is shipped to Chengchow and Hankow by way of Sze-shiu and Wei-ho and the Lo-dong Railway. The transportation fee at present averages at Tls. 14 per bale.

The following table shows the leading producing centres in this province :—

| Districts | Acreage (in *mow*) 1919 | 1920 | 1921 | Production (in picul) 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|
| Hwaying ... | — | 240,000 | 74,000 | 73,000 | 40,000 | 13,500 |
| Hwahsien ... | — | 133,300 | 185,500 | 50,000 | 12,000 | 52,700 |
| Weinan ... | — | 242,000 | 216,900 | 130,000 | 40,000 | 61,430 |
| Lingdong ... | — | 200,000 | 194,830 | 39,000 | 27,000 | 32,907 |
| Yenyang ... | — | 80,000 | 129,200 | 23,000 | 13,000 | 33,980 |
| Changan ... | — | 263,700 | 299,500 | — | 87,600 | 93,818 |
| Sanyuen ... | — | 89,000 | 154,800 | — | 14,700 | 38,559 |
| Kaoling ... | — | — | 163,200 | — | 35,450 | 46,450 |
| Kayang ... | — | — | 8,060 | — | 982 | 1,332 |
| Other districts | — | 35,650 | 989,820 | — | 23,235 | 55,291 |
| Total ... | — | 1,283,650 | 2,405,910 | — | 293,967 | 429,967 |

9. *Kiangsu Province.*—Kiangsu is by far the most important cotton producing province as well as cotton manufacturing centre of China. Cotton ranks second in importance to rice, the only principal staple product in China. Cotton is produced nearly everywhere in this province, especially in the six districts of Tungchow, Taichang, Kaiting, Changshuh, Shanghai and Changyinsha. In Tungchow district nearly six or seven-tenths of the land are devoted to cotton cultivation. This district comprises Nantung, Tsungming, Haimen, etc., covering an area of more than 300 *li* east to west and 150 *li* north to south. This is also the leading cotton producing section not only of this province but also of China as a whole. Average production is about 1,500,000 piculs. The Ta Sung Mills at Nantung and Tsungming consume the bulk of the production and the surplus is shipped to Shanghai.

The Shanghai district comprises Paoshan, Chuensha, Nanwei, Fengyen, Sunkiang, Kingshan and Pinghu (of Chekiang province). It ranks sceond only to Tungchow in area. Its average annual production is estimated at about 800,000 piculs. Besides supplying the local mills, it has a surplus usually shipped to Japan.

Kaiting district produces about 140,000 piculs annually. There is no mill in this district, the bulk of the cotton being consumed locally by the native handcraft spinning and weaving, the

rest being exported to Shanghai, Soochow, Wusih, etc.

Taichang district produces about 250,000 piculs annually for the consumption of Tsi Tai and Yue Tai Mills, surplus being exported to Shanghai, Soochow, Wusih, etc.

Changshuh district produces about 150,000 piculs annually. It also supplies its bulk to Tsi Tai and Yue Tai mills and native crafts, all the surplus being exported to Shanghai, Soochow, Wusih, etc.

Changyinsha district lies along the middle section of Yangtze Valley comprising an area of about 20 *li* east to west and 8 *li* north to south. Its annual average production ranges from 60,000 to 70,000 piculs. The Li Yung Mill of Kiangyin and the native crafts consume nearly its entire production.

In 1918 the yield of cotton in the whole province amounted to 4,128,696 piculs. The flood, however, reduced the yield to only 1,283,660 piculs in 1921, being only one-fourth of the production of 1918. This province not only produces a large quantity of cotton but also a much better quality than any other province. Shanghai, located at the mouth of the Yangtze, is the greatest cotton market as well as cotton manufacturing centre in China. Cotton produced in Hupeh, Shensi, Kiangsi and Anhwei provinces is also shipped to Shanghai.

The following table shows the leading producing centres of this province :—

| | Acreage (in *mow*) | | | Production (in picul) | | |
|---|---|---|---|---|---|---|
| Districts | 1919 | 1920 | 1921 | 1919 | 1920 | 1921 |
| Nantung ... | 7,582,300 | 5,000,000 | 5,200,000 | 1,500,000 | 1,030,000 | 56,000 |
| Haimen ... | 2,600,000 | 1,600,000 | 1,600,000 | 211,640 | 380,000 | 130,000 |
| Tsungming | 1,200,000 | 1,200,000 | 1,210,000 | 200,000 | 370,000 | 108,000 |
| Taihsin ... | 3,225,600 | 190,000 | 100,000 | 220,000 | 22,500 | 5,000 |
| Hsukao ... | 1,666,407 | 864,000 | 963,600 | 204,000 | 215,000 | 134,000 |
| Tungtai ... | 200,000 | 320,000 | 180,000 | 66,000 | 70,700 | — |
| Kiangyin | 140,000 | 180,000 | 380,000 | 35,000 | 63,270 | 25,200 |
| Changsuh ... | 410,000 | 400,000 | 350,000 | 55,000 | 153,000 | 41,040 |
| Taichang ... | 300,000 | 350,000 | 300,000 | 30,000 | 100,800 | 54,250 |
| Kaiting ... | 300,000 | 300,000 | 150,000 | 24,000 | 75,600 | 54,000 |
| Shanghai ... | 110,000 | 100,000 | 150,000 | 40,000 | 29,440 | 20,400 |
| Paoshan ... | 150,000 | 150,000 | 740,000 | 15,000 | 50,000 | 18,500 |
| Nanhwei ... | 785,000 | 750,000 | 350,000 | 140,000 | 198,000 | 85,470 |
| Fengyer ... | 423,000 | 400,000 | 100,000 | 80,000 | 100,800 | 32,600 |
| Chuensha ... | 120,000 | 150,000 | — | 25,920 | 54,000 | 14,000 |
| Other districts | 66,000 | 520,700 | 39,000 | 16,600 | 109,200 | 505,200 |
| Total ... | 19,278,307 | 12,474,700 | 11,812,600 | 2,763,160 | 3,022,210 | 1,283,660 |

The export and import of raw cotton from this province really deserves some attention. The actual amount of cotton exported from the interior parts of this province can hardly be ascertained on account of a lack of accurate statistics. According to the Customs Report, no export of cotton from Nanking is indicated and those exported through Chinkiang and Soochow are very small. Shanghai is the only port where cotton is exported in bulk. The total export in 1913 was 238,802 piculs, 254,433 in 1914, 138,767 in 1915, 199,827 in 1916 and 335,898 piculs valued at Hk. Tls. 689,681 were exported abroad and 32,118 piculs valued at Hk. Tls. 830,892 were exported to other parts of China in 1916. The above figures indicate only the cotton produced in this province and exported directly from Shanghai. In 1916 cotton shipped from the interior parts of China to Shanghai and thence re-exported abroad were 437,575 piculs valued at Hk. Tls. 9,714,165 and to other parts of China were 38,105 piculs valued at Hk. Tls. 845,931. Then there was also cotton shipped from abroad and re-exported from Shanghai to other parts of China, about 14,617 piculs valued at Hk. Tls. 320,113. The total amount of cotton exported from the port of Shanghai is approximately 858,313 piculs in 1916.

The export to Japan constitutes about eight or nine-tenths and the rest goes to the United States, Great Britain, France, Germany and other European countries.

The import of cotton into Shanghai from abroad was 272,142 piculs valued at Hk. Tls. 959,910 in 1912. Besides those re-exported to other ports, the net import into Shanghai was 257,525 piculs valued at Hk. Tls. 5,639,797. The import in 1913 was 107,186 piculs, 95,780 in 1914, 324,506 in 1915 and 383,437 in 1916. Shanghai also imported from Ningpo, Hankow, Shensi, Tientsin, etc., to the amount of 1,089,453 piculs in 1917. Beside those re-exported, the net import from those ports was 613,773 piculs and also imported through native customs 175,988 piculs, making the total import in 1917 approximately 1,047,286 piculs.

The import is chiefly from the United States and India. Because of its longer and finer fibres, American cotton is indispensable in spinning fine grade yarn, so it constitutes nearly two-third of the total import.

*7. Chekiang Province.*—The condition of cotton cultivation in this province is somewhat similar to Kiangsu. Being third in importance among the agricultural products (the first being silk and second tea), production is therefore not so prosperous as in its neighboring province, Kiangsu. Much attention, however, has been given recently to its cultivation. It is estimated that the best yield so far has been about ten million piculs. Hsiao-Lu-Chin, a very small town, is especially noted for its quantity production of over 200,000 piculs annually. There are about 1,199,000 *mow* of land under cultivation with a yield of 308,760 piculs in 1921, being the poorest production so far, on account of the flood.

The following table shows the leading producing centres of this province :—

| | Acreage (in *mow*) | | | Production (in picul) | | |
|---|---|---|---|---|---|---|
| Districts | 1919 | 1920 | 1921 | 1919 | 1920 | 1921 |
| Pinghu ... | — | 143,700 | 132,000 | 24,000 | 27,250 | 32,760 |
| Haining ... | — | 43,400 | 41,000 | 17,500 | 6,600 | 8,660 |
| Siaoshan ... | — | 275,700 | 270,000 | 24,000 | 69,716 | 89,100 |
| Shaohsing ... | — | 216,000 | 200,000 | 70,000 | 55,460 | 57,600 |
| Yuyao ... | — | 444,000 | 400,000 | 82,000 | 74,690 | 80,000 |
| Tsechi ... | — | 94,100 | 90,000 | 20,000 | 15,610 | 18,000 |
| Shangyu ... | — | 42,000 | 50,000 | 20,000 | 9,820 | 20,000 |
| Chinghai ... | — | 12,600 | 16,000 | 7,000 | 1,860 | 2,640 |
| Ningpo ... | — | 600 | — | 400 | 100 | — |
| Total ... | — | 1,270,100 | 1,199,000 | 264,900 | 251,106 | 308,760 |

*8. Anhwei Province.*—Although not an important cotton-producing province, Anhwei yielded about 163,830 piculs in 1921. The quality is very poor. The bulk of production is exported to Anking and Shanghai.

The following table shows the leading producing centres in this province :—

| | Acreage (in *mow*) | | | Production (in picul) | | |
|---|---|---|---|---|---|---|
| Districts | 1919 | 1920 | 1921 | 1919 | 1920 | 1921 |
| Nanling ... | — | 80,000 | — | — | 7,000 | — |
| Lukiang ... | 40,000 | 11,000 | — | 5,000 | 4,170 | — |
| Tungcheng ... | — | 40,000 | 50,000 | — | 10,000 | 7,500 |
| Kweichi ... | — | 12,050 | 12,500 | — | 2,663 | 1,500 |
| Tungliu ... | — | 50,000 | 52,000 | 100,000 | 15,000 | 5,200 |
| Vonkiang ... | 60,000 | 23,000 | 24,500 | — | 5,200 | 1,630 |
| Chiaohsien ... | — | 32,800 | — | — | 7,200 | 106,000 |
| Howee ... | — | 720,000 | 732,000 | — | 170,000 | 40,000 |
| Hohsien ... | 120,000 | 200,000 | 210,000 | 20,000 | 50,000 | — |
| Other districts | 2,600 | 26,845 | 18,000 | 535 | 20,743 | 2,000 |
| Total ... | 762,600 | 1,195,695 | 1,099,000 | 125,535 | 291,975 | 163,830 |

*9. Kiangsi Province.*—Cotton of this province is mostly grown in the eastern section. Lingchuen, Kingchi, Tunghsiang, Kwangfeng, Ningtu, and Vancha are the principal districts of production. In 1921, the yeild was only 45,325 piculs.

The following table shows the leading producing centres in this province :—

| | Acreage (in *mow*) | | | Production (in picul) | | |
|---|---|---|---|---|---|---|
| Districts | 1919 | 1920 | 1921 | 1919 | 1920 | 1921 |
| Hsingchow ... | — | 1,500,000 | 1,500,000 | 600,000 | 350,000 | 360,000 |
| Wuyuoh ... | — | 157,700 | 157,000 | 22,000 | 24,000 | 40,000 |
| Ngocheng ... | — | 180,000 | 180,000 | 41,500 | 56,000 | 52,500 |
| Kiangkuo ... | — | 133,000 | 133,000 | 18,000 | 24,000 | 16,500 |
| Ouchi ... | — | 166,600 | 166,600 | 36,000 | 30,300 | 17,000 |
| Tuihudi ... | — | 266,000 | 266,000 | 48,000 | 49,500 | 40,000 |
| Kienli ... ... | — | 361,000 | — | 49,000 | 65,000 | — |
| Tanghsien ... | — | 1,300,000 | — | — | 400,000 | — |
| Vancheng ... | 600,000 | 700,000 | — | 130,000 | 200,000 | — |
| Other districts | — | 1,505,400 | 447,500 | 262,500 | 381,200 | 89,150 |
| Total ... | — | 6,269,700 | 2,849,100 | 1,207,000 | 1,580,000 | 615,150 |

*10. Hupeh Province.*—Cotton is mostly produced in Yun Shui Valley, especially in Yun-meng, Yingcheng, Tien-meng, etc. In 1921, the yield was only 615,150 piculs. Usually in the ripe years, there are about one million piculs of cotton exported through Hankow.

The following table shows the leading producing centres in this province :—

| Districts | Acreage (in *mow*) 1919 | 1920 | 1921 | Production (in picul) 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|
| Kiukiang ... | — | 148,450 | 100,000 | 55,000 | 27,820 | 14,000 |
| Hukuo... ... | — | 46,400 | — | — | 8,800 | — |
| Pangjih ... | — | 34,000 | — | — | 7,490 | — |
| Kunglung ... | — | 170,000 | 150,000 | 50,000 | 53,750 | 30,000 |
| Tunghsiang ... | — | — | 840 | — | — | 290 |
| Foongcheng ... | — | — | 4,033 | — | — | 739 |
| Tuchong ... | — | — | 950 | — | — | 129 |
| Tehan ... ... | — | — | 360 | — | — | 31 |
| Chingyen ... | — | — | 180 | — | — | 48 |
| Other districts | — | — | — | — | — | — |
| Total ... | — | 398,850 | 256,650 | 105,000 | 97,860 | 45,325 |

*11. Hunan Province.*—Hunan, in spite of its favorable climatic condition, has given very little attention to cotton production. Changteh, Lungyang, Taoyuen, Nanhsien and Pingkiang are the only districts where small amounts of cotton are produced. Only recently, however, much land has been devoted to cotton cultivation in Hengyang, Pinghsien, Hsianghsiang and Changsha.

*12. Kansu Province.*—Kansu produces some cotton in its southeastern section, such as Fuyi, Kaotai, Mowmuh and Tenghuang, etc. The cotton produced is only sufficient for its local consumption.

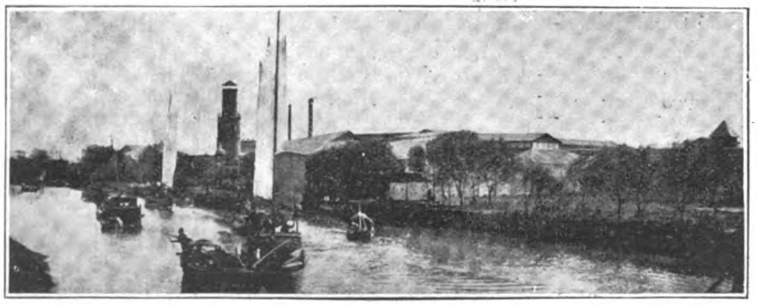
*13. Szechuan Province.*—Szechuan is now raising cotton to take the place of poppy, the growing of which is now prohibited by the government. Chengtu, Mien-yang, Fengchih, Tsunghsien, and Fushun are gradually becoming important cotton producing districts. Yunnan is taking the same step as Szechuan by growing cotton in lieu of poppy. Kwangtung and Kwangsi are two of the most important and promising provinces in South China. Fan-yang and Hsing Chao of Kwangtung produce excellent quality of native cotton, while Hai-Hwa, Tso-chi, Fukee, Ah-Lung and Ko-ling are experimenting very successfully with the American seeds. Tree cotton is produced indigenously in this province. Kwangsi is very suitable for cotton raising. Lingchuen, Yanghu, Ining and Pingloh are regarded as the chief producing districts.

In Sinkiang and Mongolia and other parts of China, with proper encouragement cotton can easily be grown. Ho Tien of Sinkiang has long been noted for its fine cotton cloth, while Chao Yang of Mongolia produces long fibre cotton of good quality. It remains only for scientific application to have cotton grown on a large scale, and this China is able to do.

# A Small Light and Power Plant

FOR a number of years most large cities in China have enjoyed the advantages of electricity, which brings not only convenience and comfort to the many homes in these cities, but also assists the large number of workers in the mills and factories and aids in building up industry, since many of these factories could not successfully operate were it not for the electric power available.

Realizing that the farm and the isolated compound of yamên in the outlying districts far away from the large cities can never



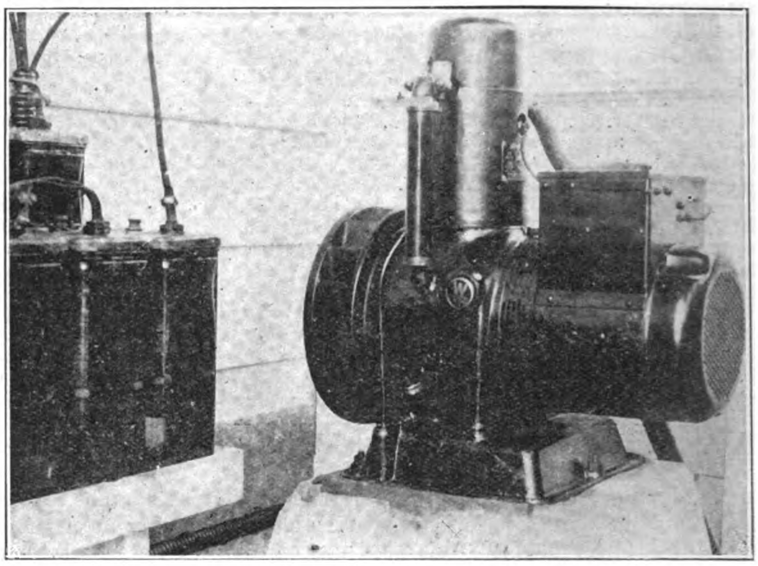
**Factory of the International Food Products Company at Shanghai**

enjoy this comfort and convenience nor reap the full benefits to be derived from the many electrical devices designed to assist the laborer, until such time as electricity is available, the Westinghouse Company has designed a small light and power plant exactly suited to such an application.

The picture below shows this plant. It is so constructed and furnished with batteries that light and power are available at all times of the day and night whether the engine is running or not. Merely turning a switch will produce light in any part of the house or outbuildings. As is well known, electric light is far superior to that of any kerosene lamp, and in addition the annoyance of trimming wicks and filling lamps with kerosene as well as the disagreeable odor are all done away with. The danger of fire from overturning of a lighted kerosene lamp or candle is no longer present.

Electricity in isolated, outlying districts as furnished by one of these plants makes it possible, by supplying the necessary pumps, to provide automatic pressure water systems which will not only give the convenience of running water, but will also furnish efficient fire protection. By installing suitable motors, various small machines, such as, churns, rice hullers, feed choppers, and grain threshers, can be operated, permitting efficient and necessary work to be done after dark at the close of the day's labors.

The power plant comprises an internal combustion engine, utilizing either kerosene or gasoline, direct connected to a three-quarters kilowatt direct current generator operating in conjunction with a storage battery with a capacity of forty-five hundred watt-



**Small Westinghouse Light and Power Plant Installed at the Works of the International Food Products Company**

hours. This is sufficient to provide for the continuous operation of ten 20 watt lamps for twenty-five hours without the engine running, or forty-eight lamps with the engine running, or their equivalent in other devices.

The Westinghouse light and power plant has been designed particularly with the idea of making it easy to operate, simple, and reliable. It is started by pressing a simple switch, and it stops itself when the batteries are properly charged. No attention is needed except at starting, which is necessary about every fifth day on the average farm. It is no longer necessary for outlying settlements to do without the many conveniences which electricity brings.

The photographs show an installation of one of these plants in the International Food Products Co.'s factory, located on the north bank of Soochow Creek near Shanghai.

One of the processes of this factory requires a large drum or well some 20 feet in diameter, and 30 to 40 feet high, completely enclosed and sealed to the outside atmosphere, in which the air is heated and conveyed as required by draft fans. It is necessary that this drum be lighted so as to observe the process, all open lights, such as, gas, oil, and candles being out of the question due not only to the fact that the moving air would extinguish them, but also because the odor, smoke, and dirt from such lights would seriously impair the quality of the products, which consist of egg yolk, albumen and whole egg, dried, powdered and flaked, and the various powdered and dried milk products.

# Municipal Government in China

## Street Cleaning System of Canton

*By H. A. Pan, Commissioner of Public Health, Canton*

THE cleaning of Canton city streets, maloos, and lanes, is being undertaken directly under the department of public health of Canton municipality. The work is conducted by the director of the sanitary division with a staff of assistants who form the nuclei of the administrative forces, says Mr. Pan in the *Canton Daily News*.

The forces directly controlling the street cleaning are the director, the chief sanitary inspector, the superintendent of street cleaning, the district superintendent, and the district inspectors and overseers. The whole city is divided into six health and sanitary districts. In each district, the district superintendent has the work divided among the inspectors, district overseers, gang foremen and scavengers. The city has a cleaning force of a thousand strong, comprising the gang foremen, cooks, scavengers, rat catchers, wagon-hands and emergency scavengers.

In the native city where maloos have not been constructed, street cleaning is done by scavengers who do the sweeping and carrying of the refuse to the nearest station where boats are provided for daily by the refuse syndicate, which pays to the government an annual revenue of seven thousand two hundred dollars. In the maloos the work is performed by the wagon scavenger force, who do the sweeping, etc., similar to the system conducted by the Hongkong sanitary department.

The emergency scavenger force is principally assigned to do the work which requires the least possible delay such as the cleaning and conveying of refuse accumulated in the different government quarters, clearing the roads for traffic after a fire has occurred and answering the call when a district requires a special force.

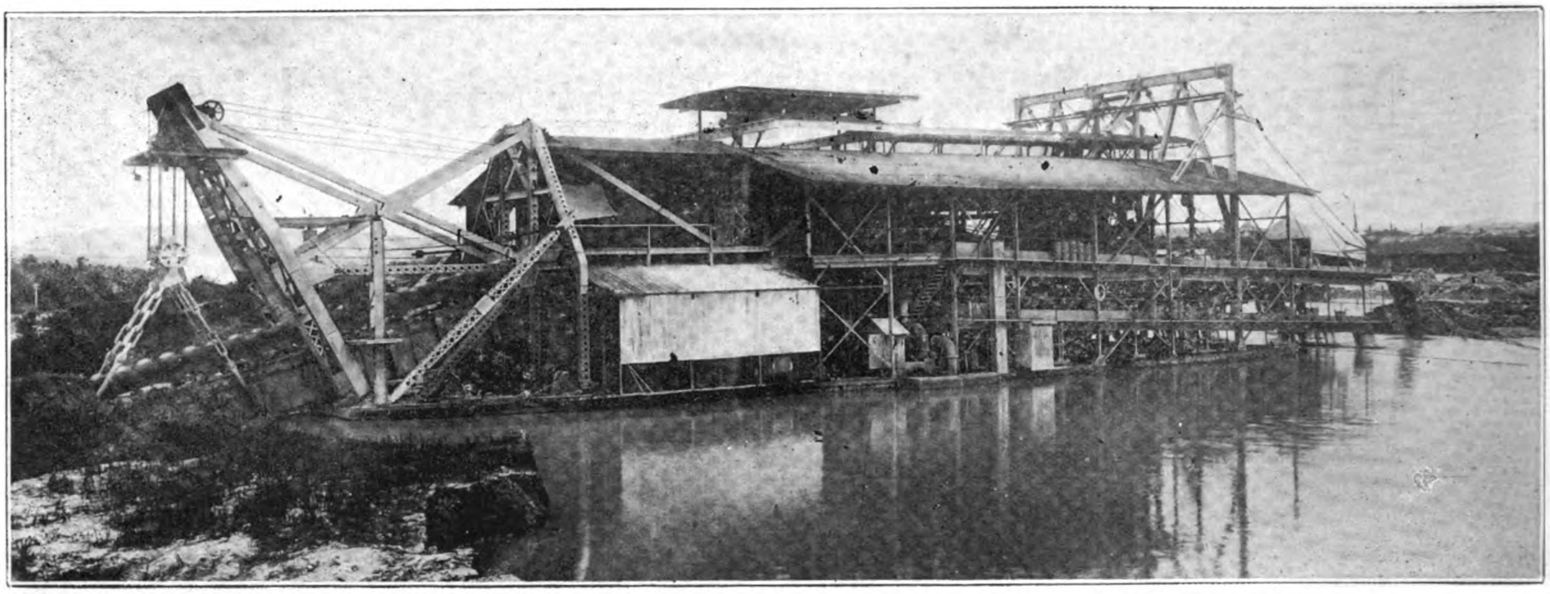
Sweeping one of the New Maloos of Canton

Strict regulations have been issued relating to refuse in the maloos and native streets. Occupants and store-keepers along the maloos are required to clear their refuse daily and dump the same into the wagons which are provided for the purpose twice daily. No refuse is permitted to be deposited along the maloos or roads under a penalty of fine.

The city has thirty-six scavenger quarters, besides quarters for the main wagon and emergency forces. The street cleaning forces are paid on a monthly basis. The scavenger provision funds are provided in advance every five days and the balance of their wages are paid at the end of each month. The scavengers are numbered consecutively. Each scavenger in the native streets is assigned to take care of a certain number of streets and lanes. In this manner, when the work is not properly done or totally neglected, the gang foreman, district overseers, and inspectors can at once trace the one who neglects his daily routine work. Each day the district superintendent is required to submit report of the work done for the previous day in printed tabulated form. The statistical value of each class of work done in a district is recorded and kept in the main office of the sanitary division, where weekly and monthly reports are submitted to the commissioner of the public health department.

The present system of street cleaning is a modified form of that of a few years ago. Owing to the continual opening of maloos in the city, the multiplicity of modern structures and tenement houses, the amount of refuse is increasing daily. The removal of filth and dirt, of the refuse of the four seasons fruits and vegetables, and of broken earth-ware, kitchen utensils, flower-pots, etc., is the kind of work which requires no small attention. The daily removal of approximately three hundred tons of refuse, besides the removal of building-refuse, is by no means a small task which the department has to perform in addition to various other duties. It is not too far-fetched to say that our Chinese people are too apt to accumulate filth and dirt. The public health question especially that relating to sanitation, is a novel thing to them. However, the publicity division of the department is doing everything possible to educate the common masses. They have to be educated to a certain standard before they can appreciate the importance of sanitation. We do not have to go very far to witness the deplorable sanitary conditions. The city of a few months ago had streets, lanes and maloos filled with accumulated refuse and the offensive smell and disease-producing bacil could be better imagined than described.

As regards the financing of this force, no special revenue has been set aside for the purpose. The frequent change of administration has produced bad effects. Street cleaning was neglected, and the people of the city suffered as a consequence. In order to make the street cleaning independent of the changes of the administration a special scheme of obtaining revenue from each store and occupant has been brought forward by the commissioner of the department, and the same passed by the city's administrative council, and approved by the mayor. It only requires the sanction of the governor. The tentative calculated sum will doubtless be sufficient to meet the expenditures. The yearly expenditures of this division amounting to approximately $150,000 is about 2 per cent. of the figure for New York city, where $7,000,000 gold are provided annually for the work, and about 37 per cent. of that for Hongkong, where the 1923 budget provides for $560,000 Hongkong currency for that purpose. It is to be hoped that an increase will be made in the yearly budget so that the sanitary condition of the city will be adequately taken care of.



The American Built Dredge on the Tronoh Properties of the Yukon Gold Company: Capacity 125,000 cu. yds. per month

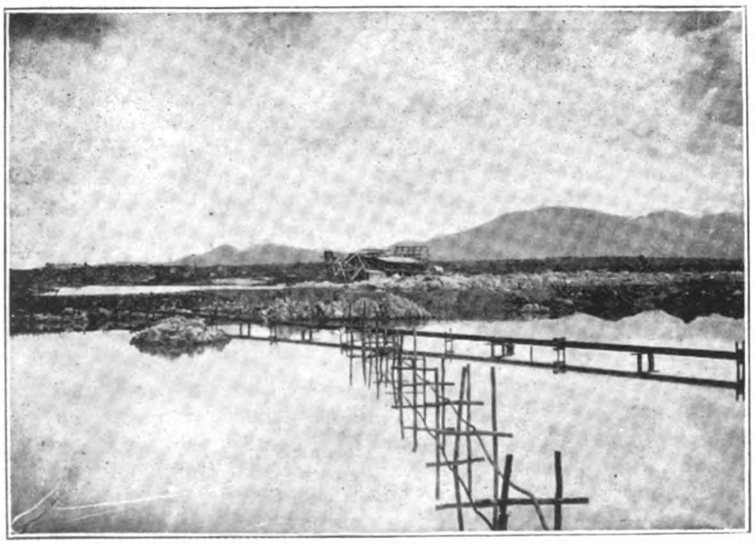
# American Tin Dredging in Malaya

THE Yukon Gold Company will soon begin operations on a large scale in the Federated Malay States, with seven steel dredges costing approximately $500,000 each. The company some time ago acquired alluvial tin properties located near Tronch, Kampar, Ampang and Salak and from 2,182 acres tested by borehold, a yield of over 75,000,000-lbs. of metallic tin is estimated. The first three steel dredges were dismantled upon the exhaustion of gold ground in Alaska, shipped across the Pacific to their new location and set up again on the river beds from which they are to extract vast quantities of tin ores. Each of these dredges has a minimum capacity for treating 100,000 yards of ore monthly, but through improvements it is expected the capacity will be increased at least fifty per cent. Five thousand acres are now owned by the company, which, it is estimated, is sufficient area for at least twenty years, while additional property is being acquired.

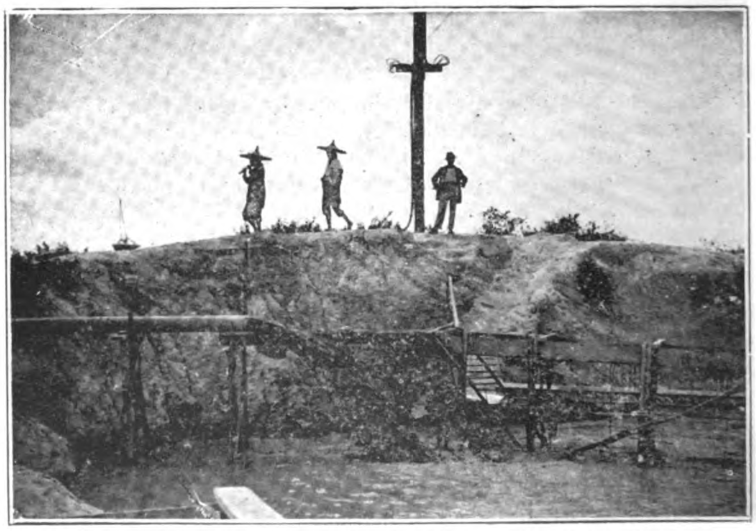
The executive head of the company is Mr. William Loeb, once secretary to President Roosevelt, with offices at 120 Broadway, New York. The Guggenheims are largely interested, with four brothers on the board of directors. The head office in the F.M.S. is located at Ipoh, with Mr. G. H. Munro in charge as general manager.

It is of interest for purposes of comparison to note that there was profit in dredging gold on ground that yielded ten cents a cubic yard. One pound of tin a cubic yard is the demonstrated yield from the Malay river bed. Power plants are installed on these dredges and, as the earth is scooped up, it is concentrated on the dredges and the concentrates bagged and sent to smelters, which are chiefly owned by British. An export duty, prohibitive in rate, is levied on shipments of tin from the Malay settlements ; this makes it impossible for the American-owned company to send concentrates to the United States to be smelted and sold.

What gave promise of developing into a new American industry was started during the war, when several smelting companies commenced to smelt tin in and around New York. About $3,000,000 was spent in equipment for handing this metal. This smelting activity has since disappeared, owing to various unfavorable conditions, except in one instance where a small smelter is importing Bolivian tin.



Yukon Gold Company's Tin Mine at Tronoh



Chinese Women Workers at the Tin Mines of the Yukon Cold Co.

# Refrigeration and Storage of Food

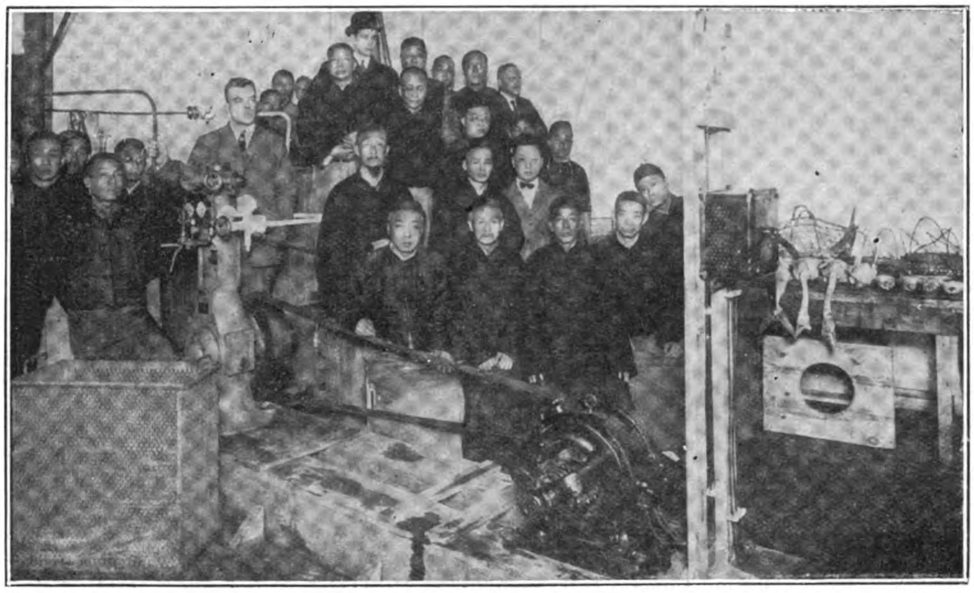
## With Special Reference to Fish

*By H. Berents*

THE use of artificial cold for the conservation of food commodities has now been generally adopted.

As regards the history of refrigeration as applied to what is popularly called "cold storage" no authentic history can be formulated, and it is only within the last forty to fifty years, and particularly during the last great war, that the practical usefulness of refrigerated storage has been fully appreciated by governments and individuals all over the globe.

Refrigeration represents, as a matter of fact, the most natural method of conservation and has the advantage that the food commodities need not be brought in contact with chemical ingredients, which easily cause permanent changes, but allow the consumer to receive the goods after long storage in more or less its original form and condition.



The Demonstration Plant of the China Refrigerating & Investment Company, Ltd., Testing Ottersen's Freezing Method with a Machine made by Thos. Sabrue, of Aarhus, Denmark

When scientific inquiry had proven the efficacy of low temperatures in preventing decay and had demonstrated the possibility of obtaining and maintaining low temperatures at will, the cold storage business of to-day was but the natural evolution resulting from such demonstration. When it became apparent that profit was obtainable by placing perishable goods in cold storage during a period of glut or surplus and disposing of them at some subsequent period of comparative scarcity or increased demand, the building of cold storage houses and the perfection of machinery or apparatus for their economical operation became the inevitable result. The pioneers in the cold storage business were speculators of the extreme kind, but this cannot be said of those in the business to-day. Where in the early days the cold storage operator owned the goods he stored almost entirely, and his customers were uncertain, now the goods placed in cold storage are almost wholly owned by dealers, and are held for the supplying of their regular trade.

Refrigeration has four chief uses in the economy of nature and in commerce :—

1. To prevent premature decay of perishable products.
2. To lenghten the period of consumption and thus greatly increase production.
3. To enable the owner to market his products as needed.
4. To make possible transportation in good condition from point of production to point of consumption, irrespective of distance.

FIRST : Without refrigeration there would be much actual waste from decomposition before it would be possible to place perishable food products at the disposal of the consumers. The immense fruit trade of the Pacific coast would never have been developed without the assistance of refrigeration, nor could the surplus meat products of the southern hemisphere and China have been brought half way around the globe to relieve the shortage in thickly settled England and to supply the armies with fresh meat durng the great war without its aid. Without the aid of refrigeration to create a constant market, the production of meats, of eggs, of fruits and other food products would be greatly curtailed, and as regards the fisheries along the China coast these can most decidedly be greatly developed with the aid of refrigeration to the benefit of the population.

SECOND : In any class of produce the ordinary season of consumption was formerly limited to the immediate period of production, or but briefly beyond. Now nearly all fruits may be purchased at any season of the year and dairy and other products are for sale in good condition and at reasonasle prices the year around.

THIRD : Instead of being obliged to bell perishable goods, when produced or purchased, at any price obtainable, the owner can now put away in cold storage a portion or all of his products to await a suitable time for selling. This not only results in a better average price to the producer, but places perishable food stuffs at the command of the consumer at a reasonable price at all times and greatly extends the period of profitable trading in such products.

FOURTH : The certainty and perfection with which food products may as a rule be conveyed from the place of production to the large centres of population where they are to be consumed is one of the triumphs of refrigeration.

Refrigeration, as well as other methods of conservation, retard or paralyse the chemical and bacterialogical processes in the goods to be stored. The speed with which chemical reaction takes place can be greatly reduced by lowering the temperature, and the growth of bacteria proceeds considerably slower by the lower than by the higher temperatures. Many bacterias are as a matter of fact not able to develop by temperatures in the neighborhood of 32°F. Some parasites, as, for instance, the fins, were totally destroyed by temperatures from 14° to 18°F., according to tests carried out by Rissling, Glage and Reissman. By reducing the temperature the freezing point is soon reached, which by the bulk of food commodities is practically the same as for water because of the high water contents of our food products.

All products which can be frozen shows a considerably greater durability than those which may only be chilled to a temperature somewhat about freezing point, as for instance fresh eggs, the greatest number of fruit, vegetables, margarine and others. A very long period of cold storage can therefore not be applied to such products.

The humidity and the air circulation plays a very important role, besides the temperature, particularly above the freezing point.

Whereas the generation of low temperatures have to-day reached a very high degree of development and efficiency, due to the most careful scientific research, the same can not be said about the utilization of the low temperatures obtained for preservation

of food commodities. The cold storage of food commodities have been carefully studied in a scientific manner in practice for a few food products only and we rely generally on subjective observations which have been generalized without any real justification. Only hereby is it possible to explain the contradictions which exist between the different cold storage authorities as regards the most suitable cold storage conditions for different food products, as fruit, frozen meat, fish, etc. Mr. W. D. Richardson's remark is worthy of notice in this connection :—

> "If the authorities are consulted on the subject of cold storage, we find a variety of opinions expressed which are quite lacking in agreement, as would be expected in a subject which has been so little investigated in a scientific manner. In marked contrast with the opinions of scientific writers are the statements of men who have had practical experience in cold storage warehousing."

Some scientific studies in cold storage have been carried out lately but here is undoubtedly a large and thankful field open for research work.

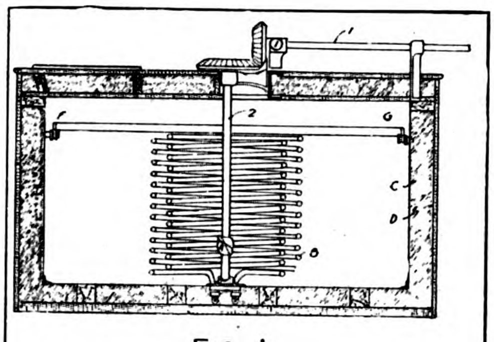
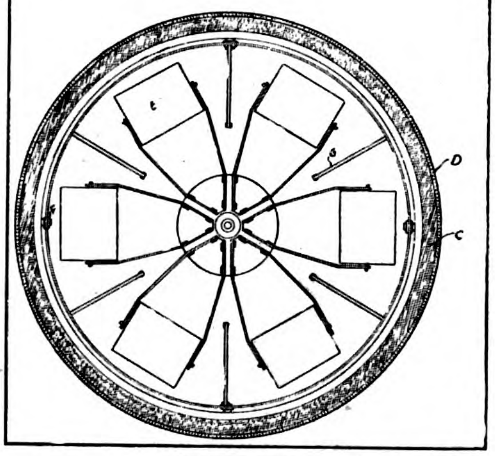


FIG. 1



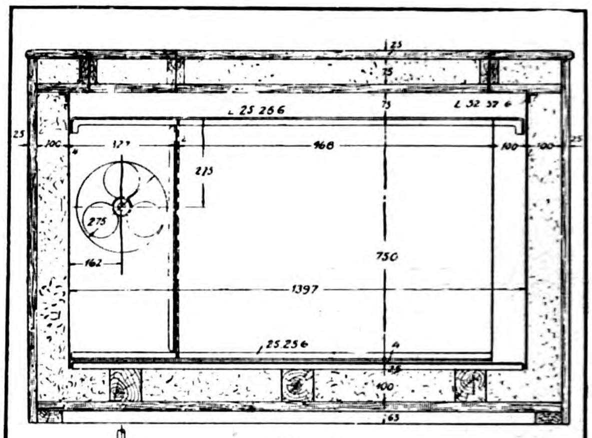


FIG 3

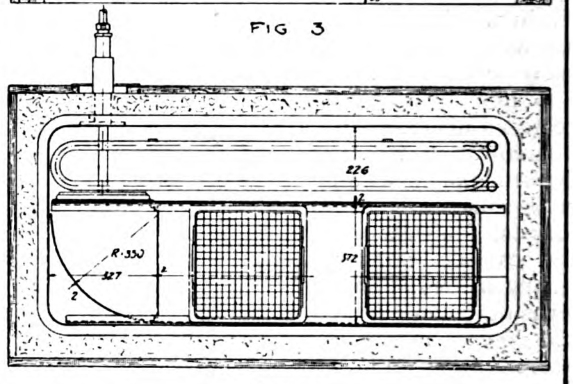


FIG 4

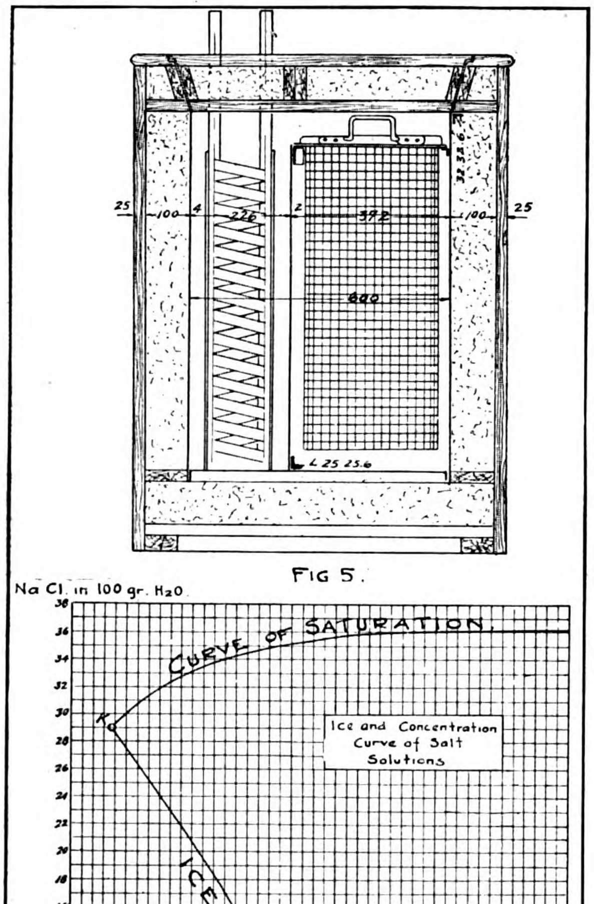


FIG 5.

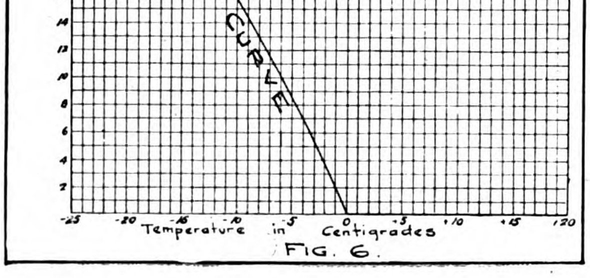
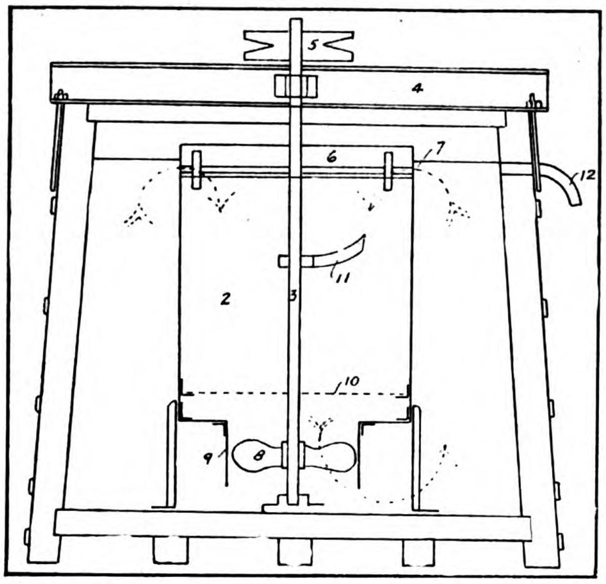
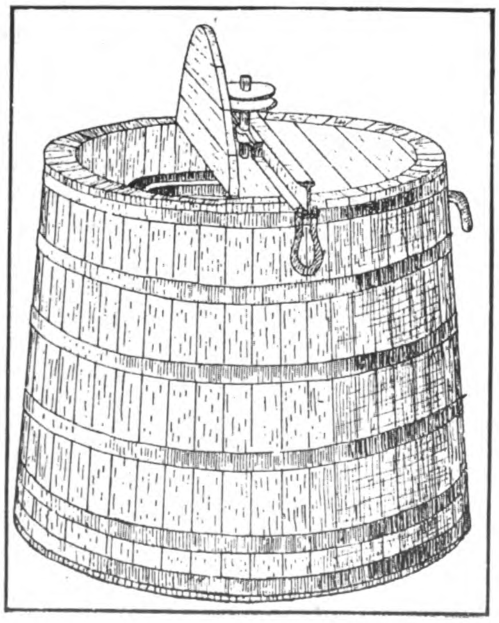



FIG. 6.





I will only mention a few of the existing contradictions : Meat has been frozen in Europe for years in comparatively high temperatures 18° to 25° F. whereby a slow freezing takes place. The freezers have been cooled down by air circulation or by a combination of pipes and air circulation which causes the meat to freeze by a lively movement of air. In America, where they have a larger experience in freezing of meat, the temperatures are kept in much lower in the freezers + 5° to–4° F. whereby the meat freezes considerably quicker. The rooms are cooled down by pipes only whereby natural air circulation is created.

If we consider the cold storage rooms for frozen meat then large contradictions exist also here. The Americans employ considerably lower temperatures, and research work lately carried out indicates clearly that cold storage conditions were much improved by reducing the temperatures.

At the same time was proved that the humidity can be much higher by low temperatures (90 per cent. and more) than formerly accepted (75 per cent. to 80 per cent.).

There are still greater contradictions relating to the cold storage of fruit and particularly fish.

Frozen fish is generally kept in cold storage by 18° to 20° F. in Europe whereas the Americans as a rule use much lower temperatures. Authorities as Mr. B. Butzler, have also maintained that fish is not suitable to freeze, but should be kept at a temperature close to the freezing point but not below. Mr. A. Gruvel recommends to store the fish in the neighborhood of 32° F. but not in temperatures lower than 26° to 28° F. so as to prevent that they freeze entirely. These authorities consider that salmon may stand freezing well but other fish will deteriorate because the muscles are torn apart by the expansion of the loose cellular tissues when frozen whereby the fish will crumble and develop symptoms of decay.

Fish is undoubtedly a much more difficult commodity to preserve by refrigeration than is meat, particularly if followed by a prolonged period of storage, and frozen fish has for years been open to objections because at its best, some impairment of texture or flavor, or both, has always occurred in the article frozen. On this ground there no doubt exists a certain well-founded public prejudice against frozen fish, particularly in the United States where the fish has to be sent for long distances, and also in Europe. But in the U. S. comparatively little fish is consumed in the interior states, most probably for the above reasons.

I remember well when going to the fish markets in Norway that the fishermen could never obtain a good price for fish which had been frozen hard in the winter, because, it was maintained, that such fish had lost much of its flavor, and no doubt in the case of fish the impairment of flavor and texture consequent upon freezing in the air, is, as a rule, readily noticeable. And yet freezing has been practiced extensively in the fish industry for many years because the flavor developed during ripening of the fish when held unfrozen is disagreeable to the human palate, and several methods suggested and employed, as applied to preservation of fish by refrigeration.

But for the fact that fish can be frozen and held in storage for many months without change in food value or flavor vast quantities of fish would go to waste, and this valuable nitrogenous food and substitute for meat would be scarce or even unobtainable, except in the smoked, salted, or canned form, during a large part of the year.

The additional fact that fish properly frozen may be shipped long distances without deterioration permits many inland communities in Europe or America to obtain at any time of the year favorite varieties of fish caught in distant waters. But in China where fish is a most popular dish, it is practically impossible to-day to get a decent dish of fresh sea fish in the interior, where often at feasts a wooden fish is placed on the table so as to keep up appearances.

Frozen fish are superior to salted or cured or smoked fish, excellent as these are for food, and eminent scientists and fish experts have repeatedly stated that they could not tell which were fresh and which were frozen fish, when both were cooked and placed on the table at the same time as a test. In taste and texture of the flesh it was further impossible to distinguish the fresh fish from that frozen and stored according to the best method known.

In refrigerating food commodities the following methods may be employed :—

A. Air—or dry—Freezing.
B. Brine—or Liquid—Freezing.
C. Freezing in Ice Blocks.

## A. Air Freezing

By the air freezing method the fish is placed in a room of a low temperature and left there for 5 to 30 hours according to temperatures employed and to size of fish to be frozen. To accelerate the freezing process an artificial circulation of air may sometimes be applied, but air, which is a very poor conductor of heat, is depended upon in a large measure to convey the heat away from the fish to the cooling medium. The consequence of this is that a long time is required for complete freezing. The consumption of time is in itself a serious objection from the point of view of plant operation but it is not the most serious objection.

It is obvious that food containing much water, as fish, will be considerably dried by the air freezing, particularly if artificial air circulation is to prevent the fish to become mouldy whereby a loss in weight will be suffered, and the slime which is the natural protection of the fish, will dry out, and give injurious bacteries and parasites, which may be available in the surroundings, easier access to the fish. Furthermore, when a juicy article is frozen, small crystals of ice begin to form as soon as the freezing temperature is reached. If the freezing proceeds slowly, the water diffuses from the surrounding tissue to build these small crystals to large ones, but if freezing takes place rapidly the water does not have time so to diffuse and very numerous tiny crystals are formed instead of fewer coarser ones, but air freezing proceeds slowly. When ice crystals are formed, the increasing size of each crystal ruptures, or the sharp angles puncture the cell membranes, the effect of such ruptures or puncturings is equivalent to a bruise throughout the body of the fish. It has been established by scientific investigation that these bruises on fish, or meat have a similar effect to that of bruises in fruits, that is they cause decomposition. This decomposition is not directly harmful or dangerous in food, but it gives rise to a repugnant smell and flavor and causes liquefaction of the tissues and consequent loss in handling. It is thus seen why fish which have been frozen in air rapidly disintegrate on thawing out and loese the nutritive juices of the fish-meat because they have been damaged throughout by formation of comparatively large ice crystals.

The above facts have been more or less recognized by some scientists and fish exporters as far back as in the eighties in Norway, and according to Stevenson still further back in the United States, and the aim of the different methods suggested have been to improve the air freezing process by greatly to hasten the freezing of the fish thereby trying to prevent the formation of large ice crystals. This can be done by employing the liquid freezing.

## B. Liquid Freezing

To improve the air freezing method an English fish export company employed salt and ice in Lofoten, Norway, about 1880, with varying results. The Norwegian fish inspector Mr. Wallem constructed two fish freezing barrels in 1890 in which herrings were frozen by direct contact with a mixture of salt and ice. The barrels were rolled to secure a good mixing but although the herrings were quickly frozen they were partly squashed and lost their slime and scales. By adding a surplus of very fine broken ice and mixing well it could be prevented that the herrings absorbed salt in any noticeable degree.

The French Engineer H. Rouart obtained a British patent in 1898 on a method to freeze food commodities, meat, fish, butter, etc., by immersing the products to be frozen in a liquid cooled down by refrigerating machinery. As suitable liquids were recommended mixtures of water and glycerin, water and alcohol, water and sea salt or other mixtures of suitable concentrations with temperatures to—4°F.

Mr. Rouart's method has the advantage that the product to be frozen does not come in contact with hard ice but with a cold fluid, whereby the outer mechanical action as by Wallem's method is eliminated. The employment of a refrigerating machine instead of a refrigerating mixture (as salt and ice) makes it furthermore possible to obtain a more quick and continuous freezing. The method has, however, the disadvantage that the salt can easily permeate the bodies frozen in any of the mixtures recommended.

As long as sea salt is employed and the infiltration of salt is limited to a thin surface, such permeation may not be considered as objectionable, but rather as a preservative, since we must salt the fish in any event before we eat it. This might be conceded if the objection to salt rested on the taste of it. However, the major objections to salt penetration are, first, that penetration of salt is always accompanied by great extraction of water, in accordance with the laws of osmosis, and therefore, loss of weight, and second, that much salt in the skin or on the surface of fish or meat makes it impossible to glaze them, and, thirdly, in practical running the brine is inevitably contaminated, principally by a gradual rusting of the iron or steel parts of the receptacle with fittings as well as by absorbtion of gas formed matter for instance the carriers of the so-called fish smell. Glazing is of the greatest importance if fish have to be transported without ice or stored for more than a short period ; if they are not glazed, rapid drying, loss of weight and of edible qualities ensue.

Mr. Rouart does not indicate ways and means whereby the osmotic processes between the mixtures recommended and the fish or meat to be frozen may either be eliminated or at least reduced.

Great merit is due Mr. A. Ottesen, a Danish fish-exporter, who, after years of long research, discovered the correct method whereby the process of liquid freezing has become a practical success.

Mr. Ottesen obtained his first patent in Denmark about 1911 and in Norway in 1913 for " A method of freezing or refrigerating comestibles of the kind in which the comestibles are treated with a solution of a substance adopted to lower the freezing temperature of the dissolving medium and which is of high osmotic activity and strong taste, the treatment being such that the substance in solution is prevented from penetrating into the comestibles, the solution at the beginning of the treatment containing easily accessible latent cold in the form of ice."

This discovery, in making the cooled solution of one or more inorganic salts to an indifferent conductor of cold, prevents that any salt permeates the commodities immersed in the solution for freezing.

To obtain this result Mr. Ottesen recommended at the outset to choose the concentration of the salt mixture of such a strength that the mixture will keep at its freezing point, by the temperature on which the plant is designed to run, whereby the mixture will shed clean ice, not as ice-crystals, but as soft snowlike bodies which partly swim on the surface and partly settle on the cooling coils.

The temperature of the mixture vary according to the strength from about 14°F. to about-4°F. (-10°C. to-20°C.).

The original form of the apparatus demonstrating this method is shown in Figs. 1 and 2 and consist of a well insulated sheet iron tank of 2 metre diameter and one metre high in which the cooling coil B is placed concentric. The coil is connected with an Ammonia refrigerating machine with a capacity of 5,000 calories per hour (20,000 B.T.U.) A steet axle with propeller " A " is placed in the centre of the tank in which the brine is brought in lively circulation by the driving axle one Fig. 2 shows a horizontal framework F-G which carry six baskets E made from steel wire and can revolve about the central axle 2. The fish is frozen in these baskets which are provided with lids. In Figs. 1 and 2, C indicates the insulation and D the outer wood covering of the tank. Very satisfactory results were obtained with this apparatus in the biological station in Bergen, Norway and a similar apparatus was also worked in Thisted, Denmark. Fish frozen according to Ottesen method were stored for shorter and longer periods, packed in ordinary wooden boxes and sent to England, Germany, France and Austria with the most astonishing results.

A later design of Ottesen is shown in Figs. 3, 4, 5 where the tank is made in a rectangular form and the refrigerating space divided from the coil by a vertical wall. Two large fish baskets made from steel wire can be placed in the refrigerating space and a propeller with horizontal axle forces the brine over the coils and through a sheet iron wall, with many small holes, evenly distributing the cold brine through the fish baskets. The tank is well insulated and covered with wood.

Fish frozen by this method is handled in the following manner : The fish may first be cleaned and left for a while in cold water to be chilled. When large fish is to be frozen individually a weight is attached to the tail or to the head of the fish to have it maintain a vertical position in the brine chamber. Otherwise the fish is placed in the baskets which are closed by a heavy lid when emerged in the brine. After completing the freezing the fish is dipped in fresh water whereby the brine drops sticking to the fish are washed away and the fish get a light ice glacing, whereupon the cold storage follows.

To freeze in a cold salt mixture according to Ottesen has important advantages as compared with air freezing, of which may particularly be mentioned. The entire avoidance of loss of weight during the freezing process and thereby the maintainance of the live fresh appearance of the fish. Further the exceptional quick freezing, which prevents formulation of large ice crystals whereby the texture is preserved, and also permits to freeze a large quantity in a small space.

To explain what really takes place we draw the ordinary ice curve of any concentration of salts, see Fig. 6. Ottesen's former freezings used always to take place according to this curve, and the point " K " marked as the freezing point of a completely saturated solution. The freezing temperature of such a solution is minus twenty-two degrees C or-8F. Below this point practical working was not possible owing to the fact that the concentration would begin to freeze and solidify at this temperature.

I am, however, advised that by following Ottesen's directions and improved method the temperature of concentration can be lowered far beyond this point and the freezing of the comestibles takes place comfortably without any ice formation in the concentration and last but not least, the evaporator coils of the refrigerator keeps itself automatically clean of ice formations. Meat, fish and other comestibles immersed in this concentration freeze naturally in a fraction of the time required by air freezing or freezing in ordinary concentrations.

When comparing the time required for freezing in air of 19F°. and in brine of 5°F. the freezing in brine will be 20 times as rapid. If for air freezing indirect cooling is used by brine coils, then the expansion temperatures of the refrigerating machines are in both cases—4°F., whereby the amount of energy required will be the same.

Furthermore small fish or pieces of meat are frozen by the temperatures generally employed 20 times as fast as by air freezing, medium sizes fish 12 to 15 times as fast, and large fish 10 times as fast. Half-pound fish freeze in from 20 to 30 minutes, 4 pound fish in about 1½ hours, large salmon and cod in about 5 hours. This rapid freezing makes the method particularly applicable to handle large gluts of fish and the small dimensions required makes it very suitable for steamers with more or less limited space.

The same brine is used over and over again for a long time, and, but little filtering (skimming) is necessary. On this point, the food investigation board (Great Britain), wrote, in connection with its investigation of the method :

" It may be noted in passing, as a point of practical interest, that the brine does not absorb the flavor of fish, or of meat or, if it does, fails to impart the flavor to other bodies. After over a ton of fish had been frozen in 37.7. cu. ft. of brine, it was filtered and a beef steak and a fowl frozen in it. Neither contracted any detectable taste of fish."

This is natural, for all blood, mucus, etc., that might otherwise be washed off are instantly frozen when the fish strike the brine.

The scientific reasons for the superiority of goods frozen according to Ottesen's method have already been given, avoidance of internal crystallization, and prevention of penetration of salt.

Meat or fish, for example, frozen by this method, differ in many respects from air frozen meat or fish. They are in the first place, not as hard and brittle as air frozen, but have a consistency more like soap or cold wax, yielding slightly when struck a hard blow. Their fins and tails bend rather than break, and the original appearance is maintained. They may be thawed in any way desired, but slow thawing out as at present practised is preferable, for practical reasons. Ottesen frozen fish or meat may be wrapped and shipped long distances without ice, for, although they may thaw out in transit, they remain cold and sweet for many days. When thawed, they are firm and of a wholesome smell and will keep longer than fresh fish, as now marketed.

Low temperatures is the real preservative, not the freezing. If we could reduce the temperature of a fish to say 0°F. without freezing it at all, so much the better, but this is, of course, impossible. Such investigation as has been done on this point suggests that the fish or meat frozen by the Ottesen method are not actually frozen to the same extent that air-frozen fish or meat are, though their temperature may be equally reduced. The rapidity of the process prevents in a measure actual freezing as we know it, because the juices set like jelly, and interfere with the formation of ice The number of B.T.U. necessary to be extracted per ton is therefore smaller.

Fish frozen by this method are excellent for canning, and large gluts can therefore be cared for without the necessity of a huge canning equipment to stand idle a great part of the time.

For the fresh fish trade, there is every reason why fish frozen as above indicated should supplant and supplement the icing of fish as now practiced in this country.

Icing, in the first place cost about as much as chilling or freezing by this method. But icing does not prevent spoiling, it merely prolongs the period during which fish can be eaten, and fish are poorer the longer they are kept on ice. The dealer may therefore be compelled to sell at a loss or dump. If kept frozen the Ottesen fish remain wholesome for a year and longer, and if allowed to thaw they will keep as well as or better than fresh iced fish. The ideal system is to employ the most rapid freezing method im-

mediately after capture, to ship the frozen fish wrapped individually in paper, to store (and re-glaze) the frozen fish for any period desired, and the consumer will in both cases receive better fish than he ever did before.

To freeze in brine was also recommended by Mr. Renderson in Australia in 1912 and experiments made in Leadenhall market in London in 1913. By this method the fish is precooled for about two hours in a room with a temperature of 32°F. after which the fish is immersed in a brine with a temperature of 10°F. The brine is led continuously through a charcoal filter with the object of removing all impurities and smells from the brine, which has a concentration of 15 per cent.

Mr. Renderson does not seem to attach any importance to the osmotic processes or to the formation of ice in the brine, as Mr. Ottesen does, because nothing is mentioned about these points and it is not one of the requirements of the method, consequently penetration of salt takes place.

While Rouart, Ottesen and Renderson use refrigerating machinery for their methods, Henrik Bull has further developed and improved Wallem's freezing method, previously mentioned, whereby Mr. Bull could also take advantage of Ottesen's experiences.

Bull writes as follows about his method :—

" The working of the apparatus is based on the principle that a brinesolution of suitable concentration is continuously brought in lively circulation over ample quantities of fine broken ice. The ice will melt and convey cold to the solution, while this simultaneously will reach the caturation point for ice or the freezing point by the lowering of the temperature. It is, however, necessary to maintain an equal concentration of the brine, for which reason ice and salt must be added in a proportion of about five parts of ice to one part of salt."

Bull's apparatus is shown in Figs. 7 and 8. By separating the mixing space from the freezing space, Bull eliminated the disadvantage experienced by Wallem's method, where the fish was bruised by the mechanical action and by the ice.

### C. Freezing in Ice Blocks

In conclusion I may mention this method, which was developed from the endeavour to eliminate the loss in weight experienced by air freezing and to preserve the good appearance of the fish.

Flat galvanized iron pans were used originally, filled with water and fish and placed in a sharp freezer, later directly on coil shelves, whereby the fish were frozen together with the water in a block.

This method had however the disadvantage that fish frequently projected beyond the frozen surface and a considerable time was further required to freeze through.

To eliminate these disadvantages Friedricks employed ice cell shaped galvanized iron pockets, filled from 1/3 to ½ with water and the rest with fish whereupon the cells were placed in a cold brine solution and frozen solid.

Because of the flat shape of the cells the contents is frozen very much quicker, and the blocks, after being removed from the forms, are stored in a cold storage room. The ice serves as a strong glacing which it will take a very long time to evaporate.

This method was employed on a comparatively large scale to freeze eel, and some of these eel blocks have been kept in storage for over two years. The fish have proved to keep in excellent condition both as regards appearance and taste.

The method is, however, expensive to employ for large quantities of fish of different varieties and sizes.

Besides my own experiences in the field of refrigeration and notes made in practice as well as at times of witnessing different tests I am indebted to the following publications for results obtained by the different methods here discussed :—

I. " Department of Scientific and Industrial Research, " Interim Report on Methods of Freezing Fish with " Special Reference to the Handling of Large Quantities " in Gluts, Food Investigation Board, Special Report " 1920, London."

II. " Bureau of Fisheries of the Department of Commerce, " Washington, D.C., for Memorando S.61, S.76, S.88 " published, relative to tests carried out."

III. " Dr. Ing. R. Plank and Dr. med. E. Kallert. Die Kon- " servierung von Fischen durch das Gefrierverfahren, " Berlin 1916."

IV. " Bureau of Fisheries, Norway, for different publications " on fish freezing methods and results obtained, 1912 " to 1918."

Modern refrigeration and cold storage is undoubtedly a benefit to all mankind in that it allows of a greater variety of food during all seasons of the year, and when refrigeration has become more generally known in this country the facilities offered will undoubtedly be taken advantage of by our Chinese friends to develop the fisheries along our coast and to obtain a more even distribution of this important food commodity all the year around to the teeming millions of China, not only to the coast population but also to the communities in the distant interior.

## The Progress of Science and Engineering in Japan

*(Continued from page 559).*

nation in the world. It is a nation where every blessed person is thinking of the other fellow. Contrast that with Germany, if you please. Perry, when he went to Japan sixty years ago, or whatever it was, brought back word that he had seen an altruistic nation. That is just as true to-day as when Perry went there.

You know they erected a beautiful, impressive monument to Perry. Once I saw three hundred men from a battleship visit this monument and I was told by an admiral that that was the regular thing, that the seamen from every ship had to go and pay their respects to Perry's monument ; that is a lovely thought and it is just like our good Japanese. They have America on a pinnacle and we must not do anything to disturb that. I believe that as engineers who are trained to deal with facts, not fancies—politics will never do it, politics will drive the two nations apart—as engineers, we should seize the opportunity of drawing us together closer and closer. We are quiet workers. You don't hear about the engineers in the morning newspapers. You do hear a lot about the politicans, but the engineers are doing an effective work in the world. They touch our lives in ten thousand places and it is just the same in Japan, of course. When you have the opportunity, I hope every one of you, personally and individually, will remember to do everything you can to help draw the nations closer together ; and nothing can do more than this idea of going to Japan. You will come back just as enthusiastic over things there as I am, and you will see a great many things that are surprising, a great many things that are built permanently. Talk about the paper houses—forget it ! The great banks and houses and structures in the cities are built just as solidly as they are built anywhere, everything is in the most permanent shape and their interiors right up-to-date.

Now, as to their antagonism to these changes. It is with that just as it is with this persistent lie that we hear about Chinamen being employed in their banks. I was given a dinner by Baron Mitsui—I judge about seventy people were present and I sat at his right. He is the head of a family of bankers with banks in Japan, Indo-China and all through there. They have an office in Philadelphia and in New York. They are also very extensive importers and exporters with a turn-over of about a billion dollars. He said, " No, we have never had a Chinaman employed in any of our banks. Yes, we think we know where that story originated. There was one time when the different provinces of China issued different currency. Some currency would be offered to us that we were not familiar with at all, but we always had a Chinaman somewhere in Tokyo that we could call upon to look it over and see whether we could take it or not. And that is the nearest to any Chinaman in our employ that we ever had."

I hope you will all read Julian Street's " Mysterious Japan," because that represents Japan to-day better than anything I know. Possibly some of you know the author.

I don't think anybody had better opportunity to see the real thoughtful Japanese, the people who use their minds, than I have had. Nothing was too good for me in industrial Japan. Their thought is that what other people can do, they can all do. Just think of it—ninety-eight per cent. of their people, children of school age being included, are able to read. The nearest we can come to that in any state is seventy-four per cent. They are going to get there. I am old-fashioned enough to say that when a fellow is willing to pay the price, that is hard work and industry, he always gets the goods. Nature never cheats us. Those people are going to get the goods in the only way that any of us is going to get it. We are obliged to help them because they are friendly to us and trying to meet us in a most sincere way.

# The Progress of Science and Engineering in Japan

**By Elmer A. Sperry, President, Sperry Gyroscope Company, Brooklyn, N. Y.**

**Address before the Engineers' Club of Philadelphia, March 20, 1923**

*Elmer A. Sperry founded the Sperry Electric Company, Chicago, manufacturers of arc lamps, dynamos, etc.; the Sperry Electric Railway Company, Cleveland; organized and is president of the Sperry Gyroscope Company, New York, manufacturers of gyro compasses, ship and airplane stabilizers, highest intensity searchlights, fire control apparatus, airplane and navigational equipment, etc. Invented products of Sperry Gyroscope Company; erected highest electric beacon in the world on Lake Michigan, 1883; pioneer in electrical mining machinery in U. S., 1888, with steady growth for 35 years; devised electro-chemical processes, detinning process and machinery for making fuse wires; built electric auto; has over 300 patents. Author of many papers and addresses before engineering and technical associations. Member, U. S. Naval Consulting Board, Society of Naval Architects and Marine Engineers, Society of Automotive Engineers, American Society of Mechanical Engineers, Electro-chemical Society (charter member), American Chemical Society, Physical Society, American Institute of Electrical Engineers (charter member), New York Electrical Society. Awarded first prize, Aero Club of France, 1914, for airplane stabilizer; Franklin Medal, Philadelphia, 1914; Collier Trophies, Aero Club of America, 1915 and 1916; decoration (two orders) from last Czar; Grand Prize, Panama Exposition; decoration from Emperor of Japan, 1922.*

* * *

LAST autumn there was an unusual honor conferred on me. There are two great engineers' societies in Japan. We have not been understanding them very well, but we understood one thing—that each one of them was going to have its twenty-fifth anniversary—and the Japanese had stood so beautifully, shoulder to shoulder, with us in Washington that the engineers of the United States felt it was up to us to make recognition of this special event. We prepared greetings and congratulations under our great seal, which were entrusted to me to take over there, and so I met two wonderful bodies of engineers in Japan which I want to tell you about.

One of these two groups was the society of mechanical engineers, about four thousand men, and they are much more active than the mechanicals in the United Stetes. They are more like the S. A. E. The other body was more dignified, possibly,—the society of naval architecture of Japan.

Also I have the honor of being a member of the engineering foundation, which represents forty-two thousand members, and I was authorized to represent them as well. So I took over greetings from a great body of American engineers. These occasions in Japan were conducted with such splendid taste—they were not oriental in the slightest degree—there was no tinge of difference in the conduct of those meetings from what we would have in the United States or in England. They were up to the very best level of performance. Everything was in order. They were greeted by representatives of several official divisions of the government, with the usual gold lace adornments, and each read a long document of greetings. By the way, they take these long documents out of an envelope, start to read vertically at the right end and then go on till sometimes some twenty feet have gone down on the floor and there it lies in a large heap at the finish. Then you expect applause, but the whole body sits there in perfect silence until the speaker has laboriously refolded it and put it in the envelope, when everybody applauds. That was a pleasant little surprise.

They applauded these various branches of the government very cordially, but when I presented credentials from three societies in America, I received a great deal more applause than any of them, not for what I said, but for the thought that American engineers stopped long enough to even think about them, our splendid brother engineers in Japan—and they are a wonderful lot.

In meeting with the mechanicals we had eight hundred people in the room and I supposed an interpreter would stand at my shoulder and after I had finished one or two sentences, that he would go on with about there times the amount of words and say it in Japanese. There is a vast difference in their language, as it takes two or three times the number of words to say the same thing. For instance, when counting, they say one, and one one, but when they want to say three they have to put an apology in the word and say "three conglomerated times." Now, if they say three teapots, it would be a different arbitrary word. Just think of a language like that which is so very involved. There I was, not thinking that if I would speak a little slowly to this audience of eight hundred people, they would follow me. It was past belief, but when I did speak rather slowly and imagined I had made a point, their faces brightened up, they laughed at times, and I could see they were following me perfectly. There is a vast difference between the navy and the army of Japan. You are introduced to a general and you are almost invariably asked, "Do you speak German?" They don't speak English at all, but not so at all with the navy, The navy officers speak English almost to a man. They have patterned their navy after the English and quite recently have taken up a great many things that we do in the United States.

After the presentation of my credentials I was taken wonderful care of. I cannot help but smile to think that I went down to Judge Gary, who had spent a week in Japan, and I said, "Judge, how many times did you have to go down on your haunches in Japan?" I didn't know whether I was going to be able to get up again. He said, "I didn't go down on my haunches at all." I was in Japan six or seven weeks. There are very comfortable hotels in all the large centres, where you can have griddle cakes for breakfast if you want them. You are in every way as comfortable as you are at home, so there is no trouble in that respect. If any of you want to take your ladies over, they will enjoy it very much.

Think of what Japan has done. Forty-eight years ago the officials of the government did one hundred per cent. of the thinking for them and they got along to where they thought they ought to have a battleship. I think they thought they saw Russia making gestures towards them, but whatever they saw, they said, "We ought to have a battleship." So it was some twenty-five years ago that they contracted for their first battleship from England, a little 12,000-ton ship, and sent many people over there to see it built, inspected, and so on. The Mikado cut down his household expenses and every officer—I met two or three who were then officers in the government—gave up ten per cent. of his salary, and they gave up enough to pay England for that first battleship. Now then, mark the progress. Do you know, within seven years they were building their own battleships and much larger ones than we are.

It was only a short time ago, in October, last year, that they celebrated the fiftieth anniversary of the introduction of western civilization in Japan. Now there is a curve of advance that is twice as steep as any curve we know of in America, and ten times as great us anything we have in Europe.

Let me tell you a little about their tools. In the great dockyard at Kobe they have a navy yard at least four times as large as our largest navy yard, at New York, for instance. There is a yard which has a great 25-ton furnace. They have an enormous steel plant where they make the steel and roll the ship's plate. They also make their own guns. There is a gun factory that is perfectly wonderful, because it is made to withstand earthquakes, which is

no small job, especially when you consider how high those great buildings have to be. They are stupendous. If we went into a building forty-five feet high, the same as we have in some of our works, we would say it was a high building. But there is one in Japan one hundred and twenty-five feet high in the clear under the crane (there are two great big cranes), beautiful steel work, and steel and glass clean to the top. It is a very impressive sight because that great lattice work is just as tough as anything you can find in America or anywhere in any bridge work.

I was taken through many of the industrial plants and navy yards. They use my apparatus in the navy and the government honored me and gave me great distinction because they imagined I helped them in their need, so I was taken care of as few Americans are. An admiral took me through the gun factory I mentioned, where they had a gun tube hanging that had received certain heat treatment. I said, " You don't mean to say that you heat treat that gun tube ? Just think of the pains that will have to be taken in trying to get that in straight. You don't go deliberately and put a curl in its tail by getting it up to a very high cherry red and putting it through a series of treatment ? " " Yes," he said, " we found out how to do it although it has taken us quite a while." I said, " What is that still hanging for ? " " Well," he said, " we got through rather late last night, as we were showing some of your engineers how to do it." The Japanese engineers have gone on pretty well to attain a position like that.

And so it was in their forge shop. The Japanese seem to have the idea of taking a lot of new things where sometimes we may question their wisdom, but they seem to take them, use them and get the blessings of them long before a great many other nations do. You see among them the very lastest things.

Take the locomotive, for instance. Here we are struggling with five generations of valve gears in the locomotive—at least five generations. You go over to Japan and you are struck with the fact that every locomotive has the very latest, the Janney valve gear, and you do not see any other. On my way home from Japan, coming out of Chicago on the Twentieth Century, the Chicago-Broadway Limited came along and there was the Pennsylvania Ltd., and they had two locomotives drawing the train; they had two kinds of valve gear on them—one was the Janney gear and the other was not—but over in Japan you see just the latest in everything.

When I had been on Japanese soil only about thirty minutes, coming up from the port of Yokohama to Tokyo, I saw at least four great big, high-transmission lines. That was my first encounter. I didn't stop at the port long enough to see the buildings there, but the first impression I got was of the finest kind of construction of high-tension lines. Great big steel bars on concrete pillars, just the finest construction that money can buy and the very latest. That was quite in contrast with my experience in coming over the track on the St. Paul road, where we saw high-tension lines that furnish those big power stations. There it is a wooden pole line and there isn't a straight pole on the whole line as far as I could see. In contrast with that, I was not prepared to see the beautiful things that I saw in Japan. They have three times the high-tension transmission lines per capita that we have.

Japan sends delegations to the United States and to the continent and we see them wandering around, saying not a word ; but don't lay that up against them. That is characteristic of the Japanese. You must remember they are taught from infancy that it is better to walk a yard than to talk a mile. They are taught to show entirely by their deeds what kind of fellows they are, rather than by anything that they say. So they don't say much but they have deeds, I tell you, just as true as the word. These delegations that come to the United States and look around—what are they taking home? They see a great many things. As a matter of fact, they reject one hundred things for every one that they take back. They are very discerning and seem to know the difference between the good and the bad, using the latest things while we are still struggling with the old.

If you want a hotel that is lighted and heated with electricity and cooks by electricity, you go to Niagara Falls, but if you want one where the water is also heated by electricity, you have to go to Tokyo.

Japan is very mountainous. No one ever told me that Japan was one long mountain range, although they cultivate those mountains almost to the top. They build a forty-foot wall to make an eight-foot wide garden. If a man fell off, he would break his neck. But there they are—men and women—tilling those little bits of gardens up there, and still they say that only one-tenth of the area is cultivated, the rest being rocks. It has taken toll from that nation for the last ten thousand years, but, of course, it has put backbone into the nation and iron into their blood. They cannot struggle against tremendous difficulties continually, as they have, without reflecting on the race. Had I not left Tokyo, the only plain they have, and gone into the mountain district, I don't think I would ever have understood what I saw in the faces of the Japanese people.

And they are such workers. They work while we are asleep. We have had a great many Japanese in our works and that is the experience we have had with them. They will tackle anything and will keep it up until they get absolute mastery of the thing. Our compasses in the Japanese navy are giving just as good results as in our navy ; much finer than in England, France and Italy. We have never sent an expert over to Japan, but we have sent experts in relays to other places to get those compasses working. Never an expert to Japan—they picked it up all by themselves.

The Westinghouse Company have had the same experience. They sold France their underground system and before they could get it into satisfactory operation, they had sent the third relay of engineers to teach the Frenchmen how to work the thing. They sold the same equipment and nearly as many of them to Japan. I have ridden on the line into Tokyo and they make the same speed as we do on our suburban lines in the United States and they are well cared for. Westinghouse held four experts ready to go over just as soon as the stuff was unpacked and ready to remove, but the Japanese never called for one of them. Finally, they said, " We are sending So-and-So." The reply was, " We are not ready yet," and by and by the payments were received and the lines were in full operation and working splendidly.

They have a large number of engineers in Japan. Just think ! You can get a 13-foot forging in Bethlehem or you can get a 15-ft. forging in England, but if you want anything larger, you have to go to Japan. I told Charlie Schwab one day about one of their large machines and he said, " Yes, I made that." I said, " Yes, I saw the one you built—it was very much smaller." This is a great two-cylinder press that they built themselves and they know how to handle it. I saw beautiful forgings that they turned out. They could handle that press and all the other presses in that great place just as well as we can. They are more careful and it seemed to me that they do their work more thoroughly than we do.

At their dock yards I have seen cargo after cargo of pig iron, fine Swedish iron, and they take all the sulphur and phosphorus out themselves and make it as good as gold ore. They take that pig iron in at one end of the dock yard and turn out a 33,000-ton battleship at the other.

When you go to Japan—and I hope you will go—you will get a right royal welcome. I hope the Mechanicals and representatives of some of our other bodies will join you and go there in a mass. A most enthusiastic welcome awaits you in more than one way. That is one of the things where we ought to be proud enough to say to our good Japanese brethren, " Let us go more than half way once." Let us feel what it is to be grateful and courteous and fine.

And then I must tell you about the workmen. I saw the finest lot of team-work there that I have seen in my life. I have seen workmen in our country and have had to depend on them. It is my job to get them in and keep them working harmoniously and in teams. If you get four or five Japanese working together, they sing. They have a funny song that you hear the street sweepers sing when they are working at night, a little simple ditty that goes on and on forever, but in that way they get close together in their team-work.

One time I went down into the under regions of a great hotel that is in process of being built, to hear this song. I said to Mrs. Sperry, " I am going down to see what part that song plays in their work." I followed the sound and finally saw a gang of men bringing in a great heavy elevator on long skids. I turned a corner and came upon them suddenly. In a case like that, in America, your workmen straighten up and think it is a good excuse to loaf, but they didn't do that. Finally I put my hand to my ear. There they were singing this song and working. They knew I wasn't there to make fun of them. They knew I was there to hear about this song. Instead of standing up, they went back to the job again without any command from the foreman, but they didn't sing. Then I touched my ear again, as if listening to them, and they all started up their song and smiled as cheerfully as before.

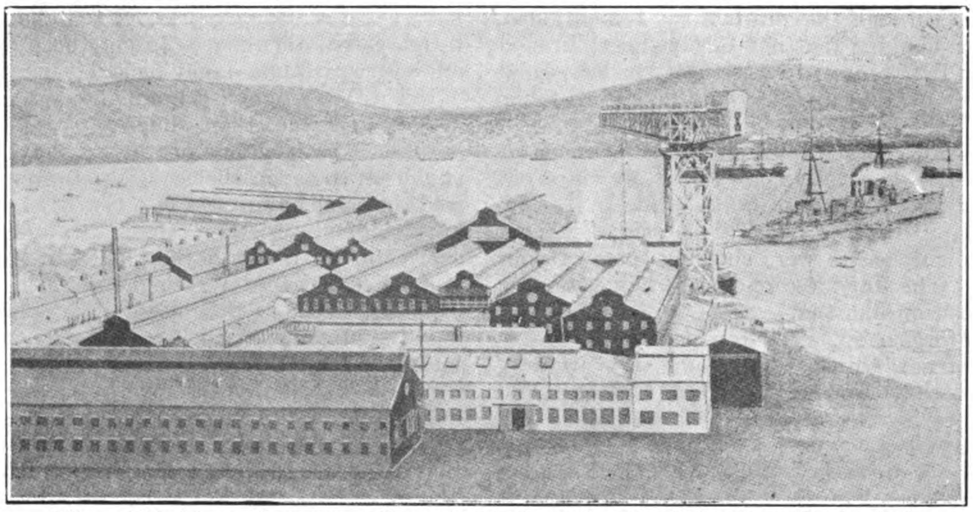
You see smiles from one end of that realm to the other. They are cheerful workers and I think they are the most courteous

*(Continued on page 557).*

# Japan's Electrical Development

## The Mitsubishi-Parsons Turbo-Alternators

FOREMOST in the development of electrical machinery in Japan stands the Mitusbishi Company whose works at Nagasaki have been turning out electrical apparatus for many years. In the construction of large units this concern has had remarkable success and many of the important plants in Japan are equipped with turbines and alternators made at their works. The Mitsubishi Company manufacture turbo-alternators at their Nagasaki Works under license from C. A. Parsons & Company, Ltd. of Newcastle-on-Tyne, while at their Kobe Works they manufacture the Stal turbine. In perfecting the mechanical and electrical designs of these alternators, advantages have been taken of the latest Parson's patents and special attention given to the thorough and efficient ventilation oɪ all parts, and the finished machines are subjected to rigorous tests and inspection.



View of Machinery Department Nagasaki Works of the Mitsubishi Zosen Kaisha, Ltd.

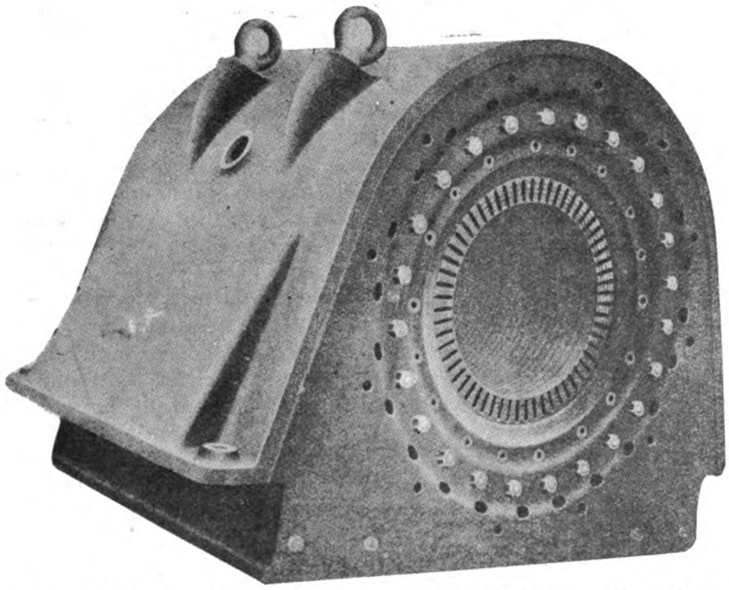


Fig. 1. Alternator Showing the Arrangement of Stator Core Stampings

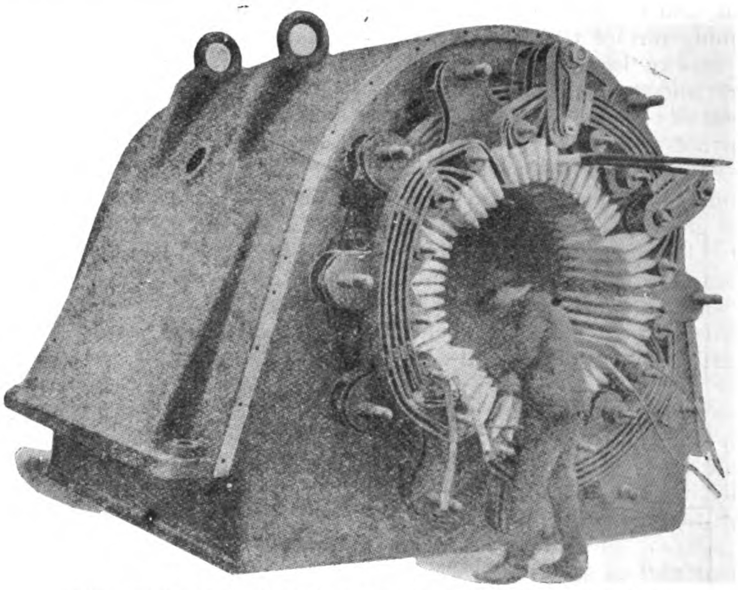


Fig. 2. Alternator Showing the Stator Winding in Building

The alternators made at the Nagasaki Works are of the enclosed ventilated type with revolving magnetic field, with stators of cast iron. The ore is built up of stampings of high permeability and low hysteresis steel sheets, insulated with paper. The stator windings are tunnel wound in suitably shaped slots insulated by heavy mica and fibrous tubes built around the conductors. The end windings are strongly stayed and supported to enable the windings to withstand any ordinary shock by short circuits or other accidental faults.

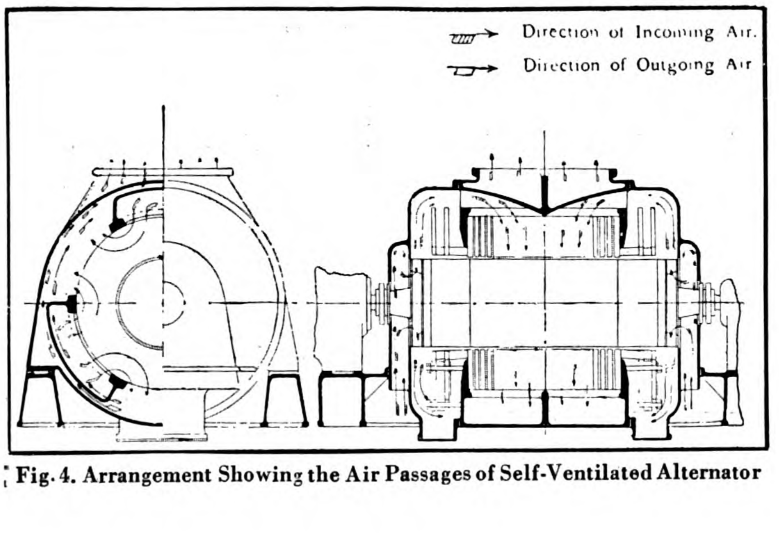



Fig. 4. Arrangement Showing the Air Passages of Self-Ventilated Alternator

The rotor body is of special forged high tensile steel, with windings of the barrel type, embedded in slots distributed around the periphery. Along the body of the rotor the windings are held in place by bronze or gun-metal wedges securely keyed to the rotor teeth, while the end windings are held by massive end caps of bronze or steel. The insulation is chiefly of mica, with fibrous materials for retaining the mica. The end caps are so constructed that when forced into position, they hold the coils tightly and prevent any movement of the windings.

The collector rings are of seamless forged steel shrunk on to the shaft over mica bushes and the connections carefully insulated. The burshes are fixed in a spring type holder fitted with catches so that the pressure can be relased and any one of the brushes removed while the machine is in operation. Grooves are provided at each end of the rotor to attach balance weights quickly and easily, and all parts of the rotor carefully balanced before assem-

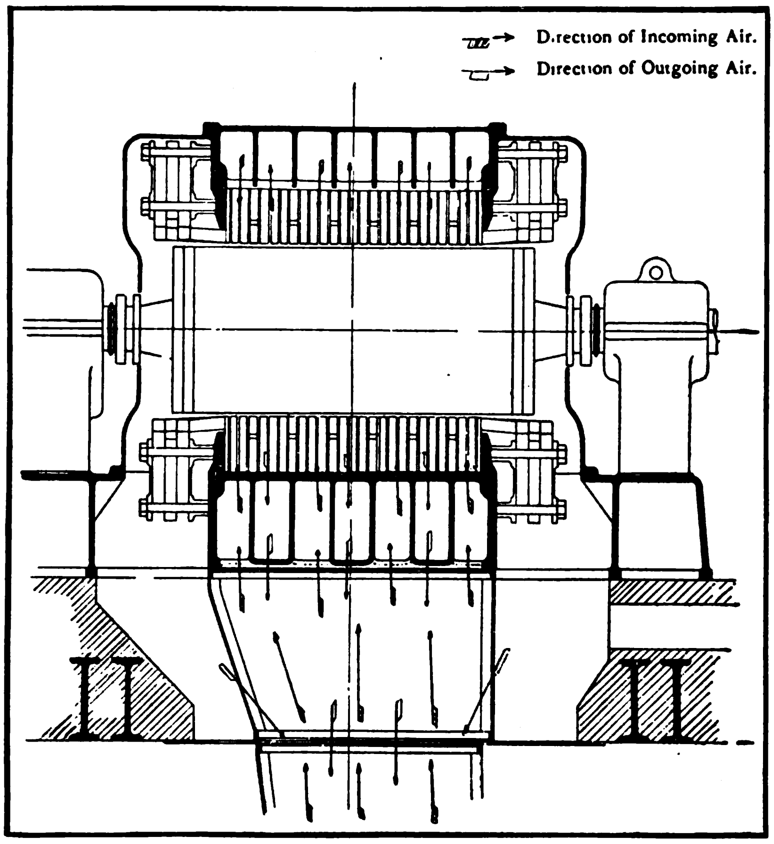



Fig. 5. Arrangement Showing the Elevation of the Air Passages of Forced-ventilated Alternator

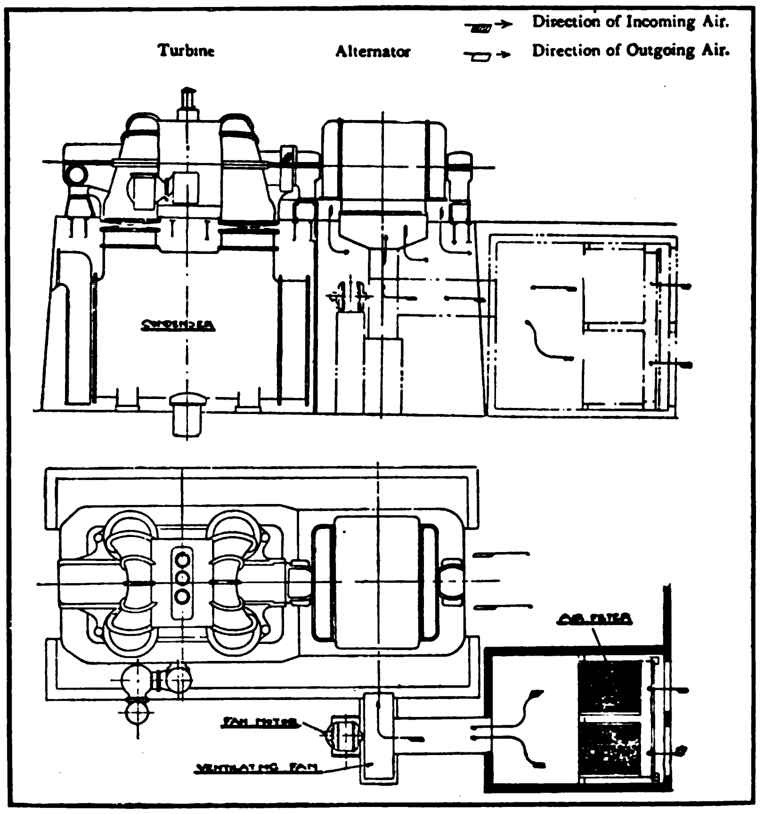



Fig. 7. Arrangement of Forced-ventilated Turbo-Alternator

bling. After completion the rotor is run up to 20 per cent. over its normal speed and carefully balanced.

Self-ventilated and forced ventilation are employed in the construction of these alternators. Air is forced in from the openings at one side of the bottom of the frame to the pressure compartments by an external fan. Passing through the ventilation ducts and holes of the stator core, the air is forced out to the neighboring exhaust compartments and goes away to the outside of the casing from the openings at the other side of the bottom of the frame. Tyis form is used for the machines of large capacities, because of the efficient ventilation and consequent saving of machine size. The patented Mitsubishi ordnance fans are used in connection with this type of ventilation.

To provide against fine dust or moisture, it is often necessary

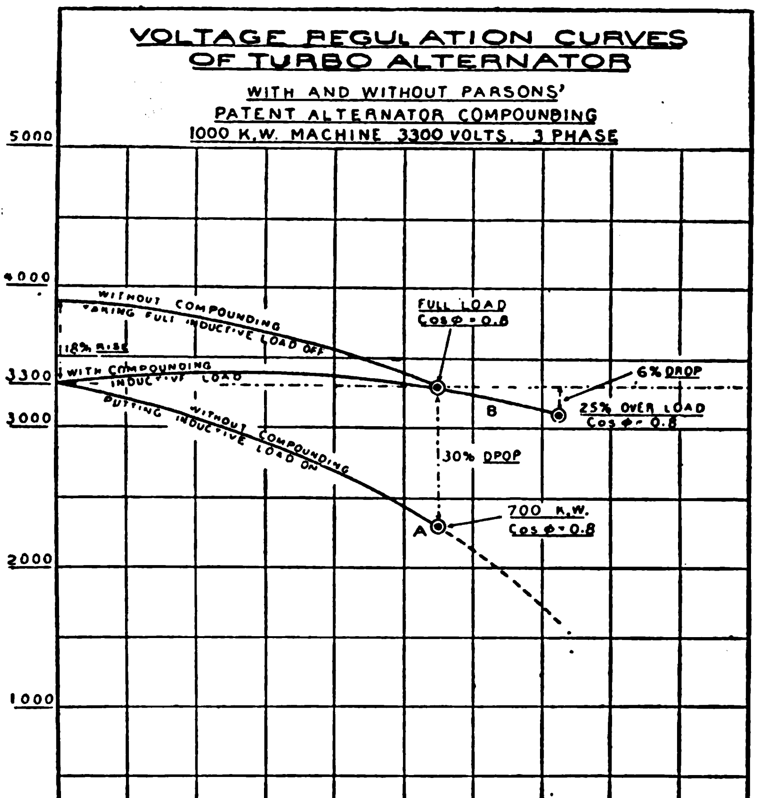



Fig. 3. Rotor Showing the Arrangement of Slots

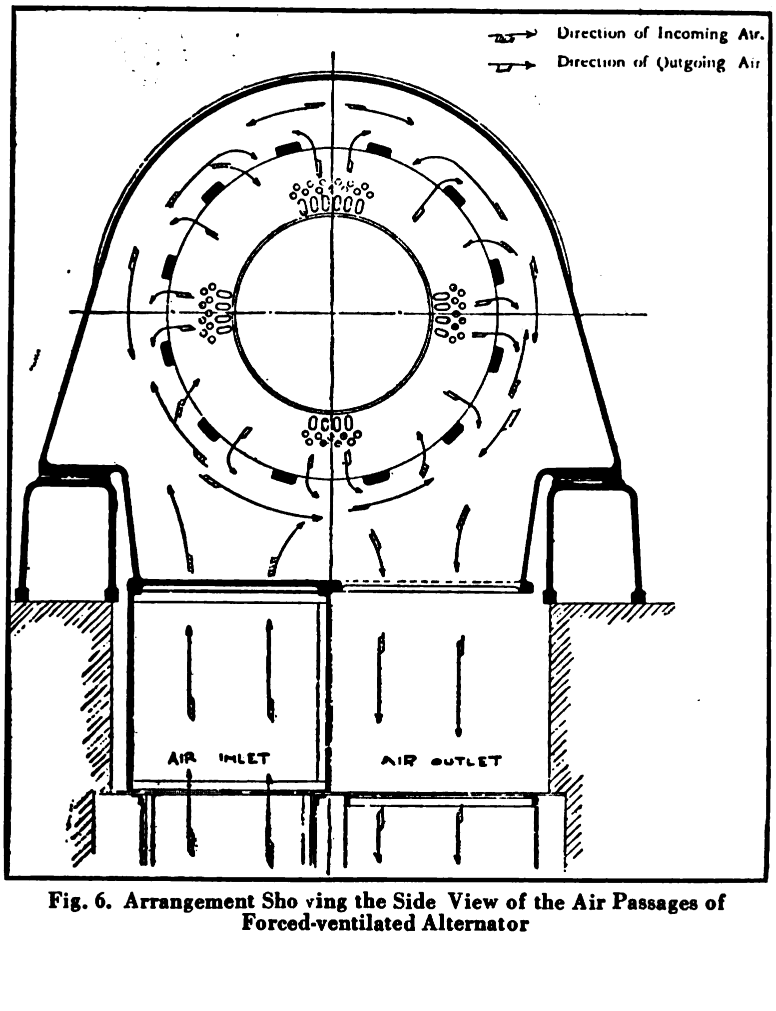



Fig. 6. Arrangement Sho ving the Side View of the Air Passages of Forced-ventilated Alternator

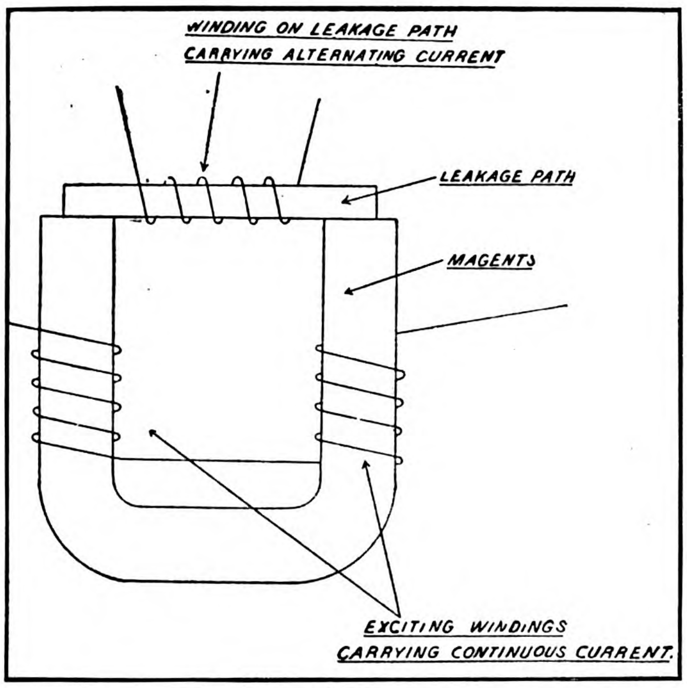



Fig. 8.

to attach a trunk which induces fresh outside air for ventilation, and here a sheet iron trunk is applied. For air filtering the Mitsubishi Works makes a dry type apparatus composed of pockets of closely woven cotton cloth in the form of rectangular envelopes with one open end.

The standard patterns of these turbo-alternators turned out at the Nagasaki Works range from 500 kilowatts (625 K. V. A.) to 20,000 kilowatts (25,000 K. V. A.) with a power factor of 80 per cent. and voltages ranging from 1,100 to 11,000, and 25, 50 and 60 cycles. To minimize the voltage variations due to sudden and large fluctuations of load, Parson's compounding method is provided for the exciter. This apparatus depends upon the simple fact that while an alternating current cannot directly produce an undirectional field, it can have a strong action in diminishing such a field. In Fig. 8, a pair of magnets are shown carrying an ordinary exciting winding. Now if an iron leakage path be laid across the pole pieces of the magnet, and a powerful current passed through the exciter windings, provided the cross sectional area of the leakage path is less than that of the magnets, the iron of the leakage path will be more or less " saturated "--that is, will be incapable of passing very many more lines of force, even when the exciter current is greatly increased. Now if an alternating current is passed through the winding on the leakage path it will be seen that when passing in one direction it cannot, owing to the iron being staurated, greatly increase the "leakage flux" in the leakage path, but when passing in the other direction it can and will—provided it be of sufficient strength—greatly reduce the leakage flux. Hence the net result is a reduction of the leakage flux. It is this principle that is applied in Parson's patent compound wound alternator, and Fig. 9 shows diagrammatically how the connections are made in the case of a three-phase alternator. Here the leakage paths, which are of laminated iron, are seen bridging the magnets of the exciter, and consequently diverting a large number of lines of force which would otherwise pass through the exciter armature.

The effect of this is to keep the voltage of the exciter lower than it would be if the leakage paths were not in position. The arrangement being three phase, there are three paths, each carrying a winding energized by the current in one phase. As described

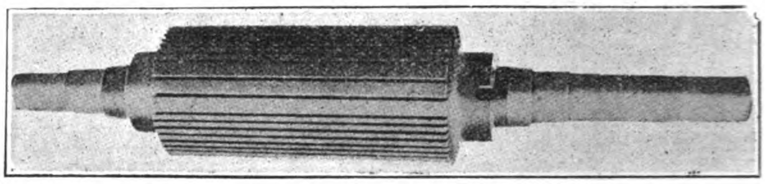


Fig. 10. Amperes per Phase

for Fig. 8, when the load comes on the alternator, the " leakage flux" in the "leakage paths" is checked back, and the flux through the exciter armature consequently increased, causing a rise in voltage of the exciter and thus automatically increasing the excitation of the alternator, the action being practically instantaneous, since the increase of current due to the load coming on is used directly to effect the regulation.

The leakage path windings are placed between the windings of the alternator and its neutral point, which is usually either "earthed" or at a potential differing but little from earth, but in spite of this they are insulated for the full working voltage of the alternator. In a few special cases current transformers are used instead of passing the main current round the leakage paths. Fig. 10, shows the voltage regulation of an alternator under varying conditions, with and without the leakage path compounding. The curve marked A shows the effect on the voltage when a heavily inductive load is thrown on : by the time the full-load current of 220 amperes is reached the voltage has fallen to 2,300, so that the load on the plant is really only 700 k.w., yet the voltage has fallen from 3,300. The curve marked B shows that when the compounding is in use the voltage remains practically constant. If desired, however, the compounding can be arranged to raise the voltage automatically as the load comes on : this is common in C. C. traction generators, and is useful when it is desired to compensate for voltage drop in feeders.

A further advantage of this system of voltage regulation is that the alternator may be designed for a much smaller short-circuit current. It is well known that where close inherent regulation is required of an alternator—that is, when it is required that its voltage shall remain as steady as possible with varying loads—the current which passes when the alternator is accidentally short circuited is very much greater than in the case of a machine designed for poorer regulation. These heavy short circuit currents not only cause considerably more damage at the point of breakdown, but also are liable to damage the windings of the alternator, and cases have been known where the main cable conveying the current have been wrenched from their supports. It is a fact that by using this method of compounding an alternator the short circuit current which passes when the machine is short circuited can be easily reduced by one-third, and the Parson's compound wound alter-

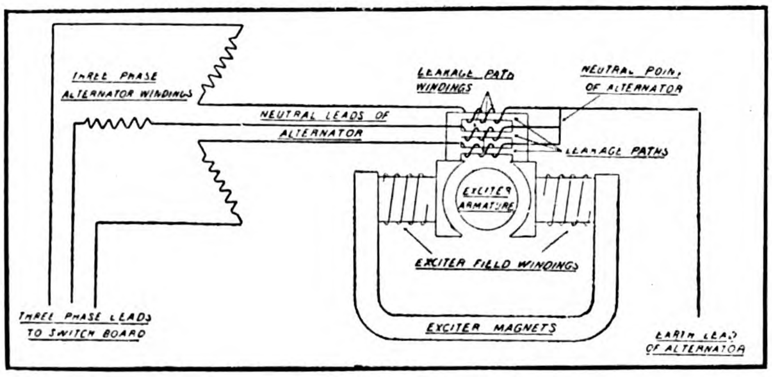



Fig. 9.

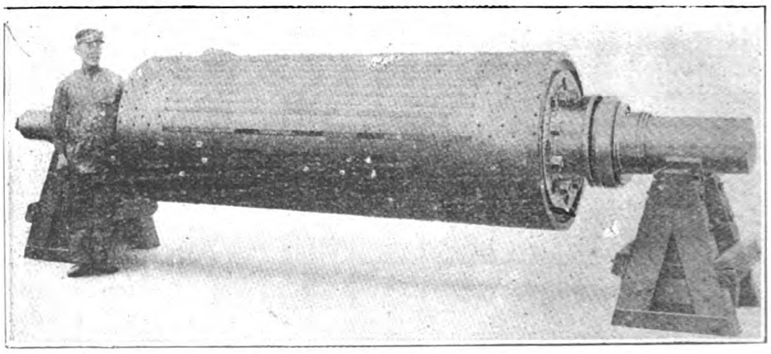


Fig. 13. Rotor of 12,500 K.V.A. Mitsubishi Alternator Supplied to the Osaka Electric Company

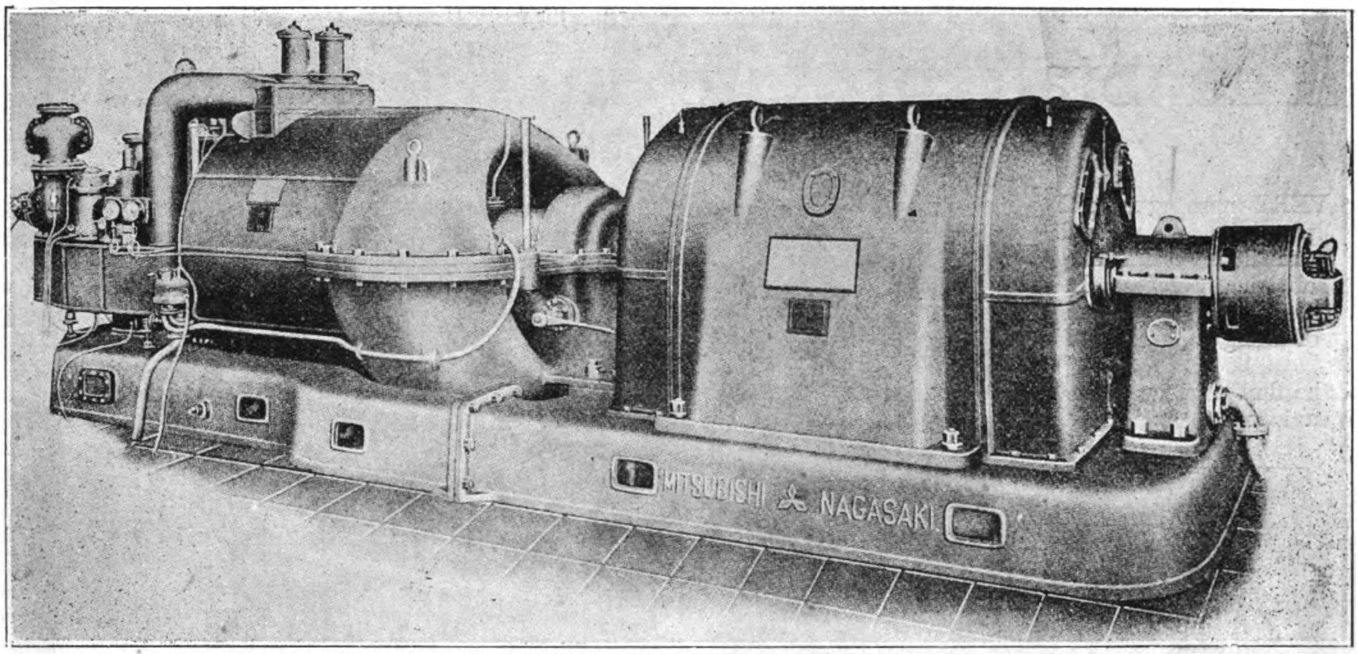



Fig. 14. K.V.A. Mitsubishi Turbo-Alternator Supplied to the Nagoya Dento Kaisha : 3 Phase, 60 Cycles, 11,000 Volts, 1,800 R.P.M., 80 per cent. Power Factor, with Direct-Coupled Exciter

nators are designed to take advantage of this. All extra apparatus required for a compounded alternator of this type is entirely electromagnetic—there are no moving parts whatever, nor any electrical contacts to be made and broken, nor are there any complications such as solenoids and electrical condensers. There is no commutator to change the alternating into direct current, and all the parts required for the compounding are fixed on the exciter. Thus, if in spite of all the great simplicity of these parts, trouble should occur in this part of the machine, it is only a matter of a very few minutes to completely remove the compounding apparatus, when the machine can be run as an ordinary uncompounded plant. It has been proved by actual trial that there is no difficulty in running in parallel machines fitted with this device : no extra complications, such as equalizing wires, are involved, and compounded alternators are also running satisfactorily in parallel with uncompounded plants.

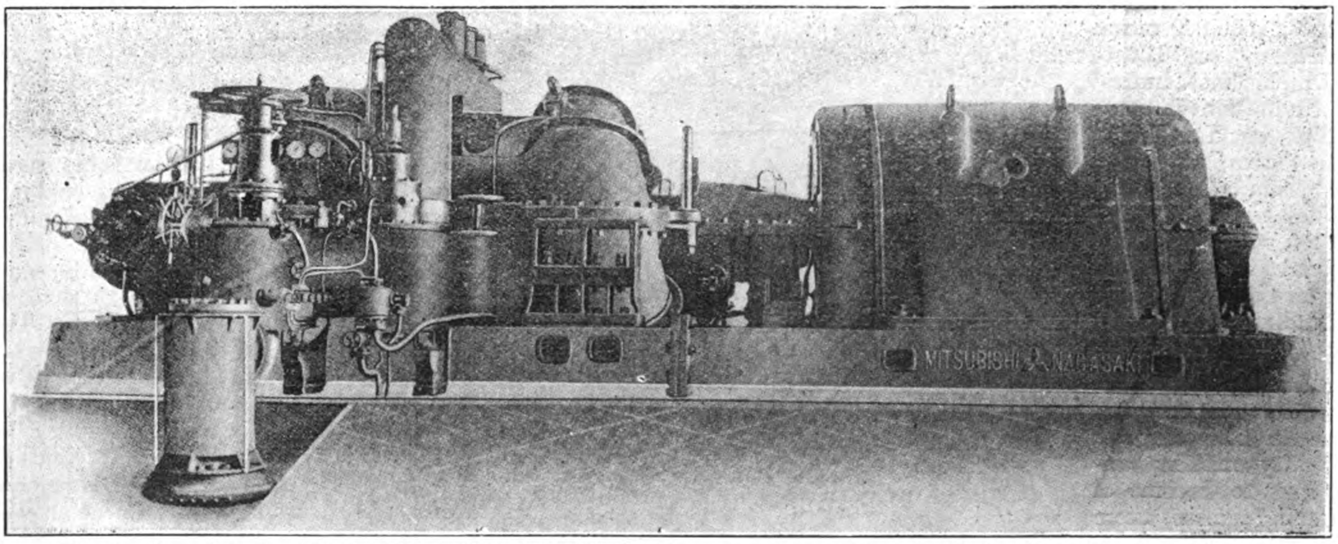



Fig. 15. One of 4 sets of 12,500 K.V.A. Mitsubishi Turbo-Alternators Supplied to the Osaka Dento Kaisha, 3 Phase, 60 Cycles, 11,007 Volts, 1,800 r.p.m., 80 per cent. Power Factor

# Frazar & Company Expands

Announcement was made on June 21 in New York, of the consolidation of the business of Cowdrey & Winkhaus with that of Frazar & Co.

Cowdrey & Winkhaus for the past sixteen years has conducted a general exporting business with South America, and particularly in Brazil and the River Plate region.

Frazar & Co. are among the pioneers in American foreign trade, Everett W. Frazar, one of the present members of the firm, being the third generation of the family in the business. His grandfather, Captain George Frazar, began trading between New England and Chinese ports as early as 1834, being succeeded by his son, Everett Frazar, who permanently established the firm in Shanghai in 1856. Two years later he joined Commodore Perry on the latter's second expedition to Japan, to which country he subsequently extended his commercial activities. On his death his son, Everett Welles Frazar, continued the business, establishing permanent offices in all important Japanese cities and in China, Korea and Formosa.

Among the early accomplishments of the firm during the development period of Japan may be mentioned the importation of the first electric dynamo, the first American locomotive and the first phonograph.

Though primarily engaged in the Far East, in recent years the business has been extended to Europe, through officials located in France and Switzerland. In addition to New York, branches are maintained in San Francisco and Seattle.

The consolidation with the Cowdrey & Winkhaus interests provides new and additional facilities in South America.

The business will be continued under the name of Frazar & Co.

# The Staff of Life in the Far East

*By Kilmer O. Moe*

EVERY morning more than sixty per cent. of the world's population wakes up hungry—hungry for rice. From time immemorial this grain has been the principal food of oriental races. It is the greatest cereal food on earth. Let us consider for a moment the vital problem of filling the mouths of this vast horde of oriental rice eaters.

China, the first country in the world in point of population; has approximately 455,000,000 people. The Indian empire is credited with 325,000,000 more. Japan with Korea, has 78,500,000. The Dutch East Indies, 42,000,000. Indo-China is credited with 15,000,000; The Philippine Islands with at least 10,000,000; Siam, 9,600,000; Federated Malay States with about 4,000,000, not to mention Persia, Afghanistan, Turkestan and others which are also within the oriental radius.

Here we have almost one thousand million of the world's population which under ordinary circumstances is increasing at the rate of fifty millions annually. What is to become of this vast annual increase, these additional mouths that need food, when the food supply now is far from adequate? Modern education, transportation and sanitation that increase desires are adding their urge for more rice to feed the hungry masses rather than adding to the supply.

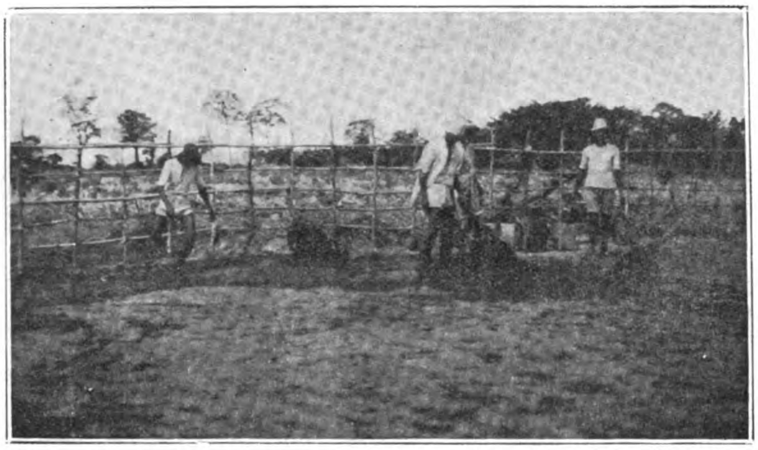
The countless millions that inhabit the Far East constitute a great volume of hunger and unrest, and their ceaseless urge will determine the ultimate struggle. This stupendous and shadowy mass comprising, as it does, over half of the human race has potentialities in the aggregate that statesmen will do well to consider. Platitudes will not stop mob hunger. It will need the broadest kind of leadership to place the food needs of the future on a satisfactory basis.

Indescribable poverty and daily drudgery enable the myriads of the Orient barely to keep body and soul together. Among these millions a cessation of labor means that the flicker of life burns low. Their lands are fertilized with the remains of untold millions who were born, lived, died and were buried in poverty. Consult the records of forty centuries.

It is of the highest importance, therefore, that every nation

Planting Time. The soft mud is worked up into a mixture that resembles motar into which the rice seedlings are transplanted.

A bountiful harvest on a rice farm in Central Luzon. Each tenant has a stack of his own.



Preparing the threshing floor. A mixture of carabao dung and mud is used. This, when dried, makes a mat from which the rice grains may be swept up with ease.

Winnowing the grain is a task usually left to the women.

Spreading the sheaves on the threshing floor. The hexagoual roller is pulled by a carabao.

in the Far East take stock of its potentialities in relation to its national existence with especial regard to the alimentation of its inhabitants. This will be the supreme test for the national welfare of oriental countries.

The great war very forcibly brought home to mankind the fundamental fact that the only possibility of survival for men as well as nations is to employ every possible means of increasing the sources of alimentation in order to safeguard those resources that tend to insure the possibility of sustaining the nation. A country that does not take this vital truth into consideration is building upon the sand. Its awakening will be rude and its final struggle will be tragic.

The post-war strife now taking place in Europe is, in the last analysis, one of insuring the staff of life for posterity. Occidental civilization is so very complicated that this purpose is hidden under a mass of detail, but the end of it all is really to make sure of three meals a day and a place to sleep for the nationals of the various contending nations. In the Orient, however, the issue is plain. Perenial scarcity of food enough to barely sustain life is here becoming the gravest of problems. It is like the sun, none but the blind can fail to see. Every day the world seems to grow smaller; every day mankind is being jostled and crowded closer.

## The Available Supply of Rice

The orient simply must have rice. No one has so far been able to discover a substitute. Forty countries of the world now produce rice but only eleven of these have a surplus in good years, and only three of the eleven—Burma, Siam and Indo-China export rice regularly and in quantity. In the best of times there is no great margin of production over requirement of this commodity. The surplus in three small countries is all that stands between the oriental millions and hunger. Half of the population of the world is at the mercy of a bad harvest.

China, Japan, Java and the greater part of India have reached their limit in production so far as extension of area devoted to the cereal is concerned. The only solution left them is that of increasing production through means of irrigation, fertilization, intensive cultivation and seed selection. But all of these countries have populations that are increasing by leaps and bounds and all of these extra months have to be filled. The increasing demand, therefore, tends to outdistance the ability to meet it. It is met only by drawing on the surplus of Burma, Siam and Indo-China including Cambodia and Tonkin.

The available supply for export from these countries is over 5,000,000 metric tons of which Burma furnishes the major portion. Where does this rice go ? India absorbs the greater part of Burma's surplus and the balance goes mainly to Europe. Siam supplies large quantities of rice to Europe also and gives the balance to Java, The Straits Settlements and Japan. Indo-China supplies China Japan and the Philippines.

The Philippine Islands have to support over two million people by direct importation. Java needs about 520,000 tons annually; Japan needs 450,000 tons, and the demand is increasing at an alarming rate in spite of efforts to meet the need through home production with scientific cultivation. China is always in the market for every ton she can find the means to import. India's periodical famines, China's disastrous floods, and the crop failures throughout the orient, soon wipe out this seemingly huge surplus of 5,000,000 tons. The rice problem bids fair to remain a perennial question of scarcity.

## Possibilities of Increase

The land suitable for rice growing is limited to those sections of the world that have the climate and water facilities necessary to mature the crop. China, Java and Japan have every available meter of rice land already under cultivation. No land goes to waste in these industrious agricultural countries. Java could supply its rice shortage for a time by converting its sugar lands into rice lands but this is not practicable from an economic standpoint.

Burma with its heavy export may still increase its area by approximately eighteen per cent. Siam with an annual export of over one million tons may increase her area twenty per cent. In Cochin-China the area was increased during the decade 1898-1908 by 48,000 hectares annually, but for the period 1908-1914, the average annual increase was only 3,483 hectares and since that much less. Tonkin can increase its area by fifteen per cent. but as its export is now only 200,000 tons and its population is increasing rapidly it will soon cease to be a factor.

Annam holds little or no possibility of an increase. The Dutch East Indies have very great possibilities and these will be taken care of by the millions of Java who will soon have to spread out over neighboring islands. There are large areas in Sumatra, Borneo, Celebes and Papus which have the proper climatic conditions but which lack the labor. In time these lands should yield the same high hectare-production of Java and like Burma and Cochin-China become one of the world's great storehouses of food for the hungry masses.

Outside of this restricted area there are many other possibilities that have appeared upon the horizon of the student of the rice industry. The lands of Mesopotamia will, no doubt, be opened up when the irrigation schemes of Wilcox can be realized. The area is considerable and if the high production of Egypt is maintained the result should give a healthy annual surplus which ought to be available within the next decade. By augmenting and enlarging its irrigation projects, India can increase enough to offset its growing population, but annual imports can probably not be reduced.

The growing of rice in Queensland, Australia, seems to have been largely abandoned for several years due, no doubt, to the inability to secure cheap labor to compete witho ther rice-producing countries. There is sufficient land suitable for rice in Northern Australia to supply an export of millions of tons, if irrigation together with modern machinery could be supplied. This would be a natural consequence of letting down the bars and peopling North Australia with orientals accustomed to life in this hot, torrid section and skilled in the production of the cereal.

As to other parts of the world, we have the potentialities of Africa as in Soudan, where irrigation projects are now being pushed to completion for the growing rice of and cotton in the area between the White and Blue Nile. British, and former German East Africa, as well as the Portuguese colonies east and west, Kameroon, Nigeria and parts of the Congo region are suitable for rice, and hold forth future possibilities of production. South America also responds very well to the growing of this cereal. Already Brazil exports now over 50,000 tons to Europe and Argentina and Peru are rice-producing countries. Large tracts of rice land are found also in Central America, the United States and Europe.

## A Question for Statesmen

From this it is readily seen that the world is quite capable of supporting its growing populations for many years to come. It is not really a question of restricted possibilities so much as proper utilization of resources. Mankind has been amply provided for in way of natural advantages. It remains for the human forces to so direct their energies that Mother Earth may yield up its wealth in sufficient quantities to sustain its teeming millions.

It is a question for statesmen. Unless nations can produce not alone political leaders, military leaders and financial leaders, but astute economic leaders they will labor under a handicap that will make the race increasingly difficult. Wise fathers prepare for the future and nations must do likewise or perish. The war's destruction like that of a storm aroused the world to a sense of its future responsibilities. The peoples who have learned the lesson are the one's that will survive the ordeal of reconstruction. It is a question of economic leadership.

The fallacy of placing transitory ignorance in positions where a wide range of knowledge and long training is necessary will become more apparent as the national food problems grow more acute. National leaders will more than ever be forced to concentrate upon those vital questions that deal with the alimentation of their nationals—increased production, irrigation, reclamation, multiple cropping, fertilization and adequate distribution—or their future and that of their country will be thrown in the balance.

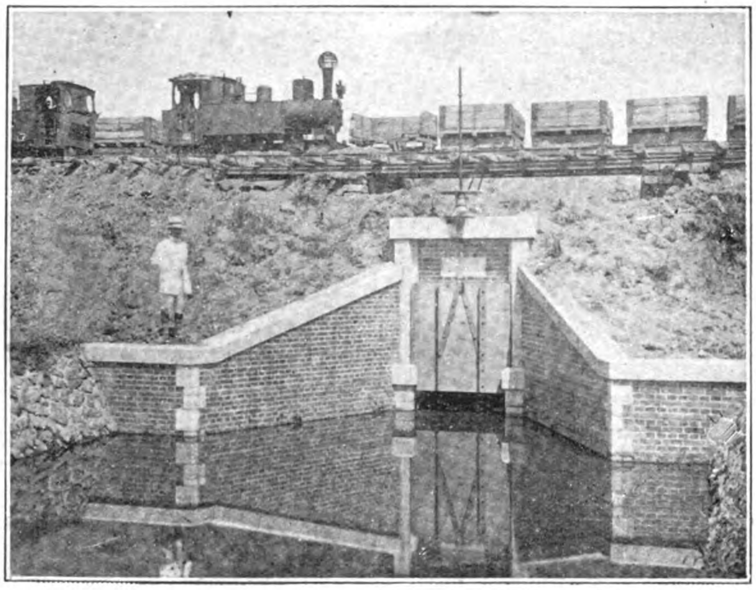
The work accomplished by the Dutch in Java, the French in Indo-China, the English in Egypt and in Burma points the way to the proper solution of the problem. Men of vision like Lord Cromer in Egypt and Sir Willcox in Mesopotamia will arise to lead the way to greater production and increased prosperity. Streams that are now finding their way to the sea without benefiting anybody will be diverted over the land and the arid regions of the earth will yield forth an abundance. A mere fraction of the world's wealth and energy which was consumed in the late war if turned into productive channels such as these will insure a bountiful supply foi all time. And the fruits of the harvest will produce a nation of home builders with strong, progressive communities that will stand in defiance of time through the struggle of the centuries.

# River Improvements in Japan

## The Watarase Gawa Contract

THE Watarase is the largest of the branches of the Tone Gawa, its zone covering an area of 597 square miles. It runs through Tochigi prefecture, to the north of Tokyo, and three other densely populated prefectures in the east of Japan. Although the main stream is not more than 67 miles long, the total length of all its tributaries is 530 miles, and of this total something like 87 miles are navigable. With its branches, it drains a basin of something like 57,965,000 *tsubo*, but in flood spreads over 137,601,000 *tsubo*.

In the upper regions of the Watarase, there are many places where there are no embankments, or where the bank is not continuous, so that flood waters overflow into the surrounding fields. There are also many places where the river is unable to hold the full flood stream and with weak embankments. This is particularly the case where the Omoi Gawa meets the Watarase. At this point, the flow back from the Tone River rises, and the flood streams coming from the Tone, Watarase and the Omoi, break all embankments, and sweep the surrounding land over an average area of 30,000 *tsubo*. Making Akamaga swamp the centre of the flooded districts, the flood spreads over the central plain of this river basin. About 70 to 80 per cent. of the flooded basin is cultivated land, and as the floods last a long time, the lands are always severely damaged. In the past, the heaviest damages were experienced in 1896, 1902, 1906, 1910, and 1914; the losses being estimated at not less than Y.16,000,000 each year.



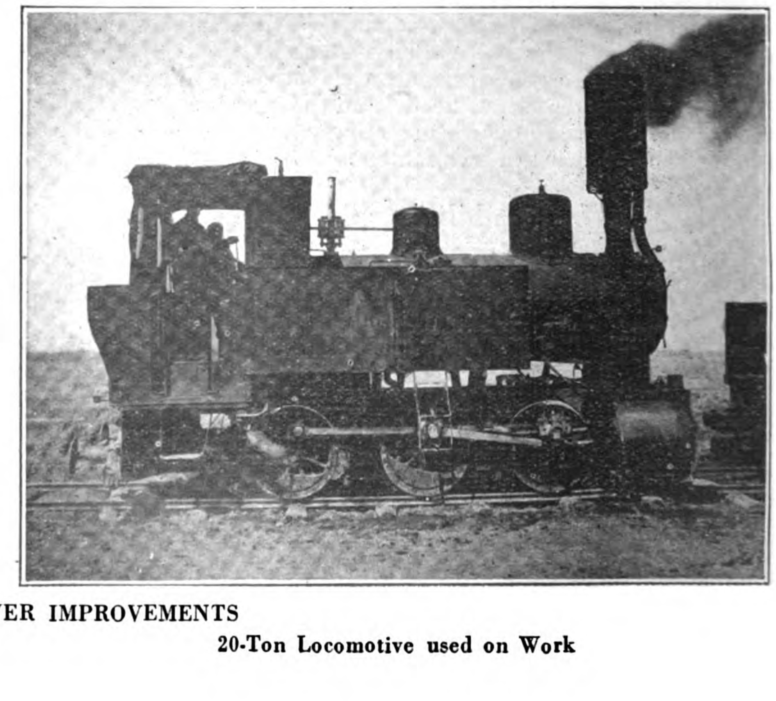
Ishikawa Sluice Gate, completed

### Plan for Improvements

The program for improving this river has been spread over a period of 14 years, and the government has approved the original cost of Y.8,900,000, to which Y.2,500,000 was added in 1918 to meet the enhanced costs of materials and labor. The program provides for the improvement of the Watarase from Ashikaga, the great spinning centre, to where it meets the Tone River. The plan includes improvements to the three tributary streams of the Watarase, the Akiyama, the Omoi and the Uzuma. Up to April 1923, about 80 per cent. of the projected construction has been completed. The balance of the work is expected to be finished this year.

The main object of the improvements which have been carried out has been to hold back the flood streams. The work gives the rivers enough embanked space to allow a flow of 90,000 cubic feet a second at the highest in the Watarase River, and 60,000 cubic feet per second in the Omoi River. In connection with this work the curves in these river beds have been eliminated to a very great extent, and embankments raised.

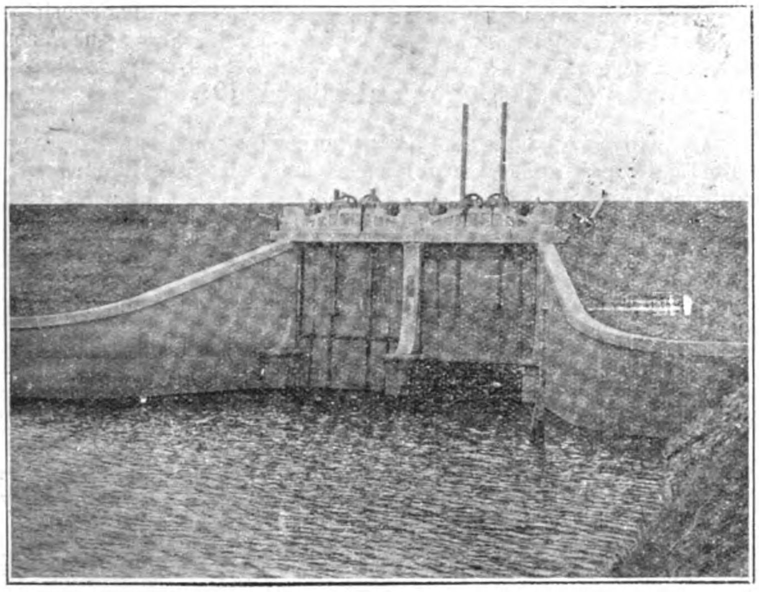
The curve in the Watarase from the town of Fujioka down stream is particularly sharp, so much so, in fact that there was found to be little room for improvement. Consequently it was determined to construct a new river bed, through the high land at Fujioka, which should empty into Akamaga swamp. It is into this swamp, or artificial reservoir, that the Omoi River and the Uzuma River are to be emptied after some straightening of their curves. In order to increase the capacity of the Akamaga swamp so that it will serve as a reservoir for the protection of the surrounding country in time of floods, the embankment of the old Yanaka basin has been removed, and both the Omoi and Uzuma Rivers have had their embankments at the points where they meet the Watarase River, removed. Instead of these old embankments a very much wider basin has been constructed, with a strong embankment around it. This new basin is 3½ miles wide, and 43¾ miles long, and its total



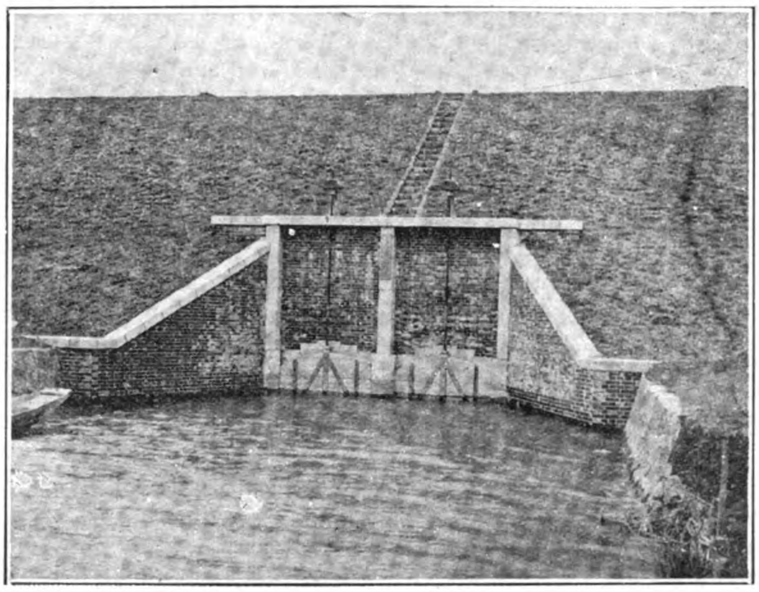
THE WATARASE RIVER IMPROVEMENTS

Dredger "Mikamo"

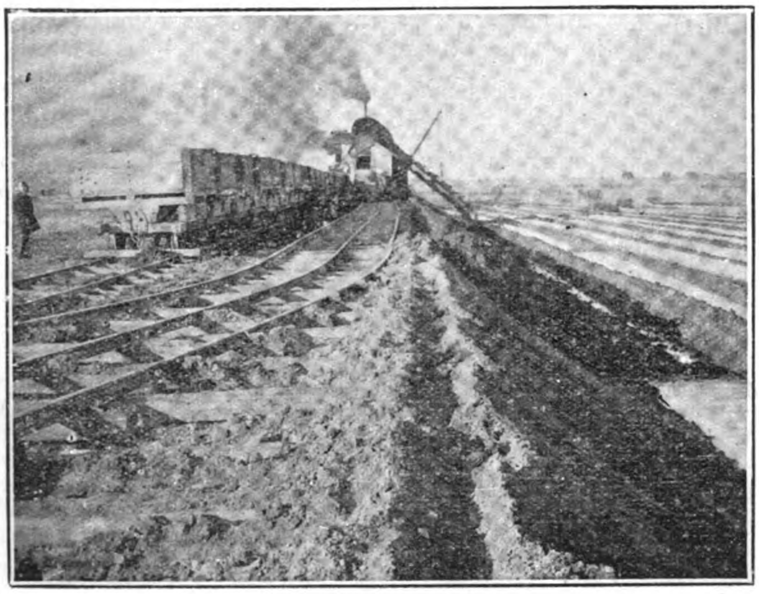
20-Ton Locomotive used on Work



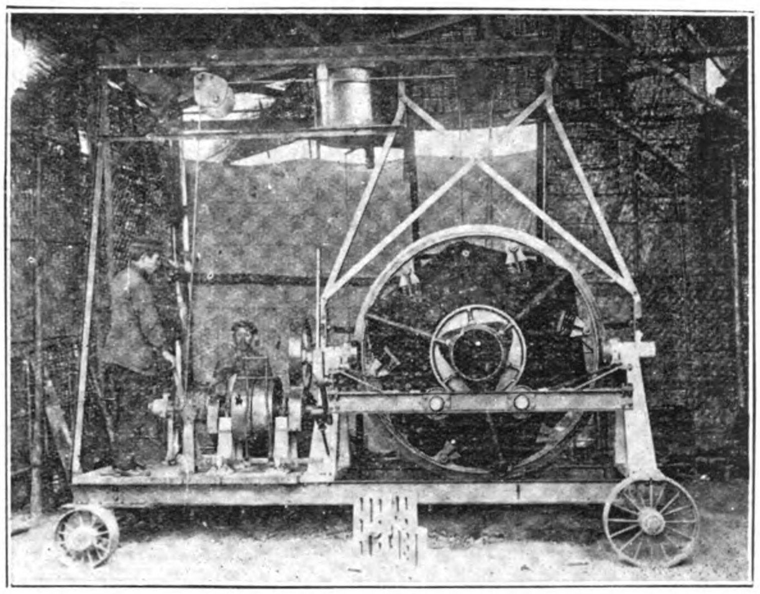
Yatagawa Sluice Gate



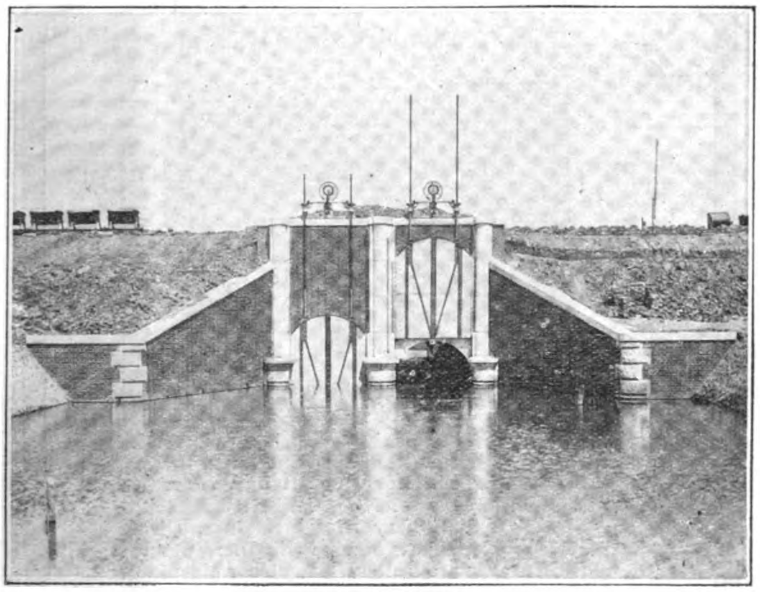
Hongo Sluice Gate



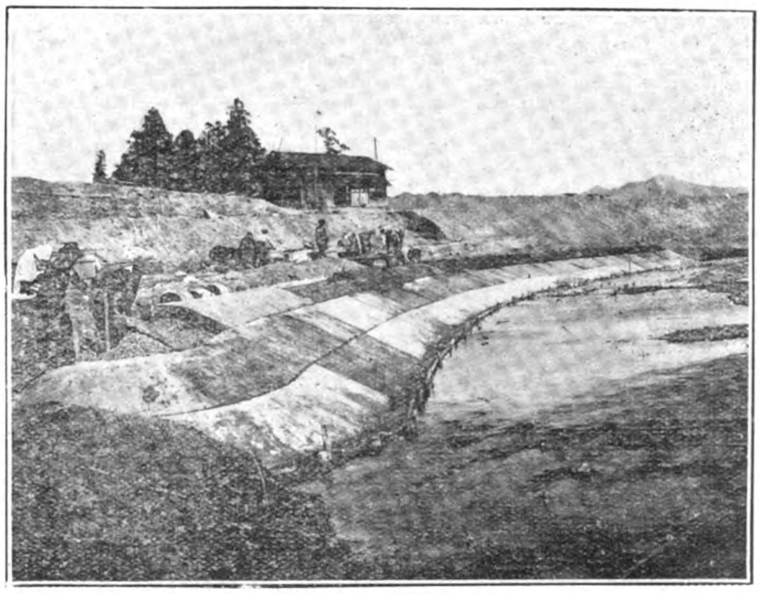
Mechanical Digger at Ishikawa



Cement Mixer



Yoragawa Sluice Gate



Reinforced Concrete Embankments

area is something like 10,596,000 *tsubo*. At the highest water level, some 19.6 feet, at Horiguchi, in Fujioka the basin, or flood prevention reservoir, can hold six billion cubic feet of water. This greatly decreases the quantity of water which flows into the main stream of the Tone River, and naturally the flow back into the Watarase, Omoi and Uzuma Rivers too. The reservoir decreases

the quantity of water in the Tone River, from Kurihashi down stream to the sea to 200,000 cubic feet. The curves in the Watarase River between Koga-machi to the outlet of the Watarase have been straightened out, and the new river bed will direct the waters of the Watarase directly into the Tone River.

The upper stream of the Watarase has been widened to 600 feet. Of course, this is the width provided for the flood stream, the actual river at low water being only a very small stream. This width will gradually be widened to 1,380 feet. At Fujioka at the opening of the new river bed the width has been decreased to 540 feet, because of its slope. At the entrance into Akamaga swamp it becomes more than 2½ miles wide, and is narrowed down again to 1,800 feet at Koga-machi, and 2½ miles down stream again, it meets the Tone River. The Omoi River has a width of 1,380 feet at Hozumi village, and is gradually widened until it empties into Akamaganuma reservoir lake.

From Fujioka down stream the Watarase Gawa, the Omoi Gawa, and the Uzuma Gawa along their entire streams, are being embanked with banks built 5 feet higher than the highest flood waters yet known. The top of the bank is 18 feet wide, and the slope of both sides is 20 per cent. On the main stream a side step 12 feet wide has been built in the embankment on the river side of the stream. The embankment of the reservoir from Fujioka to Koga-machi is built 6 feet above highest flood water level, and the top of this bank is 24 feet wide, with an outside slope of 20 per cent. down to the side step, which is built at a point 6 feet below the top, and 12 feet wide : from the step to the bottom the slope is 30 per cent. The outer slope of the embankment has a side step 12 feet wide, built 6 feet below the top. The inclination is 20 per cent. all the way down.

From Koga-machi to the outlet of the Watarase River, the height of the embankment is 5 feet above high water level. The width of the top of the embankment is 24 feet, and the outer and inner slopes are both at an inclination of 20 per cent. The river side of the embankment, however, has a side step 12 feet wide, built 6 feet below the top, and from this step down the inclination is 30 per cent. This is the same as the Tone River embankment.

The office in charge of the improvements is at Koga-machi, and the machine shop is maintained there also. The department of home affairs has furnished THE FAR EASTERN REVIEW with the following list of machinery which has been used in the construction work along the Watarase River:—

| | Capacity | Number in use |
|---|---|---|
| Locomotives ... ... ... | 20 tons capacity ... ... | 5 |
| Shovels ... ... ... | 200 cubic *tsubo* in 10 hours ... | 5 |
| Dump cars ... ... ... | 18 cubic feet... ... ... | 460 |
| Dredgers ... ... ... | 200 cubic *tsubo* in 10 hours ... | 2 |
| ,, ... ... ... | 50 cubic *tsubo* in 10 hours ... | 2 |
| Earth transporting boats | 18 cubic feet ... ... | 22 |
| ,, ... | 20 cubic feet ... ... | 100 |
| Rails ... ... ... ... | 60 pounds ... ... ... | 4 miles |
| ,, ... ... ... ... | 30 pounds ... ... ... | 15 miles |
| ,, ... ... ... ... | 9 pounds ... ... ... | 27 miles |
| Dump cars, wood ... ... | 7 cubic feet... ... ... | 950 |
| ,, ,, iron ... ... | 5 cubic feet... ... ... | 1,050 |
| Portable engines ... ... | 8 h.p. ... ... ... | 3 |
| ,, ... ... | 2½ h.p. ... ... ... | 2 |
| Centrifugal pump ... ... | 900 gallons per minute ... | 3 |
| ,, ... ... | 400 gallons per minute ... | 3 |
| Cement mixer ... ... | 11 cubic feet... ... ... | 1 |
| ,, ... ... | 9½ cubic feet ... ... | 1 |
| Inspection boat ... ... | 9½ h.p. ... ... ... | 1 |
| ,, ... ... | 6 h.p. ... ... ... | 1 |

(Does not include machine shop equipment.)

## Shimonoseki-Moji Tunnel

THE tunnel under the Shimonoseki-Moji strait is one of the pet projects of the railway department to perfect through communication between the main island of Japan and Kyushu, now interrupted by the ferry service between the two islands.

The project still seems to be a matter of finance, and engineering consideration. Little progress has been made, but at the last session of the diet, it was estimated that the tunnel might be built at a cost of Y.29,300,000, and finished in 1931.

The railway department has appointed a committee to investigate and report on the problems of construction under the following headings :—

1. Is the tunnel to be driven as a single or double one ?
2. Shall the power used be electric ? If electric, how shall the tunnel be equipped, trains, power stations, etc.
3. If electrified shall the line be pantograph, or single trolley system ?
4. What grade shall be taken as standard ?
5. Where shall the entrance of the tunnel be located, in relation to the present railway stations and the ferry landings ?
6. Shall the straits be crossed by a bridge, or by an undersea tunnel ?
7. Where shall the central point of the tunnel be ?
8. What shall be the distance between the sea bottom and the top of the tunnel ?
9. Shall the tunnel be made of steel tubing, or shall it be built of concrete ?

These and other questions are now being considered, but no decisions are expected this year.

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
No. 4 AVE. EDWARD VII

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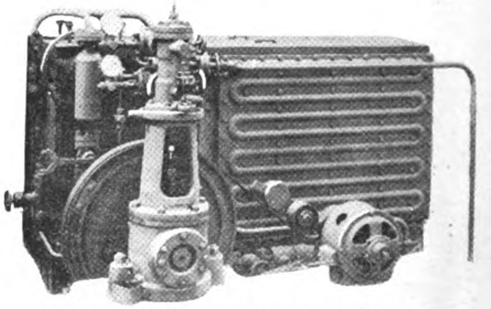

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目錄及關於工業上之問答等請直接本公司

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# THE FAR EASTERN REVIEW

## FINANCE ENGINEERING COMMERCE

上海仁記路第五號

遠東時報

### The New Trend of Asiatic Politics

The Japanese Naval Program
The Significance of Singapore
Japan Holds the Balance of Power
The Paramount American Interest in China
America, An Eleemosynary Institution
Education, the Only Hope for China
America's Lost Opportunity in the Philippines
Story of the Philippine National Bank; An Orgy of Mismanagement
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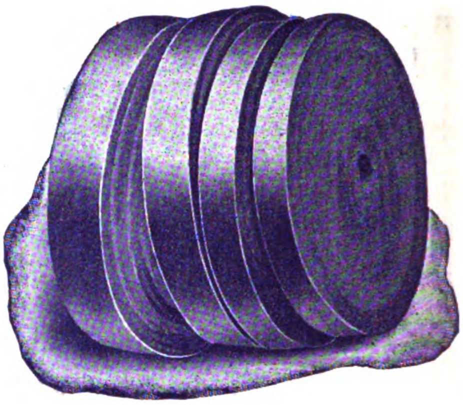

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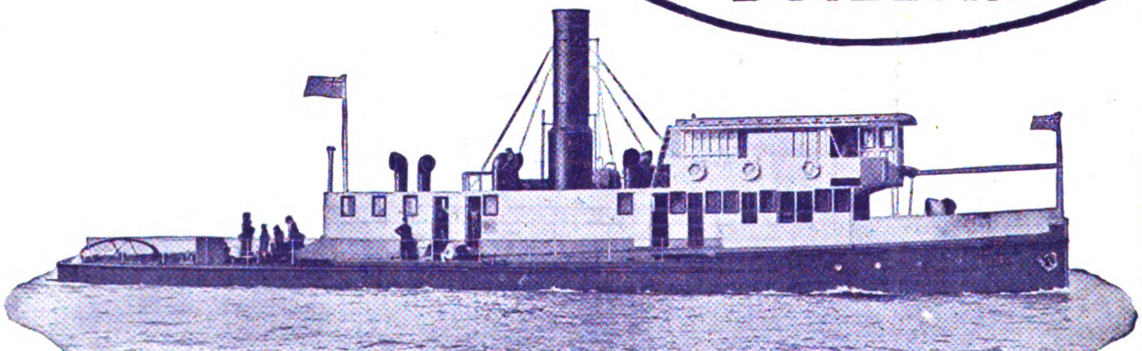


# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, SEPTEMBER, 1923 No. 9

# The New Trend of Asiatic Politics

*By Geo. Bronson Rea*

## 1. Japan's Position in the Naval Race

THERE seems to be no end to the stories circulated with the object of creating the impression that Japan is not living up to the terms of the Washington naval treaty. After weighing both sides of the evidence we come reluctantly to the conclusion that either a lot of official statements are being made to conceal or, that a propaganda is being carried on in America and Great Britain to use Japan as the smoke-screen behind which huge naval appropriations are advocated to make up for the sums saved by the limitation of capital ships. The facts prove that Japan lost no time in living up to her committments at Washington. Long before the treaty was formally ratified on August 17, she accepted its finality and even when it looked as though France might withdraw, indicated her readiness to carry out its provisions on a three-power basis. Yet the ink had hardly dried on the signatures to the Washington treaties when Japan was accused of circumventing their provisions by forcing the pace in the construction of auxiliary combat craft. Japan, it was claimed, was the only country where naval shipbuilding continued to form an important branch of the national industry. This, at a time when the Japanese shipbuilding yards were practically closed as a result of the treaties, with the government and private shipbuilders confronted with most serious problems arising from the release of surplus workers who demanded as much as two years salary for the privilege of being discharged. Steady progress, it was urged, was being made with the revised scheme of construction adopted in March 1922 aiming to create a powerful fleet of so-called auxiliary craft to make good the loss of strength in capital ships and that this program would mature in 1927 when Japan would possess a splendid and perhaps, unrivalled force of light cruisers, big destroyers and ocean-going submarines.

### Present Naval Strength

It is true that considerable activity is being displayed in Japan in the construction of auxiliary craft, but the official figures submitted recently to the interested powers indicate that the 5—5—3 ratio fixed by the treaty has not and cannot be attained by Japan within the time set by her critics. The present strength of the auxiliary surface combatant craft of the United States, Great Britain and Japan is shown in the following table of total tonnages irrespective of the age of the vessels. It will be seen that the present ratio is substantially 5—4—5 and 5—2 instead of 5—5—3:—

| Country | Cruiser | | | Destroyer | | | Total of Auxiliary Surface Combatant Craft. | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. | Tonnage | Ratio | No. | Tonnage | Ratio | No. | Tonnage | Ratio |
| United States... | 23 | 182,625 | 1 | 317 | 367,388 | 1 | 340 | 550,013 | 1 |
| Great Britain... | 50 | 259,670 | 1.42 | 200 | 234,960 | 0.64 | 250 | 494,630 | 0.9 |
| Japan ... ... | 25 | 148,170 | 0.81 | 100 | 77,653 | 0.21 | 125 | 225,823 | 0.41 |

### Auxiliary Surface Craft

The next table shows the total strength of auxiliary surface combatant craft of the three powers at the end of 1927:—

| Country | Cruiser | | | Destroyer | | | Total of Auxiliary Surface Combatant Craft. | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. | Tonnage | Ratio | No. | Tonnage | Ratio | No. | Tonnage | Ratio |
| United Stated... | 10 | 75,000 | 1 | 280 | 334,921 | 1 | 290 | 409,921 | 1 |
| Great Britain ... | 55 | 299,830 | 3.9 | 201 | 238,720 | 0.71 | 256 | 538,550 | 1.27 |
| Japan ... ... | 28 | 171,055 | 2.2 | 92 | 104,980 | 0.31 | 120 | 276,035 | 0.66 |

According to the original proposal of the United States presented to the Washington conferene, light cruisers shall be replaced by newly completed ships after 17 years from the date of their completion and destroyers after 12 years from the date of the their completion, the vessels thus superseded being scrapped. In the above table, therefore, figures are taken of only cruisers that will not be over 17 years old and destroyers not over 12 years old. The number and tonnage of the vessels for Japan are figured on the assumption that she will complete her replacement program before the end of 1927. Those for the United States are figured out on the hypothesis that she will not undertake any new construction except that covered by her 1916 program, which was to be completed in 1924. The same hypothesis is applied to the case of Great Britain. It is, however, improbable that these two countries will not construct any new vessel before the end of 1927. Therefore, it will be seen that Japan's proportion is likely to be even further within the 5—5—3 ratio at the conclusion of her building program.

### Submarine Strength

The original proposal made by the United States at the Washington conference provided that submarines can be replaced by new ones after twelve years from the date of their completion. In the following table showing the present strength and what it will be at the end of 1927, figures are taken of only those submarines that will not be more than twelve years old, no account being taken of future construction by either Great Britain or the United States. It is, however, probable that both countries will continue to build submarines:—

TABLE A. SHOWING PRESENT SUBMARINE STRENGTH

| | Number | Tonnage | Ratio |
|---|---|---|---|
| United States ... ... | 133 | 77,322 | 1 |
| Great Britain ... ... | 68 | 58,540 | 0.76 |
| Japan ... ... ... | 37 | 24,377 | 0.31 |

TABLE B. SHOWING SUBMARINE STRENGTH AT THE END OF 1927

| | Number | Tonnage | Ratio |
|---|---|---|---|
| United States ... ... | 121 | 84,900 | 1 |
| Great Britain ... ... | 76 | 68,370 | 0.81 |
| Japan ... ... ... | 67 | 68,536 | 0.81 |

### Naval Construction Expenditures

The following table shows the naval construction expenditures under the 8—8 program of Japan and under the revised program:—

| | 1923 Yen | 1924 Yen | 1925 Yen | 1926 Yen | 1927 Yen |
|---|---|---|---|---|---|
| Eight-Eight Program ... | 147,413,102 | 147,790,200 | 143,258,418 | 113,692,857 | 115,377,355 |
| Revised program ... | 116,262,479 | 110,000,000 | 110,000.000 | 85,000,000 | 71,054,030 |

In the past the expenditure contemplated by Japan, under the 8—8 program and authorized by the imperial diet, had been increased by only 20 per cent. over costs of construction in pre-war days. So slight an increase, however, was far from sufficient, and the deficit in construction expenditure had been made up annually by appropriations authorized under a supplementary budget. The government submitted to the imperial diet at its last session a new naval construction bill, which provided for a revision of the expenditure for new construction, as is shown in the table above, and the bill was sanctioned. In that table the margin has been computed with an increase of some ninety per cent. above pre-

war prices. Such an ample margin will, it is expected, save the Japanese naval authorities from going to the diet for authority to make additional expenditure in the form of supplementary annual budgets in the future. It goes without saying that the said revised naval construction expenditure includes an item for the conversion of two capital ships into airplane carriers.

### Cruisers Under Construction

Japan is now building one cruiser of 5,500 tons each at the shipyard of the Kawasaki Dockyard Company, Kobe, the Mitsubishi Shipbuilding Yard, Nagasaki, and two other dockyards at Uraga and Yokohama, respectively, and one of 3,100 tons at Saseho,—five in all of 25,100 tons total. These vessels constitute a part of the auxiliary ship program and were designed to be attached to the 8—8 fleet, the realization of which has now been abandoned in conformity with the naval treaty.

At the beginning of this year, the United States was completing and constructing ten light cruisers of 7,500 tons each, and Great Britain two ships of 9,750 tons each, two of 7,550 tons each, one of 5,560 tons, two of 4,765 tons each, and one of 4,190 tons, or eight ships in all (according to a table on page 66 of the Naval Annual for 1923) and some of these have since been completed. The table in question also shows that, while the light cruisers already in Japan's possession number 25 of some 100,000 tons, those of Great Britain number 60, representing approximately 310,000 tons.

Japan contemplates constructing, according to her revised naval plan made public by Admiral Kato in July, 1922, four cruisers of 10,000 tons and four of 7,100 tons; also 24 destroyers of 33,600 tons in aggregate tonnage. This program substitutes the auxiliary construction contemplated under the 8—8 program, but the keels for none of these cruisers has been laid down. It is expected, however, to complete this construction by March, 1928.

It is not known by the Japanese admiralty how many ships of the auxiliary class the United States or Great Britain will decide to construct before the end of 1927.

### Another Conference Needed

These official figures communicated by Japan to her partners in the naval pact, must have the effect of allaying further doubts as to her good-faith in the construction of auxiliary combatant craft. On the other hand, there arises the question of the number of non-combatant auxiliaries not provided for in the treaty. In regard to this class of vessel each country is suspicious of the other's activities. This defect in the naval treaty provides the loop-hole for unlimited construction of such auxiliaries and vitiates its spirit. British and American writers point to the number of aeroplane carriers, oil, storeships, and other adjuncts to a fighting fleet being constructed by Japan, while the Japanese are nervous over the programs formulated and pushed on by their partners to complete a great fleet of similar craft. The feeling is voiced in America and Japan that unless this tendency is checked and a stop put to naval base expenditures, another disarmament conference will have to be called to relieve the nations of these heavy and unnecessary expenditures which nullify the spirit of the Washington treaties and continue to impose heavy war burdens on a long suffering people.

## 2. The New Anti-Japanese Agitation

### The Significance of Singapore

The world wide discussion over the establishment of the Singapore naval base reveals that the general Asiatic situation has been little modified as a result of the Washington treaties, and another race is now on to checkmate the possibility of Japan's rise to dominant influence in Eastern Asia. It seems to make little difference whether Japan pursues a militaristic or a pacific policy to work out her destiny; she is certain to be mistrusted. It is generally accepted that the establishment of the Singapore base is aimed directly against a future misunderstanding with Japan, a sort of Anglo-American move for mutual protection. We are asked to believe by British writers that the base will come in handy in the event America is forced to defend the Philippines against Japan or in the event we are called upon to " drive Japan out of China."

It was difficult to believe after the Washington conference that Americans still harbored the idea of a war with Japan, but the same old talk is being revived as a result of the Singapore move and to the many British arguments for and against the base are now added the approval of such high authorities as Admirals Strauss and Rodgers of the American navy. In discussing the possibilities of war between Japan and America at the Institute of Politics in Williamstown (Mass.) Admiral Strauss asked the conference to consider the possibility of war in the Far East in consequence of the attempt of some country to discriminate against the United States in Chinese markets, or the possibility of an attempt to partition China to the exclusion of Americans. The United States then would face war with two or three powers, he said. Professor Blakeslee quoted Bywater and other naval experts who contend that Japan would capture Guam and the Philippines before the American fleet could leave Hawaii and in this event, Admiral Strauss said America would be compelled to fight Japan without a base and any American ship damaged in battle would become a total loss.

### The 50—50 Anglo-American Naval Partnership

Admiral Rodgers, chairman of the naval board, taking up the discussion declared that " sooner or later America and Britain would have to join forces in the Far East and if Britain wants to fortify Singapore, let her fortify it as much as she wants and more, the more she fortifies, the better it will be for us. But at present Britain is arrogant and we are meek. The question is whether we are going to join on a 50—50 basis or whether we will retain merely a colonial position. If we own only 49 per cent. of the stock and Britain 51 per cent., that is one thing. If we join on the basis of equality, that is another. Japan driven from Siberia by the inhabitants now realizes that her whole army is insufficient to hold or run the Amur railway. Soldiers guarding the line often disappeared without trace. The Japanese also are sensitive to cold and if they remained long in Russia they would become subjects for Bolshevik propaganda. Japan now has completely changed her policy in China. Having failed to dominate that country by force she now has adopted a policy of winning China by friendly advances."

These remarks would seem to imply the possibility that even if Japan does win the confidence of China through friendship it would be interpreted as another attempt to dominate her affairs to the disadvantage of others. The argument that she might conspire with other powers to partition China and discriminate against Anglo-American trade is evidently inspired by the possible coming together of Russia and Japan and the eventual triumph of Russian plans to pit Asia against Europe. This naturally would bring Germany into the combination at some time or other. Now the mere possibility that Japan might compound her differences with Russia and work together for the advancement of common aims in Asia through some understanding arrived at in the conferences with Joffe, has been seized upon by some writers as sufficient justification for Britain's determination to build the Singapore base. In fact, we are informed that this is Britain's answer to the Goto-Joffe conversations. The fact that Japan is trying to win the confidence of China through friendship is also accepted as being as much of a menace to American interests as though she employed military methods to conquer the country. So either way, Japan is a menace.

### Hongkong, the Key Base

Great Britain evidently intends to fully prepare against any possible danger to her lines of communications in Asia and is keeping her powder dry ready for any emergency. We now learn that another supply base is to be established at Trincomalee in Ceylon, and can expect to hear of further heavy expenditures for other sub-bases along the main lines of British imperial communications radiating from the new " Gibraltar of the East." To our way of looking at it, there seems to be considerable white-wash in all this British publicity about their plans in order to divert attention from what after all will remain their main base in the Far East. Hongkong may come within the provision of the Washington treaties as far as official activities are concerned, but its private docking facilities will soon be able to dock and repair a whole fleet at once, and in the event of war it is safe to assume that her shipyard and docking establishments will be taken over by the government. Great Britain is officially living up to her commitments in regard to Hongkong, but it requires no naval expert to sense that private enterprise will carry on and

within the next ten years, the South China port will have the largest docking system east of Suez. The growth of the port of Hongkong will legitimately call for these facilities to take care of merchant vessels, all of which can be converted into naval uses within twenty-four hours. The base at Singapore will serve well enough in times of peace to take care of Britain's Asiatic fleet, but in the event of an unfortunate break with Japan, it will be Hongkong with its formidable defenses that will provide the necessary support to a powerful fleet. Within the next ten years Hongkong and Canton will come together, placing the coal of Kwangtung at the disposition of the British for the erection of iron and steel works at Kowloon, and with the completion of the harbor improvements and extension of the present private docking and shipbuilding establishments, Hongkong will become the fighting base for the British fleet in Asiatic waters. Because of its proximity to the oil fields of Borneo and Sumatra, Singapore will retain its prominence as a fuel base, and only if Hongkong should fall, would it serve the purpose for which millions are now being appropriated.

### The American Naval Program

On top of all the publicity given to the British scheme of Far Eastern naval defense, comes the announcement that Secretary Denby is asking congress for an appropriation of $150,000,000 to keep the American navy abreast of Japan and Great Britain in the Pacific. If Admiral Rodgers reflects the official view, then the Singapore base fits in with America's plans and sooner or later we must come together in an alliance with Britain for the protection of mutual interests in the Pacific, while Admiral Strauss leaves us in no doubt as to who we must prepare against. The American program for the extension of Pacific bases at Honolulu, San Francisco, Bremerton, San Diego, Panama Canal, Manila, Guam and Samoa, is undoubtedly the answer to the question put forward by Admiral Rodgers when he asked if we were to join Britain on a 50—50 basis. The chairman of the naval board propounded the question which was answered within a fortnight by the secretary of the navy asking congress of $150,000,000, which, being three times the amount appropriated for the Singapore base, probably represents our idea of working with Britain on a 50—50 instead of a 51—49 basis. On top of the American estimates comes the news that France is also preparing to strengthen her Asiatic fleet, which means considerable activity will be witnessed in extending the docking facilities at Saigon and the establishment of submarine and aircraft bases. So we come once more to where the old game that was played in Europe is to be resumed in the Far East. What it is all about, we do not know, unless it is a tacit admission that the Washington conference failed to scrap distrust with vessels of war.

To seek for the reasons underlying this new competition in armaments it is perhaps just as well to go back to the series of articles on British naval policy in the Far East recently published in the *Morning Post* of London.

# 3. The Bogey

## The Japanese Scarecrow Clothed in the Bond Street Style

A special diplomatic correspondent of *The Morning Post* (whose name is withheld) has succeeded once more in obtaining publicity for all the old stock arguments about Japan's problems and policies in the same way that Lord Northcliffe made the welkin ring with his denunciations last year and along precisely the same lines employed by Mr. Louis Seibold in the *New York Herald* the year previous. This new series of articles bear all the earmarks of official propaganda to prepare world opinion to accept the Singapore base as a precautionary measure against the possibility of Japan's domination of China, either through colonization, economic penetration or an alliance with Russia and Germany. Taken in connection with the propaganda so skilfully designed to lead Americans to believe that the base was part of a plan to support our fleet when the time comes for us to drive Japan out of China, and with previous activities of British writers in Peking to bring about a Sino-American alliance for the same purpose, it begins to look as though there existed a set design in certain quarters to force the United States at some time or other to throw down the gauntlet to Japan. Why the United States should assume single-handed the rôle of China's saviour is beyond our understanding, yet there exists ample evidence that forces are at work to precipitate a situation which will compromise us to carry this burden. It was easy enough to understand the motives underlying the campaign directed by Chinese government advisers to create a Sino-American alliance aimed at Japan and to hold the fort at Peking pending the arrival of American troops. It is not so easy to understand the insistance of Americans that their government actively intervene in China either alone or in co-operation with Great Britain. This, certainly, is not Chinese propaganda and is contrary to the best interests of the larger American firms and philanthropic institutions in the country. If this movement fails to represent Chinese or the best American opinion, we must seek elsewhere for the motives, and we return once more to the suspicion that Americans knowingly or otherwise, are, playing the game originated in Peking under Anglo-American auspices.

The latest British outburst against Japan employs many facts which this magazine has invited attention to for several years. There is nothing new in this rehash of old stuff, the arguments employed by the *Morning Post* support our contention that no matter what Japan may do to prove her good faith and satisfy Anglo-American opinion, she will still be singled out for abuse. The same methods which characterized the propaganda of the great war are to be repeated until the hearts of the Anglo-Saxons are fired to the point where they will accept the burdens and sacrifices of another war for the preservation of China as trade market for the West, under the delusion that they are fighting for the salvation of civilization or some other equally effective phrase.

### Japan's Population Problem

It is true, as pointed out by the writer in the *Morning Post*, that the great problem of Japan is to find an outlet for her surplus population, and here she has little choice. If the doors of most of the white men's countries in the Pacific are closed to her people and they cannot own land and settle in China, Japan must absorb her increase in home agriculture and industries and seek foreign markets in competition with the West for the sale of her manufactured products. Japan must then look to China for the bulk of her raw materials and a large part of her food supply. She must, of a necessity, cultivate the good-will of China. This would seem to be axiomatic, an argument from which there is no appeal. It is the basis of Japan's present policy and explains her willingness to remedy past mistakes in diplomacy.

Now, there are two schools of thought in Japan on the question of population. Such leaders as Viscount Takahashi and Mr. Fujiyama may be said to represent the element which holds that Japan's need of an outlet is each year becoming more urgent. On the other hand, we have such capable writers as Dr. Washio and such newspapers as the *Japan Advertiser* who deny that Japan is overcrowded. They even go so far as to point to the dearth of domestic servants and the influx of Koreans in order to support their statement that outside labor is now essential for Japan to carry on with. These exponents of Japanese thought assert that the population problem does not exist and is found only in imagination or in propaganda. This element may be right, yet it is difficult to reconcile their viewpoint with the fact that the population of Japan is officially admitted to be increasing at the rate of 6 to 700,000 a year. If this be true, and Japan is taking care of this increase without emigration, it would mean that agriculture and industry are absorbing the surplus. How far Japan can do this if the same rate of increase be maintained indefinitely, is problematical. If no outlet is found, the annual surplus must be taken care of through the expansion of industries and the creation of foreign markets for the sale of their products. Otherwise they must starve. This solution involves the annual investment of an enormous amount of capital in new enterprises. There certainly is a limit to Japan's ability to absorb her rapidly mounting millions and the controversy in the end must simmer down to an approximation of the time when the saturation point will be reached.

### Friendly Relations with China Vital

In either case, the pressure will call for increased quantities of raw materials and food products and the bulk of these must come from the nearest source of supply. Although it may be urged that this necessity will influence Japan's rulers to bring China under their control, the dominant sentiment in Japan at this time holds that the best interests of the nation will be served by China's development under the open-door principle, in which American, British and other capital will assure that constant supply of raw

materials and food upon which Japan's very existence depends. It is a mistake to believe that Japan's economic penetration of China will in any way endanger the rights or interests of other nations. The field is too large and Japan lacks the capital to exclusively exploit China's resources. The competitor of Japan in China, is China itself. The same bald statement holds good with regard to America and Great Britain, or any other nation aspiring to dominate her trade and industries. As China's industries are developed she will supply her own requirements and then compete with other nations for world markets. Japan alone can never control China's industries and if she is to live and prosper by absorbing her own surplus population, her one hope of survival is to induce by all means within her power, the development of this country by foreign capital in order that markets will be created, in which, by reason of her geographical and other legitimate advantages, she may hope to supply a fair share of its requirements.

Aside altogether from Japan's acceptance of the open door principle and recognition of China's sovereignty, her very existence is bound up in the prosperity and development of her big neighbor. These committments of Japan are a guarantee to China and the world that Japan will never attempt to solve her problems through conquest or military adventures. Japan is sensible enough to understand that such a policy would result in her elimination as a first class power. To follow this road is madness. The Japanese are not mad. Under the protection of these guarantees China is secured against any loss of territories or political aggression. Instead of danger to China resulting from Japan's economic necessities, the shoe is likely to be on the other foot, for as China's industries and agriculture expands and her people regain more and more of their sovereign rights they will more and more be able to dictate to Japan, and the day may come when Japan's industries will be at the complete mercy of China. The time is past when it is possible to create a war scare or justify armament expenditures because of Japan's population or economic problems. Japan will never again permit herself to be placed in the position of inviting the combined hostility of America and Great Britain, so the arguments advanced by the writer in the *Morning Post* to bolster up the need for the Singapore base carry little weight.

## Japan's Russian Problem

As there are differences of opinion within Japan concerning the population problem, so there are two distinct lines of thought in regard to Russia—and Germany. The dominant party is essentially liberal and pro-ally, believing that the future security of the nation can be attained and assured only through friendly co-operation with America and Great Britain. This element, represented by the present cabinet, has surrendered all special advantages acquired in the past in order to more fully permit Japan to work in harmony with the other liberal powers. From the time Japan entered the consortium to her acceptance of the principles embodied in the Washington treaties, its government has given every proof of a sincere desire to merit the friendship and confidence of its partners. Nothwithstanding these concessions to world opinion, a bitter publicity campaign has been waged to discredit her good faith, destroy her influence and trade in China and so make impossible any hope of solving her problems through peaceful co-operation in the development of China's resources. Japan's influence at Peking was undermined and her military pacts for mutual defence cancelled in order to bring about the ascendency of a war-lord who was elevated into high power because of his uncompromising antagonism to Japan (a military autocrat who now stands as the one obstacle to a peaceful solution to China's domestic troubles); her attempts to develop Manchuria with the aid of American capital were condemned by American organizations who saw in this an attempt to push forward aggressive designs: there is also sufficient evidence to substantiate the statement that foreign advisers prevailed upon the Peking cabinet to demand the cancellation of the 1915 Manchurian treaty and apply the boycott as a retaliatory measure. Japan has silently watched the Soviet's violation of China's sovereignty in Mongolia, after she had been coerced by the consortium powers into recognizing that this territory constituted a most important part of the Chinese republic. She was coerced into evacuating Siberia under pressure of American diplomacy and opinion and now that the Soviet is once more menacing the peace of Asia, Japan must either prepare to defend her vital interests, or compound her difficulties with Russia.

## Japan, the Goat

It is now quite clear that the consortium powers do not intend to exert any pressure upon Russia in order to protect China's sovereignty in Mongolia. This responsibility is slowly being shouldered on to Japan after being manœuvred out of all advantageous strategic positions. Had Japan been conceded a free hand in Eastern Asia three years ago, the Soviet influence would have stopped short at Baikal and an effective check created to their activities in Afghanistan and China. Japan, however, was forced to bow to world opinion and surrender the right to defend herself in the Taonan-Jehol zone against "the menace from the direction of Urga." Japan was penalized and Russia encouraged to resume her old program for annexing Mongolia and push forward her new campaign for bolschevizing China. The movement was then launched to compel Japan to surrender her rights to the key of the strategic situation in Kwantung, Had she meekly complied, as it was hoped, it would have left Russia in complete security to carry forward her designs. Japan would again have been at her mercy through the impotence of China to discharge her international obligations. In other words, after fully protecting themselves in Europe against the eventual comeback of Germany, the powers denied to Japan the right to apply the same principles for her defense against the comeback of Russia. At every step Japan has tried to satisfy her partners, receding and ceding until she has reached the limit of concessions compatible with dignity and security. Any further advance on the part of Russia will call for strong action and in the present state of world politics and opinion, Japan will once more become the "goat."

In the event of a crisis arising in Asia as the result of Soviet activities, Japan can look for no assistance and precious little sympathy from either America or Great Britain, whose altruistic policies towards China and sentimental regard for the "Bolshies" stripped her of all strategic positions on the mainland with the sole exception of the lease to Kwantung and possession of the South Manchuria Railway. Naturally, there exists a powerful element in Japan which objected to these concessions and now decline to permit their country to be made the scape-goat in a war with Russia. In the same way that a similar element in America opposed the conspiracy to railroad their country into war with Japan and brought about a peaceful solution to the issues involved, so there is an element in Japan which demands a peaceful settlement of their difficulties with the Soviet. Surely, this is a most sensible and patriotic stand, yet the evidence keeps piling up that should Japan escape war with Russia by resuming friendly relations, she automatically becomes a potential enemy to her other partners and we are solemnly assured that the Singapore naval base is Britain's direct answer to any such understanding.

## Between the Devil and the Deep Sea

If Japan fights Russia in order to protect her vital interests or to maintain the integrity of China in Mongolia, she fights alone. The same old group of anti-Japanese propagandists will see in such a war only one more proof of Japan's determination to dominate China. Every move of Japan would be misconstrued, every official declaration twisted and misinterpreted while Britain and America would stand ready to fight her at the drop of the hat if China's interests seemed in any way impaired. The world would reject as Japanese propaganda any reference to the facts of the past few years and deny that such a war would have been forced by American and British policies encouraging China to disregard her international duties to the extent that the door was left open for Russia to work her will in Mongolia, while a wall was erected along the Taonan-Jehol strip effectively screening and protecting her from interference on the part of Japan. If Japan moves in self-defense, she faces the certain hostility of the world: if she seeks to avoid a clash by a compromise or understanding, she becomes a traitor to her partners, an object of suspicion which justifies Britain in building naval bases at Singapore with the full approval of eminent American naval experts. Under such conditions, Japan hasn't a chance in the world of saving herself, condemned beforehand by a packed jury; damned if she does and damned if she don't.

Japan undoubtedly will take the first opportunity to find a peaceful solution to this problem by compounding her differences with Russia, but such an understanding will never violate or conflict with compromises already entered into. Japan will never

accept Russia and Germany as partners in any designs upon China, so the fears which serve as an excuse for the establishment of the great Singapore naval base are wholly without foundation. As long as Great Britain and America live up to their side of the bargain at Washington and place no obstacle in the path of Japan's legitimate peaceful economic development of China, there is little likelihood of any Russo-Germanic-Japanese combination. If, on the other hand, Japan is to be continually persecuted, hounded, misrepresented and blocked on all sides, self-preservation may supercede all other considerations and the people of Japan demand a change of policy that will ally them with powers more sympathetic with their vital needs. Neither the British, American or French governments would ever permit such a situation to arise, no matter how strong the pressure and propaganda to bring it about. So, if the British possessions in India are ever seriously menaced, the foe will not steam down the China Sea through the straits of Singapore, but come tramping through Afghanistan and over the Khyber Pass. Japan will never be a partner in such a war.

## 4. Japan Holds the Balance of Power

### An Answer to Mr. Ozaki's Prophecy of Disaster

We are not surprised to read in the Japanese press that the opposition is preparing to attack the government for its alleged weak-kneed policies which, it is claimed, instead of strengthening is gradually reducing Japan to a position of isolation, pregnant with dangerous possibilities and breeding positive hostilities with other powers. Neither are we surprised to learn that this attack is being made by Mr. Yukio Ozaki, the most fearless and independent progressive in Japanese political life. It is not difficult for Mr. Ozaki to make out a strong case in support of his contentions that Japan stands to-day " a nation without a friend: that in the event of war she would seek in vain for a kind word or a helping hand." He deplores the passing of the Anglo-Japanese alliance and sees trouble looming ahead in China. Reduced to a few words, the burden of Mr. Ozaki's argument is that the policy of concessions has failed to gain the confidence of the other powers, that Japan stands alone, isolated, an object of suspicion and headed towards possible disaster.

**Mr. Yukio Ozaki, M.P., interviewed at Karuizawa, the summer resort in Central Japan, denounces the spirit revealed in the appropriation for U.S. Naval Defence in the Pacific**

Had Mr. Ozaki made this statement two months ago, it would have been difficult to substantiate, but coming as it does in the midst of a new outbreak of anti-Japanese publicity arising from the establishment of the Singapore base, together with the bitter anti-Japanese boycott in China, he is fairly justified in calling attention to obvious facts. If the Singapore base is primarily aimed at Japan : if it is being created in order that the American navy may use it in the event of war with Japan over China or in defense of the Philippines : if it voices Britain's answer to a Russo-Japanese understanding ; in short, if it meets any of the requirements claimed for it, and dovetails with a 50—50 partnership with America, then it would be foolish for Japan to play the ostrich and delude herself into a position of security opposed to all ordinary rules of common sense.

There is no side-stepping the facts disclosed by the publicity over the naval moves of Great Britain and the United States in the Pacific. If the Singapore base is a vital necessity for the defense of Malaya and India against a foe menacing these possessions from the east, the imaginary enemy can only be Japan, operating alone or in alliance with Russia and perhaps Germany, a situation, which, in itself constitutes a reflection on Japan's good-faith with her present world partners. The mere fact that this move is deemed essential for the security of India constitutes sufficient evidence in support of the statement that in destroying the Anglo-Japanese alliance, the Washington conference invited this new menace to Asiatic peace. Peace in the Pacific was assured at Washington. That is undeniably true. A new four-power pact guarantees the security of insular possessions in the Pacific which to a certain extent supersedes the old Anglo-Japanese understanding, but its provisions fail to meet the situation in Asia, the storm centre of world intrigue, the scene of future conflict for empire. Once the insular possessions of the various powers concerned were guaranteed against attack, the conference did the same thing for China. In the hysteria and altruistic concern for salving the open door and the integrity of China, the conference at Washington lost sight that the prime object of the Anglo-Japanese understanding was the defense of mutual interests in Asia : that it was directed against Russia and not America, and that it was forced upon the contracting parties by the secret alliance entered into between China and Russia in 1896, under whose provisions Russia was to make use of China's territory to facilitate her attack upon Japan and advance upon India. The Li-Lobanoff secret alliance was the key to the entire Far Eastern puzzle, the move which finally compelled Japan and Britain to come together for mutual protection. Propaganda directed largely from Peking, added to the uneasiness in the United States over the possibility of a war with Japan, completely obscured the larger issues at stake in Asia by creating the impression that the Anglo-Japanese alliance would bring England in on the side of Japan in the event of war between the latter nation and America. China's advocates pulled the wool over everybody's eyes by declaring that Japan's aggressions were made possible solely by reason of her alliance with Great Britain. If this instrument was annulled, they urged, China could breathe easy and work out her salvation without fear of interference on the part of Japan ; in fact, all of China's woes were laid to the Anglo-Japanese alliance. Not once in all the discussions or publicity surrounding this epoch-making conference, was any reference made to events which led up to and precipitated the Anglo-Japanese pact. The truth surrounding the secret Sino-Russian understanding which would have clarified the atmosphere and vindicated Japan and England, was carefully concealed. No importance was attached to anything that China might have done in the past. The originator of all the trouble, was the martyr, the innocent victim of Anglo-Japanese rapacity, unable to defend herself against the machinations of other powers. China's publicists " put it over " the conference. The "iniquitous pact " went into the discard and a new instrument designed for the pretection of insular possessions took its place.

History went back to where it stood in 1900, with Russia hammering at the Gates of Herat and pushing forward towards Peking through Mongolia. India once more faces the traditional menace from the north while Japan is left to extricate herself the best she can from the trap set for her in Siberia and Manchuria. Japan has yielded, point by point, to the wishes of her partners and found her powers of defense circumscribed by the erection of a wall in Manchuria beyond which she could not trespass. The consortium and other pacts deprived her not only of the right to meet the advances of Russia in the danger zones of Inner Eastern Mongolia, but left her helpless in living up to the terms of her alliance with

England for the defense of mutual interests in Asia. The Japanese pressure on Russia's flank was removed, leaving the latter free to work her will in the Pamirs. As a consequence of this diplomatic flub-dub to save poor old China from Japan, the road to Peking through Mongolia was left wide open for a Soviet advance. Japan's power to protect herself against a flank movement in South Manchuria or defend Peking was taken away. In Central Asia the way was cleared for the Russian advance towards India. Japan was effectively isolated, her power of offense destroyed and her strategic defenses weakened.

When the Anglo-Japanese pact went by the board, the way was cleared for Russia to pursue unhindered her set program, and, true to past performances, she lost no time in taking advantage of the opportunity presented by the kindly gentlemen at Washington. Mongolia has again passed under control of the Soviet and a vigorous propaganda launched in Afghanistan to smooth the way for the move towards India. Russia is never in a hurry. She overlooks no opportunity. She is now in possession of the road to Peking, while Japan, her one obstacle, is hamstrung behind the Taohan-Jehol wall. The chessmen are set for the next move. Russia's dear Anglo-American friends are cheerfully playing her hand at Peking urging the Chinese to insist upon Japan evacuating Kwantung and clearing the way for her next advance.

In taking stock of the situation created as a result of the Washington treaties, British strategists realized their isolation in India. They had built their hopes on a strong China taking the place of Japan in their defense schemes against Russia. When it became apparent that China was a poor reed to lean upon, they could not set back the clock or undo the damage. They realized that their old ally was in a tight position and must either fight Russia in due time or come to some understanding over mutual interests in Eastern Asia. The British could take no chances on the outcome of such an understanding, so we have their answer in the Singapore base. The ally whose fleet guaranteed Malaya and India from attack for the past twenty years, now becomes a hypothetical enemy, with America entering into the spirit of the game by strengthening her Pacific bases on a tacit acceptance of a 50—50 basis as suggested by the chairmen of the naval board.

In view of these facts, is it any wonder that wide-awake observers in Japan reluctantly come to the conclusion that their country is without a friend in the world, exposed to the wrath of the Bolschevists on one hand and boycotted and villified in China on the other, because their government refuses to surrender their remaining right to self-defense in Kwantung ? Openly designated by American and British naval experts as the imaginary enemy in order to justify their naval expenditures, and suspected of treason to the cause of the West if she compounds her difficulties with Russia, Japan's thinking men cannot be condemned if they now question the wisdom of having ceded everything but Kwantung in order to restore world confidence in her policies.

This undoubtedly is the picture which has inspired Mr. Ozaki and provided the arguments for his attack upon the government. It is difficult to explain away the facts, though it is possible to draw various deductions from them according to the angle from which they are studied. The soldier and stateman will approach them from the strategic angle, and in the present state of world affairs, it is the only sensible way to visualize the future. Mr. Ozaki is not an alarmist. He is doing for Japan exactly what many eminent writers and experts in America and Great Britain are doing for their respective countries, looking far ahead and following present day tendencies to their logical conclusions. These conditions may change. American and British experts may modify their viewpoint, but until they do and there is a let up to this unreasoning antagonism towards Japan and a better appreciation of her problems and policies, it would be foolish for her leaders to close their eyes to the trend of world politics.

Japan has gained many friends since the liberal party took over the reins of government. She merits the full trust and friendship of other world powers. No government has gone to the same extremes to prove worthy of world confidence, but the evidence keeps growing that no matter what Japan may do to play the game according to Western standards, it will be a long while before she can fully overcome the prejudice and suspicion created by years of hostile propaganda. The eminent spokesman for the opposition is undoubtedly well within the facts, but it is difficult to see how his government could have pursued a different policy without completely estranging Japan from the other liberal powers and precipitating the calamity which still looms darkly on the national horizon. The administration of Hara and Kato faced a world led by years of malicious propaganda to distrust Japan's every move, a campaign of calumny culminating at the Paris conference, where it became clear to the most inexperienced observer that peace in Europe would be followed by war in the Pacific. The first duty confronting the liberal government was to modify national policies to meet changed world conditions. To do this, Japan had to surrender many political, commercial and strategical advantages obtained during the war : to withdraw from Tsingtau, from Siberia, sacrifice her rights to defense along the Taonan-Jehol line, and see her prestige undermined at Peking. One result of these concessions is a clear understanding with America putting an end to all talk of war in the Pacific. The sacrifices were worth that, but in compounding her difficulties with America the door was left open for misunderstandings in Asia.

Before the Washington conference, Japan was the potential enemy of the United States. She now becomes suspect with Great Britain and henceforth will be the target for such British propaganda as seems necessary from time to time to unloosen the purse-strings of the British taxpayer for naval expansion and to further their policies in China. It is no fault of the liberal government that Japan finds herself between the anvil of Russia and the Anglo-American hammer. She cannot escape being pounded as long as she seems to stand in the way of Anglo-American co-operation in China. Japan can do nothing at this time to prevent this. She must wait for conditions to change. For change they must, and as long as Japan adheres to her present policy in China, provides no opening for the Anglo-American steam hammer to come into play, and finds an honorable and peaceful solution to her troubles with Russia, she sits on top of the eastern world, holding the balance of power.

G. B. R.

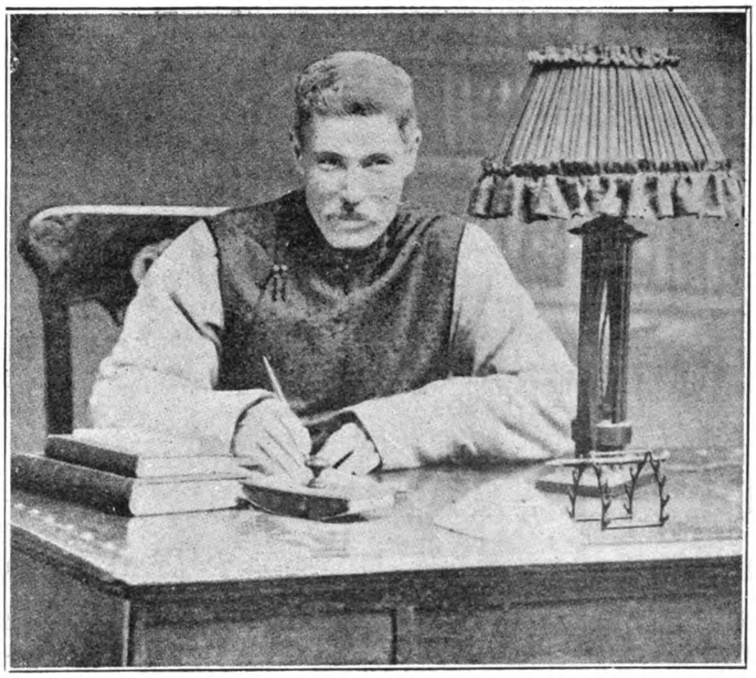
# The Trend of Events in China

## The Call for a Conference

THe sorriest spectacle of recent history is seen in the continued recognition extended by the powers to the marionettes of Peking whose sole function is to perpetuate a fiction that operates to fill the war-chest of their manipulator with the surplus salt and customs revenues released on due dates by order of the legations. This is the real reason for the existence of a so-called government at Peking that has long since graduated from comic opera to a pestiferous nuisance, if not a positive menace. By continued recognition of the Peking collection bureau of the Chihli war-lords the powers have placed their unqualified stamp of approval on Wu Pei-fu's determination to accept no compromise other than submission to his rule at the point of the bayonet. It is an unholy alliance, a most callous disregard for the welfare of a bewildered and stricken people masquerading under the flimsy pretext that China is being permitted to work out her salvation in her own way. It could not be otherwise. Foreigners picked Wu Pei-fu as the " Hope of China " and supported him morally, if not materially, while he drove the Anfu and Chang Tso-lin cabinets from Peking because of their alleged friendship for Japan. Diplomatic support to Wu followed, and on the heels of his victory over Chang came the agitation for a huge reorganization loan to consolidate his power. It is superfluous to allude to the identity of those who supported this obnoxious loan, sufficient to say that Japan blocked it by refusing to participate in any financial advance to China pending unification and the establishment of a government recognized by all factions and provinces. For two years, it may be said that anti-Japanese influences have moved heaven and earth to make their program stick by an unwavering loyalty to the shadowy cabinets which have flitted through Peking in rapid succession as schroffs for the

Loyang war-lord. Wu's campaign of unification by the sword has progressed merrily. Szechuan has been devastated. Honan is wrecked. Kiangsi is filled with northern bandits ravaging the towns and villages. Fukien is the scene of active warfare while upon the heads of the Cantonese has been loosened the furies of civil war in its bloodiest aspects. At any time the struggle may be carried into Kiangsu and Chekiang with the rich loot of Shanghai as the prize of victory. Thousands of lives are being needlessly sacrificed. Industry and agriculture are at a standstill. The wealth of the interior is flowing into Tientsin, Shanghai and Hongkong for safe keeping. Poverty, famine and disease stalks through the land. Development is out of the question and trade is dead. Foreign firms are operating with their backs against the wall, propped up by the banks, hoping against hope that something will happen to turn the tide. Failures follow each other in rapid succession. The outlook is black.

The dissemination of Chinese news is mainly in the hands of anti-Japanese agencies. There is little chance that the outside world will ever learn the true story of the desperate game of international politics played in Peking the past several years with the object of isolating Japan and bringing China under Anglo-American tutelage. Originating at the height of Japan's influence, it first sought to compromise the United States to a war, as the easiest way to destroy for all time any possibility of Japan's domination of Eastern Asia. The campaign was then relentlessly waged to oust the Anfu cabinet and then the one acknowledging Chang Tso-lin as master. Japanese financial support to Peking, it was urged, had split China wide asunder, making unification impossible. The Anfu crowd was accused of selling their country to Japan and squandering the money in fruitless campaigns against the south. Chang, the "uncrowned king of Manchuria," was alleged to be in the pay of Japan, conspiring to restore the monarchy, hence, a traitor to the republic, an obstacle to constitutional government. Tuan, Chang and their satellites had to go, in order to purify Chinese politics and save the nation from Japan. Wu, the Heaven-sent Hope, discovered and acclaimed by the muddlers of Peking as the one simon-pure, hundred per cent. unalloyed Chinese patriot, would chase the Japanese into the Yellow Sea, and with Anglo-American financial and moral support usher in an era of unprecedented prosperity in which railway and road building, industrial development and fat concessions for the insiders would be the order of the day. Everybody but Japan would receive a large, thick, juicy, piece of Chinese pie when Wu came marching home.



Sir Robert Ho Tung, Kt.

The valiant, incorruptible and invincible overlord of the Kin-Han became the pampered pet of the Peking legations, the napoleon who would carry China to her place in the family of nations so carefully prepared for her at Washington. The oracle sat in his yamên at Loyang and pulled the strings which manipulated the movements of his puppets at Peking. His cabinets came and went, eight in one year, and as each new group filed its weary way through the metropolitan ministries, begging a bone here and a crumb there in addition to the regular hand-outs in the shape of salt and customs revenues released by the legations, the joy of the anti-Japanese clique became unconfined. The legations were playing their game and no matter what move Wu might make, his continued recognition was assured.

To every call for a conference that might lead to a compromise and unite the country under one rule, the Heaven-sent Hope announced that he alone held the mandate from on high to govern, and if the others did'nt like it, they cold lump it ; he would unify them with the Krag. It is difficult to account for an attitude opposed to all accepted ideas of Chinese physiology, and can be explained only on the hypothesis that Wu is so certain of foreign support which carries with it enough salt and customs revenues to pay his favorite divisions, that he can afford to flout public opinion and press forward his military campaigns for the subjugation of other provinces. Bereft of the salt and customs surpluses, Wu would have to accept an invitation to a conference or face the gradual decline of his authority through inability to squeeze further funds from a people already squeezed dry. In view of these conditions it is fair to state that Wu's stubborn determination to woo the country with the Krag, is made possible solely because his Peking puppets enjoy the recognition of the legations and receive their contributions to his war-chest from the salt, customs and other revenues.

There is no difference between the present situation and that of three years ago. Instead of a pro-Japanese set of officials functioning in Peking their place is taken by an anti-Japanese group masquerading as a government of sorts for the sole convenience of the diplomatic corps. Civil warfare goes merrily on, increasing in horror with each passing week. Instead of the Anfu clique stamping out liberalism in the south, we now have Wu Pei-fu in arms against the field, carrying the war into all the provinces and with special ferocity against Sun Yat-sen and his little band of devoted parliamentarians fighting to establish a government responsible solely to the people. There was always some hope of a compromise in bygone days: now, there is none. To satisfy the inordinate ambitions of Wu, fire and sword are to be carried to the farthermost confines of this vast country, untold thousands of peaceful lives will be sacrificed; villages, towns and countryside sacked, its women ravished and its young men carried away by press gangs into slavery. And then, after establishing his authority over the eighteen provinces of China proper, Wu will have to reckon with Chang, of Manchuria, just now sawing wood and preparing against the day when the conquering legions of Wu will cross the dividing line of the Great Wall.

Unless our powers of observation and deduction are at fault, it is here the curtain will be rung down on the great international political drama whose first act was staged in Peking during the great war. Once Wu invades Manchuria and Japan's vital interests in the operation of the South Manchuria Railway are placed in jeopardy, the climax will be reached. It should not be overlooked that Wu has publicly announced his determination to drive the Japanese out of Kwantung, that his puppets raised the validity of the 1915 treaty, or that he personally encouraged the boycott movement by issuing instructions " not to interfere with the will of the people." After he finishes with the eighteen provinces and starts to discipline his Manchurian antagonist, he is due for the surprise of his life.

If the above picture faithfully portrays the situation, then the moral to be drawn from it is obvious. If the time should arrive for the victorious Wu to send his legions into Manchuria, it is logical to suppose that he will enjoy the full confidence and support of his foreign sympathizers, and should this sentiment be shared officially by their legations, it is not difficult to forecast the result. The show-down which the combination has been moving heaven and earth to bring about with Japan would be precipitated in a manner not included in their calculations.

For the best interests of all concerned, for the happiness and welfare of a broken people, and the preservation of world peace, foreign meddling and intrigue in China should cease. The anti-Japanese conspiracy hatched in Peking during the war and given its impetus through the confidential publications of an international association, has gone far enough. It has already complicated and

made difficult any solution to China's troubles and stands as a barrier to harmonious co-operation on the part of the powers in the application of any plan to remedy the situation. As long as Japan is a member of the consortium and her representative enjoys an equal voice in the deliberations of the diplomatic corps in Peking she can be depended upon to oppose and nullify all the pet schemes devised by the Anglo-American combination to advance their own special interests in this country. In the matter of a loan to Wu Pei-fu, it was the liberal cabinet of Japan which saved liberalism in China and blocked a deal which would have once more elevated a military autocrat to supreme power : Japan stood out against the use of foreign troops to round up the Lincheng bandits : Japan opposed foreign intervention in the affairs of China when the nationals of other powers demanded drastic action : Japan opposed the employment of a foreign military police force for guarding the Chinese railways. Japan is standing squarely upon the letter and spirit of the Washington treaties, scrutinizing all moves which might seem to be subversive of China's sovereign rights or an impairment of her administrative independence. Japan holds the whip-hand. Her enemies have presented her with the weapons to fight them with. Japan was compelled at Washington to surrender many special advantages in China and affix her signature on the dotted line of a treaty carefully drafted by Anglo-American experts to safeguard China against exploitation or violation of her sovereign rights. Japan signed without reservations. Now when the nationals of the other signatory powers call for a new deal, she simply says: "You made the rules of the game, play your hand."

As the champion of China's rights, Japan can afford to sit tight while other foreigners call for action, which, if listened to by their governments, would nullify the Washington treaties and destroy China's administrative independence. The chinafied Anglo-American element have no complaint coming. They dealt the cards from a cold deck. Japan is playing her hand to their lead.

If the international political game is to be played out under existing rules, it will not be long before the positions of the powers in regard to China are reversed, with Japan occupying the rôle of China's best friend in the place of those now holding that questionable advantage. At any rate, it is clear that internal conditions will change for the worse when the victor in the internecine struggle crosses the Rubicon and throws down the gauntlet to the overlord of Manchuria. Is the game worth the candle ? Will unification by the Krag bring peace and happiness to China or advance foreign interests in this country ? Decidedly not.

If continued recognition to Wu Pei-fu and the Pei-yang freebooters is not traceable to any anti-Japanese policy, then the time has arrived for the legations to lend their support to the movement initiated in Hongkong for a round-table conference to settle the differences of the warring *tuchuns*. If a central government is to be established without plunging China and perhaps the civilized world, into greater horrors; a compromise must be effected, The first step towards this end is a conference of the Chinese leaders. Last year the Loyang war-lord rejected the invitation of Sun Yat-sen to a disarmament conference. Wu is still the stumbling block to unification, the menace to peace. Wu is maintained in power by the recognition of the legations. The road to peace lies in a withdrawal of this support. A new call for a round table conference has been sounded by Sir Robert Ho Tung from Hongkong. Sun Yat-sen, Li Yuan-hung, Chang Tso-lin and others have accepted the invitation.

The Washington conference brought the blessings of peace to the Pacific but left the door wide open for events in Asia to undo its work. The peace of Asia and the world is assured only so long as Japan's economic life is not imperilled. Self-preservation will force her to defend her vital interests with all the resources at her command if Wu Pei-fu carries his campaign of unification by the sword into Manchuria. The Washington conference will have miserably failed if this climax to the present trend of events is not forestalled. Sir Robert Ho Tung points the method. His call for a round table conference of the warring leaders of China is as vital to the attainment of the objects of the Washington conference as it is to restore peace to this unhappy country. If the call is rejected, it is then squarely up to the four great powers directly concerned to instruct their ministers to act and act promptly in support of his plan. A peaceful solution to China's difficulties will be followed by a peaceful solution to many dangerous international political problems in Eastern Asia.

G. B. R.

# The Trend of Missionary Endeavor in China

## The Paramount American Interest: Trade or Uplift?

AT the 12th annual conference of British missionary societies held at Swannick during the last week of June, some interesting particulars were made public in regard to the comparative contributions of Great Britain and the United States for foreign missionary work. To China alone, America sends every year upwards of $9,000,000 gold, against £325,000 contributed by England. At the conference it was said that a marked tendency exists in China and India to form national Christian councils of independent churches coupled with a desire for education that amounts to a passion. Another point stressed was that present-day students preparing for a missionary career express a wish to work independently of missionary societies in the spread of Christianity or in connection with undenominational bodies. Students also complain of " unrestrained and unintelligent propaganda in season and out " and the younger men and women are taking up courses which deal not only with medicine and education but with agricultural work and economics.

Here we have food for much thought. The figures given as the amount contributed by America are undoubtedly confined to expenditures through organized missionary bodies excluding educational and hospital endowments, Y.M.C.A. contributions, and the payments from the Boxer indemnity. Nor does it include red cross, famine relief or other charities. These figures coincide with our own rough estimate which reveals that a sum equivalent to approximately twice the total profits on American trade with China is returned annually as a free gift for the uplift of its people.

The British conference accentuated the fact that the difficulties surrounding purely religious propaganda in season and out, are each year becoming greater and missionaries now realize that the regeneration of China must come through education and a higher standard of living. The tendency, therefore, is to transform the religious worker into an educational, industrial, and economic agent, subordinating the spiritual ideal to general uplift in order to prepare the minds of the Chinese for the acceptance of religious principles.

The expenditure of ten or more million dollars yearly through missionary bodies backed by the political influence of the churches, gives to this element the preponderating voice in shaping the Far Eastern policy of the American government, a policy, which, under all administrations, determines the selection of the minister at Peking. This truth is emphasized by a passage in Mr. Morganthau's memoirs in which he describes how President Wilson rejected his request to be appointed minister to Peking, because his race and religion constituted a handicap in dealing with the Christian missionary bodies, whose interests in this country were paramount. Under these conditions, the welfare of our philanthropic organizations completely overshadow those of the mere trader, and in any issue affecting friendly relations between China and the United States, it is natural that those who command the greatest political support should influence the policy of the state department. In many cases it will be found that financiers, manufacturers and merchants whose agents are struggling against overwhelming odds in building up a profitable trade in their products with China are the most liberal contributors to the organized missionary societies, and again, there are many amongst this element more concerned over their educational endowments than in promoting their own business.

As long as the activities of this element are confined to purely religious propaganda, commercial interests have no right to voice a protest, but when they depart from this fundamental sphere of usefullness and encroach on economics, industry and agriculture, it comes

within the sphere of business. If nearly twice the entire profits of our China trade are to be turned over to missionary societies for improving the general economic conditions of the Chinese as the first step towards their religious conversion, it would seem that the government should have some voice in the expenditure of these funds.

It is difficult to conceive how a missionary student equipped for a career that will enable him to better the economic conditions of the Chinese can achieve practical results without in some way becoming an advance agent of business. If the Chinese farmer is to be taught better methods of cultivation and native industries are to be improved, modern equipment and tools must be employed as an object lesson, and the instructor should be in a position to either sell direct or influence the sale of the particular implements used in his demonstration work. If we are to reach the spiritual heart of the Chinese through economic uplift it would be only fair to insist that our missionary activities produce tangible results on the profit side of the trade ledger.

Ten to fifteen million dollars is a huge sum to be expended annually in a religious propaganda whose ultimate success depends largely upon the betterment of living conditions. The thought naturally arises that if only half this sum was expended under governmental or commercial supervision, the results obtained would be far greater than if left to the individual ideas of religious enthusiasts temporarily transformed into economic uplifters. Five million dollars annually would maintain over a thousand economic experts in all lines of agriculture and industry, whose activities would contribute more towards improving the condition of the natives and preparing his mind to accept the teachings of Christ than the present system of proselyting. At the same time it would open up a market for American products that in a few years would more than justify this diversion from traditional missionary activities.

There has been much loose talk about co-operation for the advancement of American interests in China but this has never included the element which reaps the major benefits from all other national activities. When the missionary bodies now tacitly admit that success in religious propaganda can be attained only through economic and educational uplift, the time has arrived when a large part of their work should be co-ordinated with other organizations having the same end in view. If the American people are to continue to hand over an amount equal to twice their China trade profits for the attainment of a religious ideal through economic development, they should have some assurance that the funds will be expended along lines that will bring material as well as spiritual results.

Otherwise, a large part of our contribution for the economic uplift of China while paving the way towards the ultimate goal of the church, will represent a voluntary tax upon our people for the promotion of competitive trade interests. We endorse the fundamental principle that no thought of material gain or reward should accompany a donation for purely religious work in non-christian lands ; yet at the risk of being misunderstood we advance our belief that if the desired end can be attained only through education and betterment of economic conditions, it is a duty we owe to ourselves and to the faith we profess to make every effort to safeguard the resources which alone enables America to give so lavishly of her wealth for the propagation of her ideals. If we are to spend fifteen millions annually for this purpose and the beneficiaries place their orders for tools and materials with competitors, our mounting assessments for missionary work will gradually develop into a huge fund for undermining our China trade and drying the sources of the golden stream which now flows so freely into the collection plates on missionary Sundays. This idea may be interpreted as narrow, mercenary and unchristian, but any unbiassed study of the facts will inevitably lead to the same conclusion. Religion is one thing, economic uplift another. One is idealistic, the other practical. The two cannot well be merged together under the direction of religious enthusiasts with any hope of success. There exists also a reasonable doubt as to whether the bettering of economic conditions will influence the non-christian to change his religious viewpoint. Certainly, it has not had this effect in Japan, for after eighty years of strenuous missionary endeavor in that country, the church harvest is placed at 300,000 converts.

The crowning glory of the missionary in Japan is found outside the church, in education, hygiene and social welfare work. The christian example has been followed by many of Japan's great leaders who retain their faith in buddhism and national traditions. The results of eight decades of evangelical labors in Japan must therefore be sought not in the actual number of converts enrolled in the church, but in the revolutionary changes in buddhistic religion caused by contact with the christian model. It can hardly be said that christian missionary work in Japan has elevated to any considerable extent the economic or industrial condition of the people. The forces which have carried Japan to her present place in the front rank of manufacturing nations have little or no connexion with the spread of christian doctrine. If economic uplift and education plays such an important part in the propagation of christianity, then Japan's record in Korea and Manchuria merits the highest commendation from missionary bodies, yet it can hardly be contended that the material prosperity brought to the farmers of Manchuria has influenced in any way their outlook on religion.

It may be that the Chinese mind reacts differently towards christian propaganda but it is fair to assume that in the long run the results will be very much the same as in Japan. China will never be wholly converted to christianity. The best that can be hoped for is that she may follow in the footsteps of Japan and mould her religious outlook on western methods and devotion to ideals. Mere contact with christian nations through trade, diplomacy and education will exert the greatest influence towards this end. It may be accelerated by the expenditure of huge annual appropriations from the churches at home in order to maintain thousands of evangelical workers in the field. It may also be expedited by economic and industrial development providing a brighter outlook for the masses, but if the goal is to be reached by this method, it is our candid belief that the funds now contributed for religious propaganda could be better employed in creating industrial opportunities that will alleviate in part the terrible struggle for existence which now stands as a barrier to the advance of christianity, civilization and progress in this country.

# Is America An Eleemosynary Institution?

## Are Americans Preparing Huge Pacific Naval Bases to Maintain a Losing Trade Market or Defend their Philanthropies?

THE commerce reports reveal that in eleven months of the 1923 fiscal year, our total trade with China was $243,000,000 with exports of $88,000,000 and imports of $155,000,000. We bought from China in this period $67,000,000 more than we sold to her. At least 50 per cent. of our imports and a large percentage of our exports pass through the hands of foreign firms. There is no gain to the national wealth from such transactions. With the exception of the petroleum and tobacco companies, nearly every general trading firm in China has experienced severe losses these past four years, driving many into bankruptcy and the hands of receivers. Those who survive have pulled through by additional assessments of new capital or are carried by the banks. It can be fairly said that at least fifty per cent. of the total American business with China has been conducted at a loss for the last four years.

For the sake of argument we can allow a five per cent. profit on the total value of our exports to China (say $95,000,000) for 1923, so the gain to the national economy is $4,750,000. A similar profit may also be taken on half the volume of imports through purely American concerns (say $160,000,000), which gives us another $4,000,000, or a total of $8,750,000 from our entire Chinese trade, against which stands our contribution of $9,000,000 for missionary work alone. This wipes out the profit on trade. Add to this the endowments for schools, colleges, hospitals and similar

institutions, contributions for the Y.M.C.A. and Y.W.C.A., red cross relief work, flood and famine prevention and other charities, the Boxer indemnity remission, the Rockefellar Institute upkeep and special calls on Americans for the maintenance of their own schools and churches in the treaty ports and the total may well run up to another $6,000,000 or $15,000,000 a year for general uplift work in China from America alone, about five per cent. on our total trade with this country.

With this as a basis, add the $40,000,000 gold with interest now owing to American firms by the Chinese government—with no prospects of being paid for the next five years: to this, add the losses of American firms in China for the past four years : the contribution of 300 odd American firms who answered the call of the booster to come to China and capture its trade by weight of numbers : the wallop received by the Philippine National and other American banks on exchange, not to mention the heavy burdens imposed upon all American firms to keep their heads above water while the Chinese indulge in their prolonged Doneybrook Fair, and the sum total will approximate $80,000,000. Add this to the $36,000,000 for missions spread over the past four years, then the $24,000,000 for other charities and we have a grand total of $140,000,000, or an average of $35,000,000 a year as our contribution to China for this period. We can deduct from this the five per cent. profit on our actual exports to China of approximately $5,000,000 a year and we find that the people of the United States are out about $120,000,000 in the past four years. With the average annual export profit it will take many weary years to wipe out the red ink figures ; double the profit to ten per cent. and the result is the same. It is true that the above figures are only approximate and may be modified ten to fifteen per cent. one way or the other but if we have even approximated the truth, it is time the American business man and his government took steps to verify them.

These figures tell us that America's main business in China is philanthropy, and protection to our eleemosynary institutions. Whenever there is talk of a possible war over China, Americans are told they must fight for the protection of a trade principle, for the right to do business on a basis of equal opportunity with other nations. When, however, the American business-man calls upon his government to protect American lives and properties in this country and enforce the observation of treaty rights on the part of the Chinese he is invariably opposed by the element whose interests are best served by the application of a kid-glove policy. The protection of American trade rights against possible encroachments of other nations on the open door doctrine, is the favorite bogey conjured up to fire the hearts of Americans and force through huge naval appropriations, but when these same interests are injured by China herself and our traders clamor for protection, their cry is drowned by the voice of the missionary and professional uplifter demanding non-interference. The result is that American business which provides the funds for our philanthropic activities, is banged over the head whenever it tries to assert its rightful position. American trade with China will never be worth fighting for as long as these conditions prevail.

The American people should be made acquainted with the facts surrounding this phase of their activities in China. If our naval authorities put through an appropriation of $155,000,000 for the extension of Pacific naval bases in order to work on a 50—50 basis with Great Britain and be prepared against a possible war with Japan over China, let us at least know what we are expected to fight for.

Are we to continue to throw away millions for the protection of a losing trade proposition, or are these extra drains upon the taxpayer to be charged against the already enormous sums expended for civilizing, educating and bettering the economic conditions of a people, who, to date, have demonstrated little gratitude in return for our charitable contributions towards their evolution from paganism into christianity?

This is a matter that should command serious consideration on the part of Americans. Our presentation of facts as we see them, is not to be taken as an argument against missionary or educational work in China, but as a stimulus to a fuller investigation that may lead to the publication of an official balance sheet showing the relative financial position between trade and philanthropy. We fully concur with the thoughts expressed by Mr. F. W. Stevens in his remarkably able presentation of Chinese conditions set forth in the following article. We accept Mr. Stevens as the spokesman for American interests in China and unqualifiedly endorse his opinions, but at the same time we venture to say even that this expert has failed to examine the balance sheet. More than any other American, Mr. Stevens speaks for the great financial interests who desire to see China started along the road to prosperity and greatness and stand ready to convert their good-will into practice just so soon as China herself reaches a position to accept their proffered help.

Our one comment on the program outlined by Mr. Stevens is, that the educational uplift of China through American contributions is assuming such great proportions that the cost of carrying on and extending the work will increase by leaps and bounds until it becomes a serious drain on our charity. Furthermore, the total of the sums involved in endowing these general uplift institutions will completely overshadow our trade and compromise the government to a policy that discriminates against its development. The point we desire to emphasize is that if the United States is to assume the task of regenerating China and return for uplift purposes at least twice the profits from our trade, the facts should be made known, so that in any discussion or program for the expansion of armaments in the Pacific, we will have some idea of the real issues at stake. Christianize, civilize, educate and uplift the Chinese to any extent that our charities will permit, but let there be no misconception of our true position when congress is called upon to vote huge naval appropriations or the manhood of the nation is asked to take up arms for the preservation of a trade we will not protect when injured by the recipients of our generosity.

Recent events fully justify the statement that the American government will take no action other than perfunctory diplomatic protests for the protection of American lives and properties in China or to safeguard their trade and treaty rights, neither will it approve of any measure on the part of other powers for the protection of their vested interests that involves any impairment of China's sovereignty or administrative independence. Aside from the traditional reluctance to intervene in the affairs of other nations, there is reason to believe that this benevolent policy is dictated by missionary and philanthropic organizations who fear the effect of drastic action on their own usefullness. Coincident with these events, our naval authorities revive the talk of war with Japan and ask congress for missions to strengthen our Pacific bases in order that our trade interests in China can be more readily defended against any nation or group of nations who might violate the doctrine of the open door. It is a remarkable picture. We take absolutely no steps to protect the interests of our traders when jeopardized by China herself in order to safeguard our eleemosynary privileges, but when hundreds of millions are required for naval expansion and an excuse is needed to keep the people keyed up and prepared for war, we are asked to believe that our wonderful trade opportunities in China warrant the extra burden of taxation and make necessary the greater sacrifice when the call to arms is sounded!

Such a policy is pure, unadulterated piffle, the inevitable fruit of an incessant, interminable and ubiquitous publicity campaign originating in 1899 with the open door doctrine to preserve the Chinese from the consequences of their insincerity, instability and general inability to do anything for themselves and leading up stage by stage through successive administrations and the rapid expansion of our missionary activities to the point where a large and influential element in our country has deluded itself into the firm belief that the salvation of China, educationally, spiritually, morally politically and financially, together with the obligation to defend her against all foes, real and imaginary (with the exception of Russia) is a heaven-sent duty imposed upon us in order to establish, disseminate, propagate and perpetuate our ideals, beliefs and institutions amongst a people steeped in their own self-sufficiency and traditions and centuries removed from our standards and conceptions of life, government and morality. It may be, and we do not deny that it is our christian duty to contribute from our stupendous prosperity all that we can spare for the uplift of the Chinese and the betterment of their economic conditions but when this philanthropic obligation assumes such proportions that it calls for the formulation of a state policy to the detriment of other more important interests, then the time has arrived to call a halt while we get a better perspective on what it all means and where it will all end.

The conquest of China through education is a task that calls for such enormous annual contributions of capital that no one outside nation should lightly take up the burden. It is a task calling for

united action between all the great powers, including Japan. No other people at this period of great world depression and uncertainty can hope to compete with America in propagating their ideals amongst the Chinese, and it stands to reason that notwithstanding our protestations of disinterestedness other nations will incline to the belief that we are taking advantage of their present helplessness to bring China under our influence. Our example has already compelled others to remit their share of the Boxer indemnity for educational and industrial propaganda, which simply means that the struggle for dominating China has been removed from the sphere of international politics and brought under the direction of organized philanthrophy.

# Education, The Only Hope for China

## The Philanthropist's Answer

## China's Present Problems

*By Frederick W. Stevens*

*The following article was originally an address by Mr. Stevens, who, from 1920 to 1923, represented the American Group of the China Consortium in Peking. The address was given in New York before a group of about fifty men (the guests of Charles R. Crane, formerly American Minister to China) who are actively interested in China and especially the Peking Union University; and it has been published in pamphlet form by the China Society.*

REPUBLICS are governed by public opinion. This need not, of necessity, control through the ballot, but it must control, or the word republic is a misnomer. Public opinion is the prevailing sentiment of the articulate portion of a given community. It is not, therefore, of necessity the opinion of the majority of individuals. Every republic has passed through, if indeed it does not still remain in, the state where ruling public opinion represents not the numerical majority but the numerical minority. A true republic, one which has the really progressive tendency, must look toward a day when the majority shall be articulate, and therefore ruling; but it may fairly claim the name republic long before that day is reached.

### A Republic Only in Name

Since the fall of the Manchu dynasty in 1911, after a reign of about two hundred and fifty years, and after a monarchical form of government lasting for thousands of years, a so-called republic was formed, and China is to-day called a republic. But the Chinese people were not well prepared for a republican form of government, and few who are adequately informed will deny that China is now a republic only in name. On the other hand, she is no longer a monarchy, and I believe she will never be again. She is ruled, in fact, by military lords. Her so-called central or Peking government is impotent in more than half of the territory of China. Her so-called parliament, lately reconvened at Peking, after several years' eclipse, is not representative, is not respected, and is openly charged with being governed by selfish and corrupt motives, and is largely powerless for good.

Frederick W. Stevens

Her representatives are unable to bring about disbandment of her armies, constituting a millstone about the neck of each succeeding cabinet; and there has been a new cabinet every few months. The armies are not national armies. Her military lords, each independent of the other, seize legitimate revenue when they can and levy illicit revenue, to keep their armies together and to maintain their individual power. The civil wars of China are usually the result of personal ambitions, not of national purposes.

The only public revenue handled rightly is that which is under foreign domination; and such revenue is mortgaged beyond its capacity. The so-called central government is bankrupt; it has been compelled to allow many millions of foreign and domestic debts to go to default, and the wages of its representatives and employees in almost all branches are long unpaid. The power of the provinces as independent political units is growing, and in violation of treaties made by the old Peking government, these provinces are levying taxes on imported goods, while the Peking government is powerless to stop these violations.

The continued recognition of the Peking government by the foreign powers, which I do not criticise, is the chief reason for its retaining the semblance of power. The unification of the provinces, the creation, in Peking, or elsewhere, of a contral power recognized by all China, seem a long way off. International control by the powers, advocated by many, would, in my opinion, end in a huge failure, and it will probably never be attempted. China must and will work out her own political salvation. And in China, as in every republic, real or nominal, the basis of success must be an informed, enlight-

ened, and moral public opinion. It is only righteous and aggressive public opinion that frightens bad rulers, that restrains wicked officials, that produces a good government, that secures even-handed justice to all.

### China a Pretty Safe Place

Against this array of unhappy facts, we may set the fact that persons and property are perhaps on the whole as safe from violent seizure in China as in our own states. There are roving bandits in some parts of China, and foreigners are sometimes seized for ransom, as we know by recent reports, but, when I read of assaults and robberies in our own states, I think China a pretty safe place. There personal assaults and robberies, burglaries and street brawls are rare.

### A Fiction Unmasked

I promised myself recently to take advantage of an early opportunity to denounce publicly a story that seems to have reached every man and woman in the United States. I have scarcely conversed as much as ten minutes with anyone who has not visited the Orient, without being asked, "Are the Japanese and Chinese honest?" And when I say "Which ones?" I am always met with something like this: "Well, I understand that the Japanese bankers cannot trust their own people and have to engage Chinese to run their banks."

There is no truth in the story, and there never has been. The Japanese banks have rarely, if ever, had Chinese in their employ. The story ought to be widely denounced in this country, for it does an injustice to the Japanese; and the Chinese, who, as a people, are doubtless as honest as any other people, do not need this false testimony as to their integrity. The story probably originated from the circumstance that when two British banks, which had long operated in China, opened branches in two cities of Japan, their leading compradore in China installed Chinese employees in these branches.

### The Question of Population

There has never been a reliable census of China. It has been a habit of writers and speakers about China, during the last forty years or more, invariably to refer to her 400,000,000 people, an unchangeable figure despite the great number of births and the mortality in China. Although skeptical about even the approximate accuracy of the figure, I find it difficult to make myself such a heratic as would be involved in using some other figure. I assume that there are about 400,000,000 people in China.

### China a Farmer Nation

According to those well qualified to make the estimate, about eighty per cent. of all the people of China—which means, let us say, upwards of 300,000,000 people—get their living from labor connected quite directly with the cultivation of the soil. There is a very wide distribution of the ownership of land. There are said to be in China about fifty million distinct land holdings,—ownerships in fee. This fact is considered by many as an insurance against Bolshevism, the advocates of which are said to be distributing large quantities of Bolshevistic literature in China. In southern China, a plot of ground approximately the size of an ordinary city residence lot here, is a "farm," and its products keep a family alive. In northern China, the units are often much larger.

### The Poverty of China

"Keep it alive," is what I say, and is all I mean. It seems to be true that a large part of these millions live year after year on the edge of starvation, seldom or never having enough food to satisfy hunger, much less to provide a reserve supply to meet the contingencies of famine, due to flood or drought or other cause, that frequently arise. Too much is demanded of the land. It is a constant fight, by those who get their food from it, to obtain material necessary to produce the requisite soil fertility.

The lack of demand for labor, to which I shall refer later, forces resort to the soil by more people than the soil can well support. Government provides little in the way of drainage or other artificial aids. The farming methods of thousands of years ago are generally followed, yet practically nothing in the way of advice and assistance as to modern methods of farming is furnished by any governmental agency. Practically all that is done in this direction,—instruction in soil fertility, plant diseases, seed selection, animal husbandry, etc.,—is by the Christian missionary colleges.

### The Labor Problem

Another ten per cent., perhaps fifteen per cent., of the Chinese people, which means in the neighborhood of fifty million people, constitute the laboring class, other than those engaged in agricultural work. These are the artizans, the factory laborers (there are only a small number of the latter) the coolies, servants, and manual workers of all classes. These millions as a rule do not own the hovels they occupy, and they also live on the edge of starvation. Their pitifully small earnings seldom allow them to feed themselves well, to say nothing about saving up anything to meet the needs of worse days than the common run. Life for them has no luxuries and few comforts, and, in our sense of that word, none. "Home" to them means squalid, almost bare quarters, with little or no heat in cold weather. Hot water is a luxury. Cold water is not carried to them by pipes, but is bought in small quantities, out of their pitifully small supply of coppers, from the carts of the water vendors; and to make hot water requires fuel, which for them is very scarce and costly, often to a prohibitive extent, and always to an extent which limits its use to the very minimum. Clothing from head to foot is the simplest imaginable by anyone, and probably more simple than can be imagined by those who have not visited Oriental or tropical countries. Those who know only poverty as it exists in this country have little idea of poverty as it may be. Within a few steps of any place in any city of China, you can be shown poverty of a depth quite beyond your previous imagination.

### The Problem of Illiteracy

I have been speaking of the two classes who with their families constitute a total of about ninety per cent. of the Chinese people, perhaps more. These people are nearly all illiterate. By well informed people, those who can read and write are estimated for all China at not more than ten per cent. of all the people, and often at only five per cent. It should be remembered, however, that illiteracy does not of necessity connote lack of intelligence. The court of the Emperor Charlemagne was illiterate, as was the emperor himself, but this condition was due to circumstances, and has never been understood to show a lack of intellectual ability. The Chinese have great ability in the direction of learning what is taught them.

It can hardly be expected, however, that people who can neither read nor write can have much part, if any, in the creation of that righteous and aggressive public opinion that will smash public evils. Indeed those illiterates naturally know little or nothing about the political conditions and developments that surround them, however much they may be unknowingly interested in them. Public opinion is the product of the articulate classes, the educated classes.

### Native Buoyancy

Despite all the poverty existing among the peasants and the laboring classes of China, the limited possibility there to find enjoyment in life according to our view, these people as a rule are a good-natured people, a peaceable people, a temperate people, a law-abiding people, a people who endure their lot with wonderful patience and fortitude. Indeed, they know no other life, these sturdy industrious people, who are as willing to work long hours as laborers anywhere and who, according to American engineers speaking from large experience with Chinese laborers and with laborers in other parts of the world, make as good laborers as any people in the world.

### The Chinese Deserve a Good Government

Such a people deserve a good government, one that will bring them more of the comforts of life; and some day good government, and more comforts, will come.

Despite the unhappy political conditions, the good qualities possessed by the masses of the Chinese people, inspire hope among China's foreign friends, and create the belief that a better day is coming. I share in that hope and belief. The responsibility of the educated classes to see that that day is hastened is immense, but is not, I fear, commonly accepted by them. If it be possible to weld into a real republic, a nation of 400,000,000 people, largely illiterate, spread over an area approximating that of the United States, speaking many dialects not commonly understood, and with no history or background to fit them for the republican form of government, the Chinese will some time accomplish it, but perhaps

only when an entirely new generation has come, a generation governed by new principles, and creating righteous and aggressive public opinion, overcoming the selfishness, the corruption that now governs so large a percentage of the educated class in China's political affairs. The best men in China, both Chinese and foreign, look to such public opinion for relief, partial or complete, sooner or later, from the curses that now beset her.

## China's Three Great Curses

There are three great curses which I would mention. One is found in the worse than useless armies of a million or more men, which keep China in turmoil. There is grave need of a public opinion strong enough to compel the disbandment of a large part of them, and intelligent enough to devise an effective method for accomplishing such a disbandment, itself a difficult task.

Another is the growing use of narcotics encouraged by at least some of the military lords because of the illicit revenue it provides them. China has lost much ground in recent years in dealing with this evil.

The third is the prevailing corruption among the officials, made up altogether of the educated classes. Mention of it cannot be avoided in a statement of the true situation, but I pass over the harrowing details. This evil will never be done away with, except as the result of education that breeds character, that results in righteous, aggressive public opinion so widespread that it will break up this deep-seated evil. You may say we live in a glass house ourselves, on this subject; but, as I know our history, we have never suffered with this evil as China suffers.

Of course, I need hardly say that there have been and still are notable, honorable, and highminded men in Chinesep ublic office, men far above the practices I refer to, who deplore the evil.

## The Cause of China's Poverty

Why is it that in China, a very large part of whose people are ready, willing and anxious to work and capable of doing good work, there is so much poverty ?

It is because there is little demand for labor in China. I often think it a pity that the demand for labor, particularly domestic labor, which is so great in this country, and the supply of such labor, which is so abundant in China, cannot be allowed to meet, to the advantage of the people of both countries. The supply of labor is so great in all parts of China, and the demand so small, that a Chinese laborer who receives on an average per day an equivalent of ten cents in our money, is among the very fortunate ; and with that pittance he often clothes and feeds, to the limited extent I have mentioned, several people, old and young.

Why is there so little demand for labor ? Largely because China lacks a government that protects Chinese in the establishment and operation of industrial enterprises,—enterprises that would produce an ever increasing demand for Chinese labor and lessen the poverty that is so general. Instead of governmental protection of those who attempt to conduct manufacturing and other industrial enterprises, there is, too often if not generally, official extortion practised upon them ; and consequently there is little extension of industrial enterprises in China, outside the limited areas which have some measure of foreign protection, such as the so-called " concessions " in Shanghai and Tientsin.

With the political conditions such as I have outlined, it is not remarkable that the pending industrial revolution progresses slowly, so far as purely Chinese enterprises are concerned. But, despite these conditions, enterprises under proper protection are making surprising headway.

## How Can China's American Friends Help?

What can the foreign friends of China, those who believe in the brotherhood of man, who believe that a bad condition such as exists in China is harmful to the whole world,—what can they do to help ?

### 1. Open Opportunities for Practical Business Experience to the Chinese Students in America

By the return of the surplus from our share of the Boxer indemnity, we have brought to our shores for education thousands of the young men and young women of China. We have generously opened to them all the facilities of our institutions of learning ; but this is not enough. They need in addition the practical contacts with business and industry which alone can fit them for the task which await them. Given these contacts they should be ready to lead in the difficult work of developing China's great, natural resources—but without the practical knowledge which only such contacts can give, it is vain to expect of them the certain touch which means success. China's problems are practical problems, and in the presence among us of over 2,000 Chinese students we have an opportunity to serve China, and at the same time to serve our own interests. We should at once take steps to insure to every Chinese student of serious purpose a chance to learn, by practice, how practical men meet practical problems. This can be best accomplished by taking them into our industries. Our own rewards will be practical rewards ; for we shall then have in the expanding markets of China men who appreciate the essential soundness of American business and American business methods.

### 2. Get Behind American Missionary Educators

I know of no better way for individuals to help China than by helping to increase the opportunities of the arising generations of Chinese to obtain education of the right kind—the kind that takes into account the moral side of life—the kind that breeds character, the kind that teaches that citizenship carries with it public duties as well as personal advantages, and what those duties are ; the kind that will produce a determination on the part of the educated classes to see that corruption in the government service is smashed ; that armies are disbanded and that the government is run for the benefit of the masses ; the kind of education that is being offered in the primary schools, the middle schools, the colleges and universities, carried on under missionary auspices, in charge of as unselfish a lot of people as can be found anywhere in the world. These institutions are all too limited in their physical ability to reach the Chinese who need their help, and are eager to have it.

I have come to believe that America's greatest contribution to China, greater even than America's political friendship, is the work of the American Christian missionaries in China. This statement may indicate the importance I attach to the need of moral regeneration which must precede any great political and industrial improvement. In all China there is not a single organization, on a scale of importance, that aims at moral improvement, or is calculated to bring it about, that is not traceable in its origin to the Christian missions. I have inquired among all kinds of people from all parts of China for such an activity of non-Christian origin, without finding one.

One who engages in an effort to learn what is the matter with China, and what is the remedy, whatever may have been his former attitude toward religion, cannot fail to become interested in religion as a factor in China. The Chinese are a non-religious, not an anti-religious, people. Neither Buddhism nor Confucianism nor any other of the Oriental religions is any longer a motive force in China. A distinguished scholar, who spent a long period in China, has recently declared :

" Instead of carping at missionaries, we should remember that they have been almost the only ones in the past with a motive force strong enough to lead them to take an active interest in Chinese education."

I regard the Christian universities, colleges, academies, middle schools and primaries, with their nearly 250,000 Chinese students, as most potent factors in fitting China for taking her proper place in the world drama.

At one of the leading play houses in New York city, in a play that has had a long run to crowded houses, there is a character supposed to represent a Christian missionary in one of the South Seas, and I suppose it is accepted by many who see the play as representing the missionary type. By chance, I saw the play a few nights ago. According to my knowledge of missionaries in China and Japan (and I have seen much of them, and learned much of their methods and work) the portrayal in this play is a scandalously false one. I believe that with the most diligent search, extending over any length of time, carried on by those most eager to find justification for the portrayal, no such character would be found in all China, nor in Japan, nor in the South Seas.

The men and women engaged in Christian missionary work in China and Japan are well educated, mostly college graduates, well-bred, high-minded, very sensible and practical-minded people, as I believe any fair-minded man, religious or otherwise, with knowledge of the missionaries and of their methods and work, will say. They are doing a work of far-reaching and vital importance, and with an

unselfish devotion far above praise. Sometimes I wonder if there may not some time travel up and down this great land a Chinese John Wesley, or better still a hundred of them, arousing to a high pitch the moral sense of the people, as John Wesley aroused the English people long ago.

If China's educated men as a class have not the inclination and the courage to stand for the right, there is not much hope for her; if, because of fear of personal harm or personal disadvantage or because their moral sense is weak, they withhold support from men who are trying to do China good service, and with creditable success, then the worst has not yet come to China. And if the people of the United States do not realize the immense value of the work which their missionary educators are doing in China, they should be made to realize it; for China's problems are, to a large extent, the problems of the world in general, and of the United States, in particular.

For two and a half years, I have watched in China for signs of hope, signs of the coming of that all-important righteous aggressive public opinion upon which depends China's future; and the future of liberal government in Asia, for China is the test case. I have been often discouraged, disappointed; but I have never lost hope. I believe in the future of the Chinese people because I know what they are; and, despite their errors and their inevitable failures, I desire to help them, and to see my country help them. Therefore, I face the facts, the evil with the good, and desire my countrymen to know both. If they are enabled to understand China as she is, they will then be the better able to help her to become what she should be, politically, economically, and spiritually a great republic.

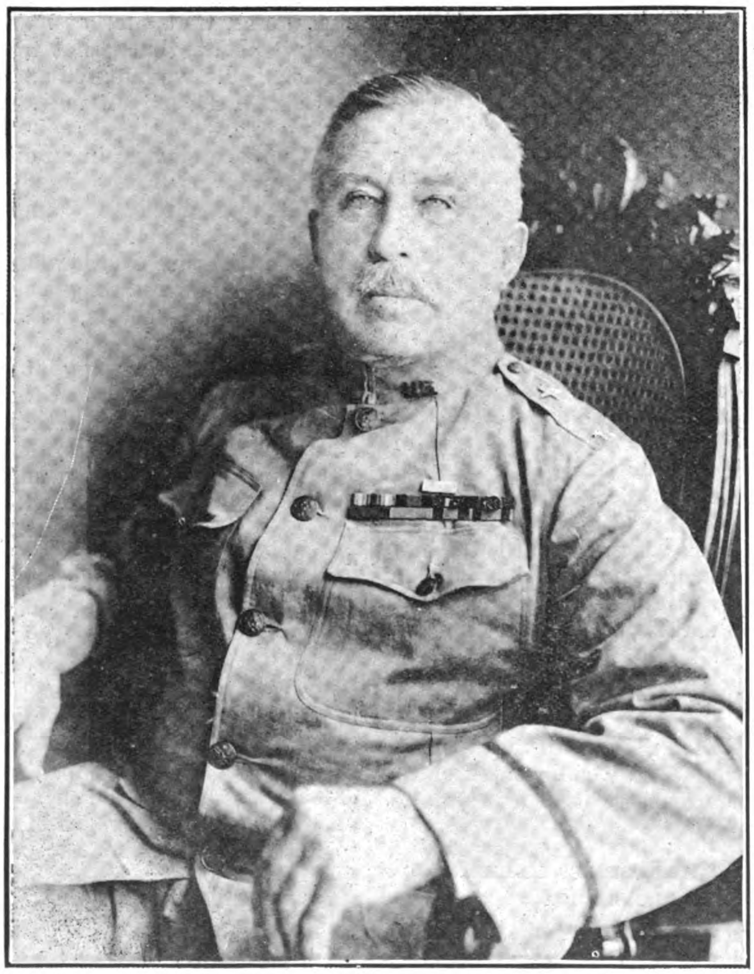
# The Trend of Events in the Philippines

## The High Cost of Altruism

THE message of Governor-General Wood to the Philippine legislature on the operation of the Philippine National Bank comes as a timely document to supplement the analysis of America's Far Eastern policies presented in the preceding articles. The Philippine National Bank was organized during the war as a depository for government funds and to perform the functions of an agricultural and commercial bank. Instead of seeking to justify its existence for the joint development of American and Philippine business, it was turned over to native politicians for the exclusive promotion of personal and insular interests. A great opportunity for advancing American prestige in the Orient was thrown away in the frantic rush to finance and exploit native enterprises on the top wave of the war boom and when the inevitable crash came the national bank was buried under a mountain of worthless paper. For twenty-five years Americans in the Orient have been pulling themselves up by their boot-straps, telling the world about their plans to capture the trade of Asia over the heads of competitors. They could see that British, French, German and Japanese business in China rested on the secure foundation of national banks specially created for its benefit. For all practical purposes there banks were colonial institutions, backed by the full weight of their home authorities, designated as depositories for colonial funds, and employed as instruments for advancing the policies of their respective foreign offices through Chinese loans. The establishment of a similar American bank was vital to the success of our trade and prestige with the central government of China.

Had the American authorities remembered some of their own publicity arguments about making Manila the distributing centre for American products destined for other Eastern Asiatic countries, they would have utilized the Philippine National Bank as the instrument to push forward such a worthy program. As a semi-official Far Eastern bank with headquarters at Manila, managed

Lt.-Col. Peter Bowditch



The Governor-General of the Philippines and his Capable Assistants

Major-General Leonard Wood

Lt.-Col. Gordon Johnson

by men familiar with exchange and other special phases of Far Eastern trade, enjoying the confidence and financial support of the Philippine and American governments, the Philippine National Bank would have soon taken its proper place in finance by the side of the Hongkong & Shanghai Banking Corporation, the Banque de l'Indo-Chine, the Yokohama Specie Bank and the Banks of Chosen and Taiwan, the two great semi-official Japanese colonial institutions whose operations cover the Orient. In commenting on this situation, we do not underestimate or wish to criticize in any way the splendid work of other American banks who have struggled against most adverse conditions to establish their footing in this field, but who are handicapped in their freedom of action by a directorate sitting in New York and influenced by the daily fluctuations of the American money market. Such banks could never serve the same purpose as a semi-official colonial bank designed to advance American interests in this part of the world through participating in loans to China for general railway and industrial development. What the Hongkong Bank has accomplished for national prestige with the full support of the British government, could have been duplicated by a Philippine Bank, working with the American government for the furtherance of American interests.

Hand in glove with the routine business of such a bank would have gone the plans for the creation of a free port or zone in Manila, with its terminals, bonded warehouses, subsidiary steamship lines and other activities which would have made the Pearl of the Orient the centre of American trade in Asia. With these dreams ever before them, Americans in the Philippines set out to build up a billion dollar trade with the home country, yet when the great opportunity arrived, they permitted the Filipinos to create and direct a national financial instrument for the exclusive exploitation of insular enterprises whose prosperity hanged entirely on war-profits from a duty free home market.

The Filipinos, it may be urged, were justly entitled to control and operate a national bank for the exclusive development of their own trade, industries and resources without interference on the part of Americans ; on the other hand, we hold to the opinion that as their prosperity is largely derived from the remission of duties on Philippine sugar and tobacco (a free gift taken from the pockets of the American people), some reciprocity was due to their benefactors. The Filipino is prone to overlook this obligation and claim for himself all credit for insular prosperity. It is only fair, however, after accepting this preferential position under our tariff laws to insist that he should co-operate with us for the advancement of our trade and prestige in the Orient. It is not enough for Americans to look forward to the time when our exports of manufactured products to the islands will repay in part this $20,000,000 yearly contribution towards the prosperity of our wards. The price of our philanthropy should at least be an honest and loyal co-operation. The rule should work both ways.

However, we realize that such thoughts are unworthy and place us outside the philanthropic pale. After all, the Filipino cannot be censured for this selfish attitude. As the twig is bent the tree's inclined. From the day we arrived in the islands, the native was led to believe that we were not there to exploit them, and to prove our words we enacted laws which closed the door to the entrance of American capital. Americans were most emphatically not in the islands to promote American trade. We were there first, last and always in a philanthropic capacity, a good-natured big brother who would act as trustee for their posterity safeguarding them against exploitation until such time as we uplifted them to a plane of equality with the white man and educated them to manage their own affairs preparatory to full independence. Under no possible circumstances were Americans expected to reap any pecuniary benefits from their experiment in colonial government. We enacted the land laws which preserved their inheritance from passing into foreign hands and then protected them against the cheap labor of China. In pursuit of our altruistic policy we opened our tariff doors to their principal products and took from our treasury an annual amount which might have been well utilized in other ways at home. And then we handed over to them the revenues and finances of the islands to play with through the establishment of a nice little national bank, all their own, in which Americans were excluded from participation in management. We gave them everything, even to the one instrument that would have made American trade dreams come true. They were like a child with a new toy. They laughed and cried over it, hugged it and kissed it, fondled it, rocked it to sleep and then woke it up and jumped on it, banged it with a club, ripped it open and pulled the stuffing out of it. What they did to it is told in the message General Wood sent to the Philippine legislature sometime in February and not made public until August 17 when it was released by the American executive over the protests of the Filipino leaders. The document comes to strengthen, confirm, uphold, justify, commend and in all other ways endorse the words of wisdom contained in the findings of the Wood-Forbes report.

That the Filipino leaders should have remained silent and opposed publication of the message is quite understandable after a perusal of its text and we agree entirely with the opinion of the governor-general that the time had arrived for the people of the islands to know how their money had been handled and where responsibility for the great losses rests, losses and mismanagement which have made it necessary for the government to issue additional bonds for approximately P.100,000,000, and increasing the national debt to this amount.

Fortunately for the islands, for the Filipinos and for American prestige throughout the Orient, the bank's losses of more than P.72,000,000 are guaranteed by a benevolent group of nice old gentlemen sometimes known as the government of the United States. For them such a loss is a mere drop in the bucket compared with our charitable expenditures in China. Every two years our church-going public and millionaire philanthropists cheerfully contribute an equal sum for bettering the conditions of the Chinese, and, in addition, dictate the government's policy in any critical situation affecting our relations with China. China can go bankrupt, default on her loans, drive American firms to the wall and violate her treaties, but the administration that would dare to call them to book by any application of force, would be swept out of power at the next elections by the united opposition of every religious, educational and charitable organization in the country.

As we fit together the pieces of the Far Eastern puzzle we cannot close our eyes to the picture already exposed to view. The strategic significance of the Philippines will overshadow its economic importance for the next half century, yet the native political leaders continue to cry for an independence that carries with it such onerous international obligations that only a very rich, prosperous and strongly armed people could hope to comply with. The aspirant for the Katipunan presidency in his deep solicitude for the rights of posterity has defeated General Wood's proposal for the development of a rubber industry, which analyzed, tells us in no uncertain words, that the Filipinos are opposed to any scheme that will bring in American capital for the development of insular resources. They are willing to accept, in fact, they are praying and hoping for an independence guaranteed by the presence of an American fleet with its base in Manila, but most unwilling that their benefactors should reap any pecuniary rewards from business that might in any way recompense them for the cost of protection. Such, in brief, is the reward of twenty-five years of altruism, and, in any discussion over the future of the islands, there will always be found an influential element at home who would gladly shoulder the costs of such a one-sided protectorate and submit meekly to the impact of the Katipunan boot on their southern polar extremity.

When the pieces of the puzzle are fitted together we see on one side vast preparations to strengthen our defenses in the Pacific in order, so we are told, to co-operate with Great Britain and utilize her Singapore base in a war with Japan for the defense of the Philippines or the salvation of China, Two of our leading admirals endorse this program and the secretary of the navy asks congress for an appropriation of $155,000,000 to carry it out. On the other side, the still hazy picture is gradually developing along lines which convince us that the above war-like talk and preparations are justified not for the defense of any trade principle, equal opportunity, open door or preservation of China's or Philippine independence, but solely for the privilege of enforcing our right to continue in business as an eleemosynary institution. When we add the cost of our experiment in the Philippines (including the sum total of our free gift in the remission of duties on sugar and tobacco) to the $150,000,000 invested these past four years in China, there is no mistaking the ultimate picture slowly taking form as the pieces of the puzzle fit into position.

G. B. R.

# An Orgy of Mismanagement

## The Story of The Philippine National Bank

### " A Violation of Every Principle which Prudence, Intelligence or Even Honesty Could Dictate "

## The Governor-General Message to the Philippine Legislature

" GENTLEMEN OF THE LEGISLATURE:

" In my message delivered at the opening of the present session of the legislature I said,—

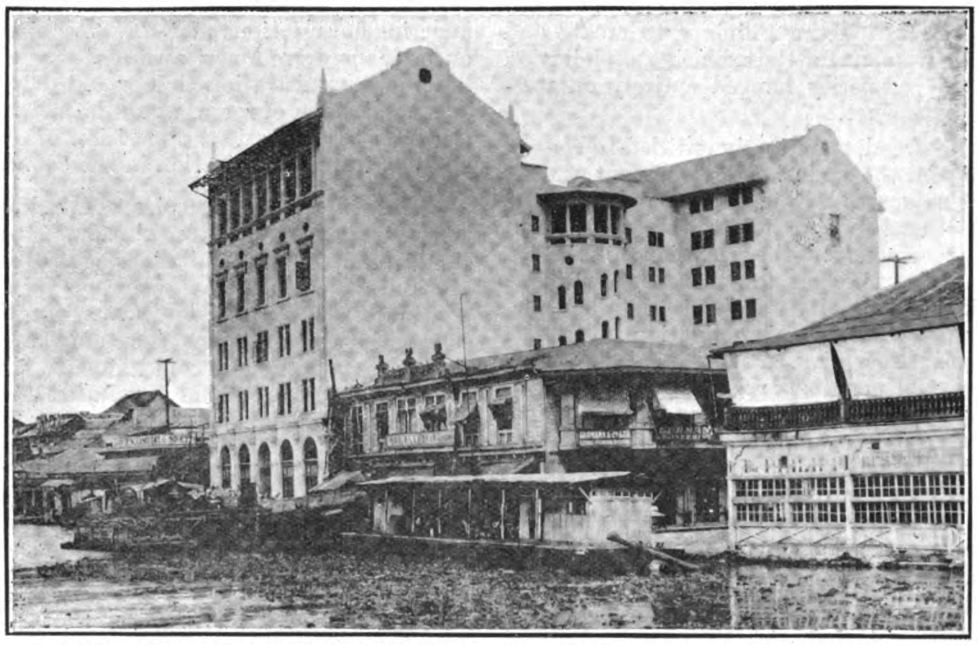
" 'A full statement of the general financial condition of the government, including the condition and operations of the national bank, will be transmitted to you as a special message in the near future.''

" Although the final returns from the various bureaus concerned are not yet available it appears that the revenues for the past year were slightly in excess of the estimates. Actual expenditures, however, were considerably in excess of revenues collected, the difference being made good by the partial repayment of government deposits by the national bank.

### In Limit of Safety

" On the same basis of taxation the prospects for the present year, as far as can be judged at the present time, are even more encouraging. It is apparent that with the rigid economy of the well-balanced budget for 1923 we will find ourselves well within the limits of safety.

"However, in accomplishing this many vital public activities have reduced to an undesirable minimum. We are in great need of a larger allotment of funds for education, health, and sanitation, to secure which new sources of taxation must be devised in such a manner that the burden will be equitably distributed. Special provision was made by the last legislature through the issue of bonds for irrigation, port works and certain other public works. These bonds are being sold only as actually meeded and every effort is being made to place them on the market in such manner as to yield the largest returns. Care must be taken that the proceeds of the sale of these bonds are used only for the specific purpose designed. They should be in no way confused with funds devoted to similar purposes but which are a proper charge against current revenues.



Pasing River Front of The Masonic Temple Building at Manila, the first floors of which were occupied by the Philippine National Bank

"The heavy losses of the national bank were largely responsible for the increase of our bonded indebtedness which is now up to the limit prescribed by congress. During the past year bonds in the sum of $23,000,000 were sold to provide funds for the re-establishment of our currency system upon its original basis. Fortunately the natural course of trade had brought exchange to par and the indications are that we are entering upon a period in which the balance of trade will be in our favor. The revised system has, therefore, been placed in operation under favorable conditions. There is now behind every treasury certificate in circulation the full face value of the certificate in gold or silver coin. The gold standard fund, for the main tenance of the parity of the peso, is recognized to be smaller than is desirable but it is as large as the limit of our indebtedness would permit. Provision has been made, however, for a gradual increase of the fund under which it will reach a desirable maximum. In the meantime safety is assured by the provision for the issue of temporary certificates of indebtedness in the possible sum of $20,000,000. Business may, therefore, proceed upon the assurance that the parity of the peso is no longer a matter of question.

### Additional Burdens

" The issue of bonds for the above purpose together with the issues yet to be made for irrigation and other public works imposes an additional burden upon the government in the way of interest and sinking funds. This will necessitate rigid economy as well as an enlargement of our revenues. It is part of the price the government has had to pay for its policy of entering the field of business. While this has been undertaken with the best motives it has entailed enormous losses due to the bank, the railroad, the coal company, and the national development company, all of which are a continual drain upon public revenues. The true condition of these enterprises is not often apparent because of exemption from taxation, interest, etc. I am now endeavoring to obtain reports which will reveal the exact extent to which the government is involved in these enterprises as well as the extent to which it may become liable in the future. The operating losses of these concerns are in reality government subsidies and should be shown as such.

" It is the present policy to withdraw gradually from all such undertakings and leave the field open to private capital and initiative, and the recommendations I have made from time to time with reference to encouraging the development of our agricultural and other natural resources have had this in mind. I trust the legislature will provide the means by which such a policy may be carried out.

### The Philippine National Bank

"The national bank presents one of our most serious problems. The first reliable report on the examination of the bank, rendered in the fall of the year, 1920, showed that the instituation was in a dangerous condition. As a result the bank was placed under its present management in January, 1921. Although the banking and business world was aware of the situation the general public remained in ignorance.

"One of the first efforts of the special mission, which arrived a few months afterward, was to determine the exact status of the bank. For this purpose the well-known firm of Haskins & Sells was employed to make a thorough examination which took nearly a year. The essential facts of the preliminary report of this firm were made known through the report of the special mission, and for the first time the people were given reliable information as to the approximate condition of the bank.

" The final report of Haskins & Sells was not received until last June. In view of the condition revealed by this final report, and in order that we might proceed with a greater degree of assurance of the facts, I deemed it advisable to have their findings checked. Accordingly Special Bank Examiner Ben F. Wright and National Bank Examiner Leo H. Martin, men of mature experience, have made a thorough revaluation of the bank's assets.

### Reports Transmitted

" I now have the honor to transmit herewith, for your information the final report of Haskins & Sells as of May 19, 1921, together with the report of Messrs. Wright and Martin upon the reapportionment of the bank's assets as of June 30, 1922. The national bank is a creation of the Philippine legislature, founded with, and operated almost entirely upon, government funds belonging to the people. It is important, therefore, that the people should know the facts as to its stewardship.

" The report of Haskins & Sells shows that the bank, as of May 19, 1921, had incurred losses in the approximate sum of P.75,089,000. The report of Messrs. Wright and Martin places the losses at P.63,091,000 as of June 30, 1922. To this amount must be added the losses written off by the bank between the two dates in the sum of P.11,600,000, making a total of losses as of June 30, 1922, of P.74,691,000 as compared with the estimate of P.75,089,000 by Hankins & Sells.

" It is evident, therefore, that the government has lost its entire investment in the capital stock of the bank, P.32,398,000, and in addition some P.30,693,000 or about 64 per cent. of its P.47,543,000 deposits in the bank. Not only is this true, but the remaining assets, including a large amount of doubtful assets, are tied up solidly in frozen loans and investments and must remain so indefinitely. Further, the bank was carrying practically no reserves behind its P.81,675,000 deposits and some P.30,756,000 circulating notes.

## P75,000,000 Loss

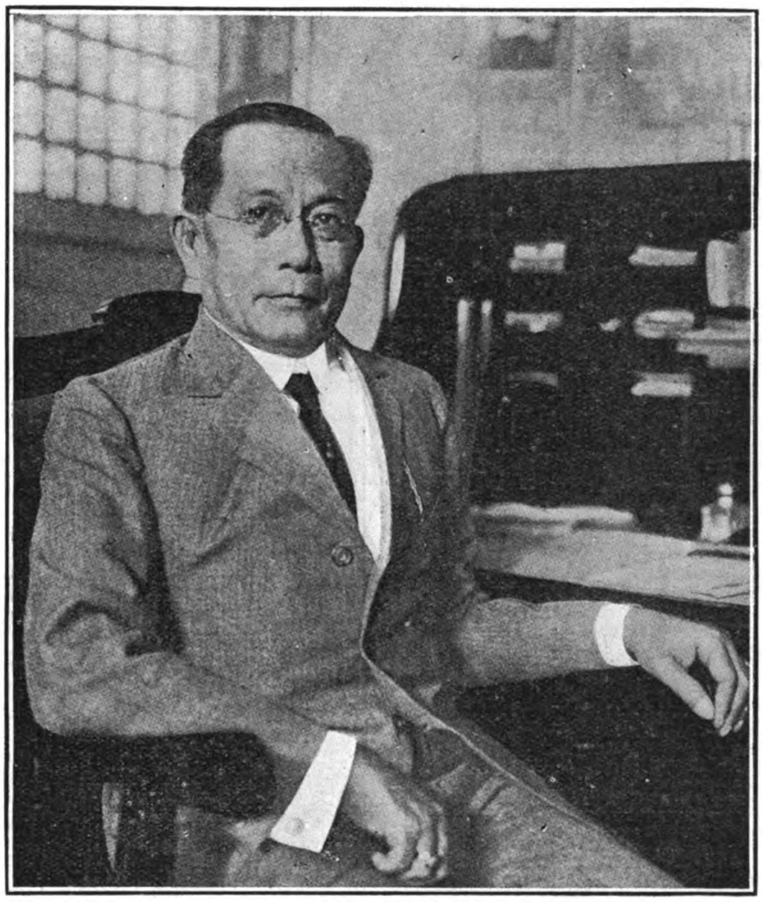
" After six years of operations the government finds that its venture in the banking business has cost it approximately P.75,000,000. This is a convincing demonstration of the universally recognized fact that governments cannot successfully conduct business enterprises of this character.

" Under the conditions above set forth there can be no question as to the insolvency of the bank. In accordance with the ordinary rule of law it would have been my duty to close the bank as soon as this condition was clearly revealed. It is unjust for the government to fail to enforce its own laws against an institution of its own creation while enforcing the same laws against private institutions. In following such a course private capital is unjustly discriminated against and the foundation of our business prosperity, which must rest upon private initiative, is undermined. However, the conditions have been exceptional, and I have felt for this and other reasons that it would be unwise to resort to the clearly indicated legal remedy of closing the bank, certainly not until after the legislature had been given full knowledge of the situation. On the other hand, I have sought in the meantime to protect the interests of the government and the public in the bank. Fortunately the public is aware that the government is in effect morally and legally responsible for the bank through its ownership of some 92 per cent. of its stock. The situation is thus relieved of any element of danger to depositors or holders of the bank's circulating notes.

## Steps Detailed

"The efforts of the board of control were first directed toward securing accurate data as to the actual condition of the bank. Second, shortly after assuming the duties of my office a committee was approinted under executive order number 54, composed of Miguel Unson, undersecretary of finance and then president of the bank, E. W. Wilson, general manager, and Special Bank Examiner Ben F. Wright, to coordinate the interests of the government and the bank. The committee has rendered valuable services in assisting the board of control to formulate a general policy for the bank's operations, and in bringing about a closer supervision of the bank's affairs in behalf of the government's interests. And finally, a most earnest effort has been made to secure a board of directors composed of the most reliable and competent business men who would conscientiously discharge the duties imposed upon them by law.

"Under the present management improved banking methods have been installed, the personnel reorganized and a good deal accomplished in obtaining additional securities for the protection of loans formerly granted, but in spite of these efforts it has been impossible to overcome the damage wrought by former mismanagement. Most of the liquid assets have been converted into cash. Between January 1, 1921, and June 30, 1922, approximately P.30,000,000 of deposits were returned to the government which has thus enabled to function under considerably reduced revenues. Large sums have also been reinvested by the bank in an attempt to work out the involved affairs of various individuals and corporations indebted to it. It is doubtful whether the real condition of the bank has been improved by so doing.



**General Venancio Conception, President of the Philippine National Bank**

In General Wood's Message to the Philippine Legislature President Conception is characterized as an asture Politician with only slight tolerance for Americans or things American, a strong partisan and not a banker either by training or inclination. During his three years administration every American but one (a subordinate) was eliminated with the result that there was "not a trained banker or a man trained in bank detail among them, and these to handle P300,000,000 of values)."

## Business Restricted

" The outcome of the above operations has been to place the bank in a position where it is able to transact only an insignificant banking business with the public. It is now able to do little more than finance in a very restricted manner the involved business of its debtors. Other patrons have been forced to transfer their business to other banks. The national bank, as shown by the report of the insular auditor, is now operating at a considerable loss.

" Experience, here as elsewhere, has proven that it was a mistake to combine agricultural relief with commercial banking. The two functions have little in common. The underlying fallacy of the national bank was that it encouraged speculation in the handling and marketing of products rather than assisted in their production. The promotion of agriculture was the main original purpose of the bank and yet it was completely dwarfed by the commercial activities which broght about its final undoing.

" At the present time the efforts of the bank are largely directed toward working out the affairs of various commercial interests which it has fallen heir to, such as sugar, oil, tobacco, etc. The success of the bank sugar centrals is dependent upon a continuation of present high prices which is at best problematical ; upon the retention of the preferential tariff rates on Philippine sugar ; and upon obtaining from government operation a degree of success which universal experience has shown is not generally forthcoming. Up to the present time the bank centrals, as a whole, have failed to meet their interest payments. In the case of the oil mills the situation is even less hopeful. In fact it is considered practically hopeless by the board of directors of the bank. Private oil mills are anxiously awaiting the abandonment of government operations as the only solution of their difficult situation. Old established tobacco manufacturers are gravely concerned with the use of public funds in direct competition with their business.

## Forced Into Business

" As the result of government ownership and control, in an effort to prevent losses, the government has been forced into an increasing number of strictly business ventures in which public funds are being invested in competition with private capital to the great detriment of the latter and the introduction of a discouraging uncertainty in the affairs of business generally. It is a serious question as to how far the government is justified in using public funds in competing with those who are heavy contributors to the revenues of the government.

" All of this is contrary to the policy of the home government which has the real and permanent interests of the islands at heart, as stated in my former message,—

> The home government has expressed through the secretary of war the opinion that the insular government should be gotten out of business as rapidly as practicable. I concur in this opinion and long ago transmitted the views of the secretary of war and my strong concurrence therein to the president of the senate and the speaker of the house.

" The outstanding circulation of the bank presents another very serious situation. On December 28, 1922, there were outstanding P.32,127,108 of those notes with practically no reserves behind them and protected only by frozen assets. It is impossible, therefore, for the bank to redeem them in lawful money as required by law. Under such conditions they are a constant menace to the financial stability of the government and private business. Future contingencies may well arise under which those notes would seriously interefere with the proper operation of our currency system. Fortunately those notes circulate freely because the people know that the government is responsible for their redemption.

## Deposits Tied Up

" Again, according to recent figures the provinces and municipalities have on deposit with the bank some P.16,765,000. This represents the working balances of these organizations. Together with other deposits they are tied up in long time capital loans and investments. The insular government must hold itself responsible for these as well as other deposits, and must see that local governments do not suffer from inability to secure these funds as needed.

" The government is thus faced with an exceedingly difficult situation. The failure of the bank was due to Americans as well as to Filipinos for the power which lay in the hands of the former was not properly exercised. The United States has twice demonstrated its failure in the field of commercial banking. It is quite natural, therefore, that the policy of the government in Washington should be that the Philippine government should retire from the banking business as rapidly as practicable.

" Force of necessity has required that the bank be kept in business in spite of the fact that it has operated in open violation of law and in competition with private institutions, and contrary to the announced policy of getting the government out of business. The board of control has, however, endeavored to confine the activities of the bank as closely as possible to liquidation. Under date of April 29, 1922, I outlined very clearly to the general manager of the bank the policy of the board of control in this respect. Again under date of February 1, 1923, this policy was reiterated in a letter to the president of the bank impressing upon the board of directors the necessity of bringing the operations of the bank into strict harmony with the policy of getting the government out of business. Copies of both letters follows :

*(Continued on page 615).*

# The China Society of America

## A Common-Sense Program for Educating Chinese in America

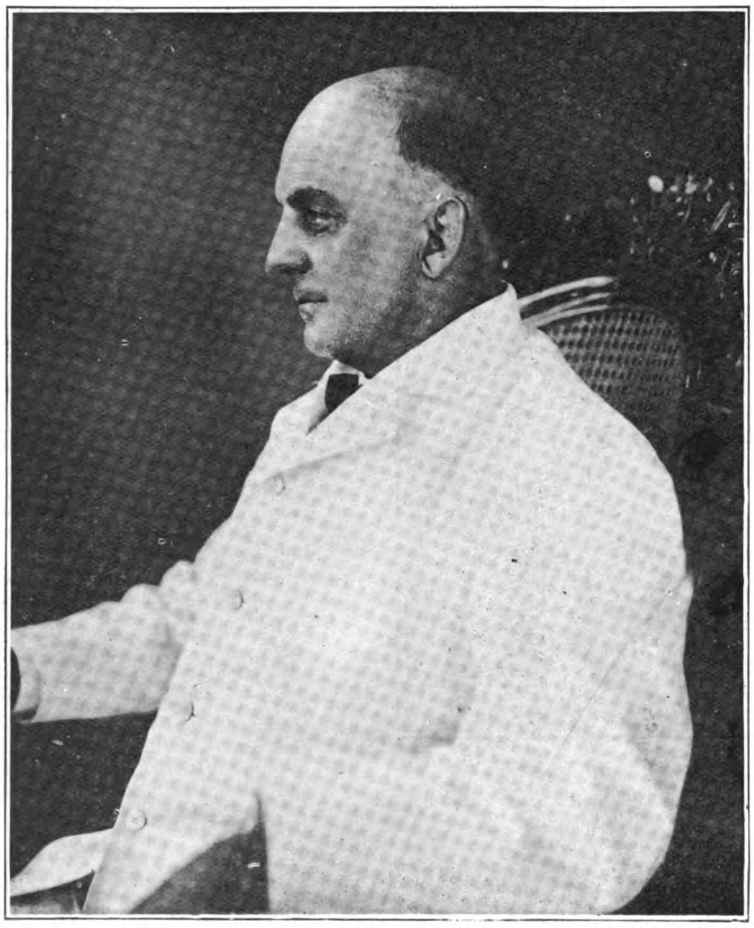
AMERICANS and Chinese alike have reason to feel optimistic over the new program adopted by the China society of America having for its object the attainment of practical benefits from our general educational policy towards China. For a long time it has been apparent to close observers that the American system of educating young Chinese failed to equip them for usefulness on their return home. The influence for good exerted by these returned students is not underestimated but it is recognized that a university training, valuable as it is, should be supplemented by practical experience after graduation in some of the many great American industrial establishments. A knowledge of American business methods combined with technical practice is essential to the success of the young Chinese college graduate if he is to become a leader in industry and co-operate with American firms for the extension of their trade on his return to China.

The system of educating Chinese in America where they absorb ideals difficult to live up to or apply in practice on their return home, is open to considerable criticism, as above all other things China needs at this crisis in her national life, the services of men trained to understand their own problems, to think, talk, dress and develop as Chinese citizens. The practice of turning out annually hundreds of college graduates and returning them to China in a half-basked condition, filled with democratic ideals and a theoretical groundwork in popular government, is largely responsible for the political unrest in this country. Such men are misfits in the Chinese scheme of government and utilized only in such positions where their presence serves to delude the foreigner that the old system is changing. The best of them like Alfred Sze, Wellington Koo, C. T. Wang, Wang Chung-huei and W. W. Yen are merely window-dressings for the foreigners to admire, diverting attention from the old style mandarins, the real rulers of the country.

The British and French were quick to see the defects in our system and make plans to use our groundwork as the basis for a course of practical training in their machine shops, foundries and textile mills. The war was hardly over when the French government arranged with the Peking authorities to send a large number of young Chinese to France for a year of "training in civilization," which translated into its proper meaning, meant a year of practical experience in French industrial establishments where the student of civilization would be taught the use of French tools and machinery and then returned to China as trade missionaries. The British accepted the same principle, insisting, however, that the Chinese should be educated and trained in China, at the Hongkong University. In later discussions over the best method of applying the boxer indemnity for educational purposes, the British favored the plan of using the funds for the erection and endowment of a textile school in Shanghai.

It was recognized by our trade competitors that Young China was receiving a liberal education in American colleges in general subjects presenting them with the opportunity to utilize this groundwork to their own advantage along more practical lines and reap the material profits from the American outlay in altruism. The

### Two of America's Greatest Executives Direct the China Society



**Hon. W. Cameron Forbes**
**Former Governor-General of the Philippine Islands, now Honorary President of the China Society of America**

**Major-General James G. Harbord**
**Former Chief of Staff of the American Army, now President of the Radio Corporation of America, and the China Society of America**

China society of America has recognized the defects in our system and under the able direction of Professor McElroy has initiated a movement that will enable the young Chinese student to supplement his college work with a course of practical training in our industrial establishment. In pursuance of this program several hundred have been successfully placed in manufacturing plants, banks and business offices throughout the country. In the long run this departure should be productive of excellent results. However, it still has its weak points arising from the absence of large American industrial enterprises or commercial firms in China who can give employment to such men on their return. In the keen competition to win China's confidence and trade by benefits, it is hardly to be expected that British, French or Japanese controlled enterprises will open the door of opportunity to Chinese trained in America and favoring American materials. If Americans hope to reap and material gains from the new departure, they must go further and furnish the capital for the creation of American industries or construction of loan built railways that will provide employment for their proteges, or, hope for the best through their employment in purely native enterprises. Notwithstanding the present dark outlook for the development of native resources through the investment of native capital, the new American plan has much to commend it. It is a step in the right direction.

It is especially gratifying to see that the China society has abandoned its former anti-Japanese attitude and is now pursuing a policy calculated to make for peace and harmony in Asia. It is also a matter of congratulation for Americans interested in the Far East to learn that the society is now directed by men of broad vision and experience in handling Asiatic questions, men who command the full confidence and respect of their countrymen of all political beliefs and parties. With the Hon. W. Cameron Forbes as honorary president and Major-General James G. Harbord as president, the China society enjoys a leadership which few national organizations can hope to equal. The record of W. Cameron Forbes as governor-general of the Philippines typifies all that stands for efficiency and probity in public life and the highest ideals of government. A great administrator, big-hearted philanthropist and a statesman of the highest order with a full understanding of the basic problems of the Orient, the honorary president of the society may be expected to exert his great influence for the peaceful and honorable solution of problems which still exist to unsettle conditions and make for unpleasantness in international relations in this part of the world.

As its president, the society has one of the greatest soldiers and executives our country has produced. General Harbord is also president of the Radio Corporation of America with a lively interest in Far Eastern affairs. In addition, the society counts on its board of directors Mr. Edward Marshall one of the most brilliant names in American journalism. The other directors elected at the last annual meeting of the society are Owen Roberts, former president of the society; M. A. Oudin, vice-president of the International General Electric Co.; Charles Haydon, president, Haydon, Stone & Co.; K. C. Li, president, Wah Chang Trading Co.; R. C. Patterson, jr., vice-president of the Peacock Film Corp.; Edward Marshall, of the Edward Marshall International News Syndicate; Mrs. John Allen Dougherty, of Washington, D. C.; Mrs. Simeon Ford, of New York city; A. J. Drexel Biddle, jr., vice-president of China Enterprises, Inc.; Mrs. Thomas Lamont, of New York city; Dr. Frederick Peterson of New York; with Professor Robert M'elroy of Princeton, as managing director.

## Six Men Out of a Job

*"The next governor-general of the Philippines will be a Filipino."*

On several occasions during the past six months we have been confidentially informed by those close to the native Filipino political leaders that this was the next step on the road to independence. It is hardly necessary to name the aspirant for gubernatorial honors as recent events leave no doubt as to his identity. In order, however, to prepare the ground for these long deferred hopes, a vacancy in Malacanan palace was quite essential and as there appeared to be no immediate prospect that the present tenant would voluntarily seek other quarters, the Filipino politicos set out to facilitate and quicken his departure. Which gives us the background of the conspiracy to create an issue that would either frighten him away or compel his recall.

The appointment of Leonard Wood to the governor-generalship of the Philippines carried with it the mission of salving the wreck after eight years of sentimental democracy directed by native politicians under the leadership of Manual Quezon. This most capable and shrewd *politico* picked General Wood's predecessor for the job and for eight long years dictated his policies. The governor-general's name was Harrison, but the power behind the throne was Quezon, the hero of the independence movement. Four more years of Wilsonian democracy would have firmly consolidated his rule and by this time, the United States would either have a first-class insurrection on its hands or forced to concede absolute independence to the islands with Su Excelentissimo Senor Don Manual L. Quezon holding down the Big Chair in the Ayuntimiento, extending his legs under the mahogany at Malacanan, and receiving the salute of the Filipino army corps on Wallace field.

The Wood-Forbes mission spoiled these well-laid plans. In recommending that "under no circumstances should the United States permit to be established in the Philippine Islands a situation which would leave the United States in a position of responsibility without authority," General Wood incurred the undying enmity of the independence party. Figuratively speaking, since that time Don Manuel has been silently and assiduously grinding and whetting his trusty bolo against the time he could use it on Wood's official neck. After two years of tom-toming, war dancing and working up to the proper frenzy, the agile Filipino finally saw what he thought was a good opening and slashed out with a blow that would have felled a less skilfull antagonist and added his top-piece to the dessictated trophies adorning the head-hunter's fire-place.

This, in brief, is the story wafted to us by the summer typhoons from the palmy isles of the Southern Seas. Quezon has swung his bolo and challenged the governor-general and Washington to the show down which it is hoped will result in hanging a To Let sign on the palace gates of Malacanan. The entire Filipino cabinet has danced to the sound of the war-drum and resigned their jobs in a body to rally around the big cacique. A cablegram has been dispatched to the president demanding Wood's immediate recall. Wood, however, has accepted the six resignations and is standing pat waiting for the next move. President Coolidge has the option of endorsing the governor-general or of recalling him handing over the government to the Filipinos, pulling up stakes and leaving the islands to their fate, in which case, Don Manuel moves in when Wood moves out. Until moving day comes around, however, the much advertised political crisis in the Philippines resolves itself into a very simple economic problem. Six men are out of a job. That is all.

# Foreign Supervision Over China's Railways

### A Comparison of Chinese and S.M.R. Statistics which Reveal how China's Railways are being Looted

The Westminster Bank, the Hongkong and Shanghai Banking Corporation, and the Yokohama Specie Bank, as agents for the Industrial Bank of Japan, have issued in London £4 millions 5 per cent. sterling bonds of the South Manchurian Railway Company at 88 per cent. The bonds are repayable at par in 1948, with an option to the Company to redeem the whole or part after 1933. Both principal and interest are unconditionally guaranteed by the imperial Japanese government. The total share capital of the Company is 380 million yen, of which 120 million—about £12 millions sterling—is held by the Japanese government as compensation for guaranteeing that amount of 4½ and 5 per cent. debentures issued here in 1907, 1908, and 1911, and still outstanding. Of these, the 5 per cent. debentures, which are repayable at par in 1932, stand at 94, thus giving a yield of 5⅞ per cent., while the present issue will return anything from that amount up to 6½ per cent., according as it is redeemed late or early. In addition to sterling loans there are internal debentures to a total of 195 million yen. After paying the dividends on these debentures, the profits for the last four years average some 39 million yen, or enough to cover the service of the sterling debentures about five times. Further

figures show that most of the Company's activities are meeting with increasing success each year, and, in fact, the growth has exceeded expectations, with the result that the present issue had to be made to provide capital for new railway and harbour facilities.

The floating of this loan in London is accepted in Chinese official circles as further evidence of the existence of a " gentleman's agreement " between the members of the consortium to recognize Japan's special position in Manchuria in violation of the Washington treaties. In the opinion of this element the Y.20,000,000 loan to the Oriental Development Company by American group bankers was also the outcome of this secret understanding, overlooking that the consortium pact does not cover existing railways or those lines upon which substantial progress has been made. Under no stretch of the imagination can the South Manchuria Railway or its branches be included within the scope of the consortium agreement, any more than those loan-built lines in China proper, which unless all signs fail, will sooner or later be forced into the money markets for new capital for necessary improvements and extensions.

The collapse of China's railway finance coupled with a cynical disregard for maintenance and the terms of loan agreements have almost destroyed the earning power of the properties and eliminated them as security for the service of their construction loans. The pitiable condition of China's railways has precipitated the movement for the employment of a foreign directed police, auditors and traffic managers to safeguard the bondholders and save something from the wreck. As matters stand, it is hopeless for China to expect foreign financial aid in the reconstruction or extension of her transportation system except under such conditions as will provide adequate guarantees that the interests of the bondholders will be protected, and from the present outlook, new construction is out of the question for many years unless existing railway revenues are, set aside for its financing. The one and only hope for an early resumption of railway construction in China lies in the complete severance of the railway board from the other ministries and the application of an independent budget system that will set aside the revenues of existing lines for financing extensions through foreign loans.

When we recall that British and French investors have furnished practically all the funds for the construction of Chinese railways and have seen their security all but ruined by the application of a policy which admits of no intervention for protecting their interests, we can better understand and sympathize with the movement to bring all the lines under more effective control. There is no good reason why China's railways should not contribute a handsome surplus to the national treasury over and above the sums needed for the service of old loans and new construction. The remarkable results arising from efficient management and protection can be seen in a comparison of the Chinese government railway statistics with the results obtained by the Japanese owned and operated South Manchuria system. Remembering that the population of China proper is placed at several hundred per square mile while that of Manchuria is 35 to 40, the following figures compiled from official reports tell their own story.

In the first table will be found a comparison of the mileage of all Chinese government lines with that of the South Manchuria railway over the period 1915-1920. It will be seen that the Chinese [illegible] total length of 6,042 kilometres or nearly six times [illegible] of the Manchurian lines of 1,106 km. With this handicap, (Table 2) the South Manchuria Railway enjoys a revenue per kilometer of $77,140 (silver Yuan) against $15,689 for the Chinese system. With one-sixth the mileage the Japanese operated lines benefit in revenues five times the amount collected by China. In Table 3, we find that the Japanese line has 30 locomotives per 100 km. with a tractive power (Table 4) of 436 metric tons against 13 locos with a tractive power of 131 metric tons for the Chinese lines. The Japanese line has 30 passenger cars (Table 5) per 100 km. against 23 for the Chinese and 508 freight cars (Table 6) with a capacity of 13,673 metric tons (Table 7) against 203 with a capacity of 5,028 metric tons for the Chinese lines. The average number of paying passengers transported per kilometre by the S. M. R. is 7,344 (Table 8) bringing in a revenue of $12,341 against 5,241 passengers with a revenue of $5,397 for the Chinese system. The average metric tonnage carried by the S. M. R. per km. is 8,329 against 3,693 for the Chinese lines, or an average *total* per km. of 3,017,000 metric tons against 758,000 metric tons for the Chinese system. The average freight receipts per km. for the S. M. R. are $57,476 or about seven times greater than the $8,454 collected by the Chinese lines.

These figures are eloquent and explain why the South Manchuria Railway can raise a loan participated in by the most important British bank in China without difficulty, while the same group of bankers demand exceptional guarantees from China. At the same time, the comparison clearly conveys the reason why other powers decline to intervene or take sides in the never ending political squabbles started by China to drive Japan out of Kwantung and Manchuria. The restoration of the S.M.R. terminus and deep water port to Chinese sovereignty would simply invite the same catastrophe which has befallen all other important foreign investments when placed under Chinese direction. One year of Chinese misgovernment in Kwantung and the railway zone, would wipe out one of the most important civilizing influences in the whole of Asia.

Bearing in mind the great difference in the density of population and industrial development between China proper and the territory served by the S.M.R., it would seem that with efficient honest direction the 6,000 kilometres of Chinese operated state railways could be brought to earn revenues of $462,840,000 per year, the same as the Japanese managed line, instead of the present $94,000,000. The difference of $368,000,000 would pay for all new railway construction, finance the government and create industries without having to call on foreigners for financial assistance. The S.M.R. figures at the best are only an indication of what the future holds out, for as the branches under construction are completed opening up new territory to agriculture and colonization, as northern Manchuria contributes her quota of wheat and flour for export, as the Fushun mines reach their full output and other resources are developed, the revenues of the S.M.R. may be expected to double. Every energy of its management is directed towards this end, and each year it becomes necessary to provide new capital in the form of loans to hasten development. China has a wonderful example in her own territory of what she can expect when her railways, no longer the playthings of politicians and *tuchuns*, are brought under efficient management through an independent railway commission working in harmony with friendly foreign assistance.

COMPARATIVE STATISTICS OF THE CHINESE GOVERNMENT AND SOUTH MANCHURIA RAILWAYS.

| | *1915* | *1916* | *1917* | *1918* | *1919* | *1920* |
|---|---|---|---|---|---|---|
| **Length of Line I. in km. including Branches.** | | | | | | |
| Peking-Hankow Railway ... | 1,316 | 1.313 | 1.313 | 1.313 | 1.313 | 1.321 |
| Peking-Mukden ... ... | 965 | 965 | 975 | 975 | 975 | 975 |
| Tientsin-Pukow ... ... | 1,107 | 1.107 | 1.107 | 1.107 | 1.107 | 1.107 |
| Shanghai-Nanking ... ... | 327 | 327 | 327 | 327 | 327 | 327 |
| Shanghai-Hangchow-Ningpo.. | 270 | 286 | 286 | 286 | 286 | 286 |
| Peking-Suiyuan ... ... | 429 | 467 | 467 | 495 | 495 | 499 |
| Cheng-Tai ... ... ... | 243 | 243 | 243 | 243 | 243 | 243 |
| Chinghua-Taoku ... ... | 152 | 152 | 152 | 152 | 152 | 152 |
| Pienlo ... ... ... | 185 | 185 | 185 | 185 | 185 | 185 |
| Kirin-Changchun ... ... | 130 | 130 | 130 | 130 | 125 | 125 |
| Pinghsiang-Chuchow ... | 97 | 97 | 97 | 91 | 91 | 91 |
| Canton-Kowloon ... ... | 143 | 143 | 143 | 143 | 143 | 143 |
| Canton-Sanshui ... ... | 49 | 49 | 49 | 49 | 49 | 49 |
| Changchow-Amoy ... ... | 32 | 28 | 29 | 28 | 28 | 28 |
| Canton-Hankow ... ... | — | — | — | — | 423 | 423 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 88 | 88 |
| Total ... ... | 5,445 | 5,492 | 5,503 | 5,524 | 6,030 | 6,042 |
| South Manchuria ... ... | 1,112 | 1,112 | 1,112 | 1,112 | 1,109 | 1,106 |
| **Gross Receipts per Kilometre Yuen (silver dollar).** | | | | | | |
| Peking-Hankow Railway ... | 13,099 | 15,653 | 14,353 | 18,291 | 20,343 | 19,905 |
| Peking-Mukden ... ... | 15,985 | 15,745 | 18,053 | 22,058 | 21,211 | 24,069 |
| Tientsin-Pukow ... ... | 7,729 | 9,318 | 9,589 | 11,443 | 12,836 | 14,701 |
| Shanghai-Nanking ... ... | 10,529 | 11,737 | 12,991 | 15,003 | 17,572 | 21,058 |
| Shanghai-Hangchow-Ningpo.. | 7,674 | 6,556 | 7,965 | 8,493 | 9,266 | 10,636 |
| Peking-Suiyan ... ... | 8,450 | 8,407 | 8,060 | 9,131 | 10,083 | 11,729 |
| Cheng-Tai ... ... ... | 8,823 | 9,074 | 10,494 | 13,395 | 14,111 | 16,284 |
| Chinghua-Taoku ... ... | 4,164 | 5,493 | 6,158 | 6,296 | 6,480 | 8,007 |
| Pienlo ... ... ... | 6,281 | 7,000 | 7,503 | 7,016 | 9,265 | 14,141 |
| Kirin-Changchun ... ... | 7,031 | 7,208 | 8,754 | 13,731 | 15,336 | 20,480 |
| Pinghsiang-Chuchow ... | 7,113 | 7,670 | 6,340 | 6,121 | 7,703 | 6,571 |
| Canton-Kowloon ... ... | 5,713 | 5,643 | 6,594 | 6,406 | 6,923 | 7,280 |
| Canton-Sanshui ... ... | 17,388 | 19,653 | — | — | — | — |
| Changchow-Amoy ... ... | 594 | 1,679 | 1,828 | 1,679 | 1,000 | 500 |
| Canton-Hankow ... ... | — | — | — | — | 468 | 378 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 3,580 | 9,250 |
| Average ... ... | 10,577 | 11,568 | 11,807 | 14,276 | 14,140 | 15,689 |
| South Manchuria Railway ... | 21,487 | 25,013 | 30,987 | 40,461 | 60,470 | 77,140 |
| **Number of Locomotives per 100 km.** | | | | | | |
| Peking-Hankow Railway ... | 10 | 10 | 11 | 11 | 11 | 12 |
| Peking-Mukden ... ... | 15 | 16 | 16 | 16 | 17 | 18 |
| Tientsin-Pukow ... ... | 9 | 8 | 8 | 8 | 9 | 11 |
| Shanghai-Nanking ... ... | 11 | 11 | 11 | 11 | 11 | 13 |
| Shanghai-Hangchow-Ningpo.. | 13 | 13 | 13 | 13 | 13 | 13 |
| Peking-Suiyuan ... ... | 14 | 13 | 14 | 14 | 14 | 16 |
| Cheng-Tai ... ... ... | 23 | 23 | 23 | 23 | 23 | 23 |
| Chinghua-Taoku ... ... | 7 | 7 | 7 | 7 | 8 | 8 |

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Pienlo ... ... ... ... | 8 | 8 | 8 | 8 | 8 | 8 |
| Kirin-Chengchun ... ... | 10 | 10 | 10 | 10 | 14 | 14 |
| Pinghsiang-Chuchow ... | 12 | 12 | 12 | 13 | 13 | 13 |
| Canton-Kowloon ... ... | 10 | 10 | 10 | 10 | 10 | 10 |
| Canton-Sanshui ... ... | 20 | 8 | — | — | — | — |
| Changchow-Amoy ... ... | 6 | 8 | 7 | 7 | 7 | 7 |
| Canton-Hankow ... ... | — | — | — | — | 5 | 8 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 6 | 6 |
| Average ... ... | 12 | 12 | 12 | 12 | 12 | 13 |
| South Manchuria Railway ... | 24 | 24 | 24 | 26 | 30 | 30 |

Traction Power of a Locomotive per 100 km. (metric ton).

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 86 | 86 | 99 | 98 | 98 | 117 |
| Peking-Mukden ... ... | 126 | 136 | 137 | 139 | 161 | 174 |
| Tientsin-Pukow ... ... | 87 | 87 | 87 | 87 | 101 | 144 |
| Shanghai-Nanking ... ... | 94 | 94 | 94 | 94 | 94 | 110 |
| Shanghai-Hangchow-Ningpo.. | 122 | 114 | 114 | 114 | 114 | 114 |
| Peking-Suiyuan ... ... | 179 | 169 | 189 | 191 | 191 | 206 |
| Cheng-Tai ... ... ... | 123 | 123 | 123 | 123 | 123 | 123 |
| Chinghua-Taoku ... ... | 57 | 45 | 57 | 57 | 71 | 71 |
| Pienlo ... ... ... ... | 64 | 64 | 64 | 64 | 56 | 56 |
| Kirin-Changchun ... ... | 86 | 86 | 61 | 83 | 128 | 128 |
| Pinghsiang-Chuchow ... | 96 | 96 | 96 | 101 | 101 | 101 |
| Canton-Kowloon ... ... | 82 | 82 | 81 | 81 | 81 | 81 |
| Canton-Sanshui ... ... | 116 | 117 | — | — | — | — |
| Changchow-Amoy ... ... | 34 | 38 | 38 | 38 | 38 | 21 |
| Canton-Hankow ... ... | — | — | — | — | 63 | 97 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 13 | 68 |
| Average ... ... | 103 | 104 | 109 | 110 | 112 | 131 |
| South Manchuria Railway ... | 302 | 205 | 305 | 338 | 411 | 435 |

Number of Passenger-Cars per 100 km.

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 14 | 18 | 14 | 17 | 20 | 21 |
| Peking-Mukden ... ... | 35 | 35 | 36 | 30 | 29 | 31 |
| Tientsin-Pukow ... ... | 20 | 20 | 20 | 18 | 18 | 18 |
| Shanghai-Nanking ... ... | 31 | 31 | 31 | 31 | 31 | 31 |
| Shanghai-Hangchow-Ningpo.. | 42 | 40 | 43 | 44 | 44 | 48 |
| Peking-Suiyuan ... ... | 19 | 17 | 17 | 19 | 19 | 20 |
| Cheng-Tai ... ... ... | 20 | 21 | 21 | 21 | 21 | 21 |
| Chinghua-Taoku ... ... | 18 | 15 | 14 | 12 | 12 | 12 |
| Pienlo ... ... ... ... | 19 | 19 | 21 | 26 | 26 | 31 |
| Kirin-Changchun ... ... | 20 | 20 | 19 | 13 | 14 | 14 |
| Pinghsiang-Chuchow ... | 16 | 17 | 17 | 18 | 18 | 24 |
| Canton-Kowloon ... ... | 31 | 31 | 29 | 29 | 29 | 29 |
| Canton-Sanshui ... ... | 85 | 86 | — | — | — | — |
| Changchow-Amoy ... ... | 18 | 21 | 25 | 25 | 25 | 25 |
| ffanson-Hankow ... ... | — | — | — | — | 12 | 11 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 13 | 14 |
| Average ... ... | 23 | 24 | 24 | 23 | 22 | 23 |
| South Manchuria Railway ... | 19 | 20 | 21 | 23 | 27 | 30 |

Number of Freight—Cars per 100 km.

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 204 | 200 | 201 | 203 | 201 | 251 |
| Peking-Mukden ... ... | 244 | 344 | 345 | 350 | 345 | 386 |
| Tientsin-Pukow ... ... | 119 | 119 | 123 | 126 | 117 | 117 |
| Shanghai-Nanking ... ... | 134 | 133 | 133 | 134 | 134 | 134 |
| Shanghai-Hangchow-Ningpo | 195 | 180 | 177 | 177 | 176 | 168 |
| Peking-Suiyuan ... ... | 200 | 185 | 186 | 172 | 172 | 177 |
| Cheng-Tai ... ... ... | 258 | 258 | 258 | 258 | 258 | 258 |
| Chinghua-Taoku ... ... | 105 | 108 | 111 | 123 | 134 | 215 |
| Pienlo ... ... ... ... | 119 | 119 | 112 | 108 | 111 | 105 |
| Kirin-Changchun ... ... | 178 | 178 | 176 | 182 | 182 | 182 |
| Pinghsiang-Chuchow ... | 190 | 190 | 190 | 208 | 208 | 198 |
| Canton-Kowloon ... ... | 44 | 45 | 47 | 47 | 47 | 47 |
| Canton-Sanshui ... ... | 41 | 41 | — | — | — | — |
| Changchow-Amoy ... ... | 31 | 36 | 32 | 32 | 32 | 41 |
| Canton-Hankow ... ... | — | — | — | — | 85 | 85 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 26 | 32 |
| Average ... ... | 196 | 193 | 194 | 197 | 189 | 203 |
| South Manchuria Railway ... | 286 | 286 | 308 | 377 | 433 | 508 |

Capacity of Freight-Car metric ton.

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 4,254 | 4,255 | 4,269 | 4,270 | 4,259 | 6,377 |
| Peking-Mukden ... ... | 7,482 | 7,365 | 7,423 | 7,389 | 8,876 | 9,319 |
| Tientsin-Pukow ... ... | 2,841 | 2,853 | 2,988 | 3,016 | 2,850 | 2,845 |
| Shanghai-Nanking ... ... | 3,400 | 3,328 | 3,306 | 3,320 | 3,330 | 3,326 |
| Shanghai-Hangchow-Ningpo . | 5,653 | 5,133 | 5,052 | 5,040 | 4,949 | 4,720 |
| Peking-Suiyuan ... ... | 5,760 | 5,203 | 5,228 | 4,840 | 4,837 | 4,869 |
| Cheng-Tai ... ... ... | 5,190 | 5,272 | 5,272 | 5,272 | 5,272 | 5,276 |
| Chinghua-Taoku ... ... | 2,983 | 3,028 | 3,113 | 3,507 | 3,802 | 6,898 |
| Pienlo ... ... ... ... | 2,389 | 2,389 | 1,697 | 2,163 | 2,227 | 2,108 |
| Kirin-Changchun ... ... | 3,832 | 3,772 | 3,699 | 3,699 | 3,799 | 3,799 |
| Pinghsiang-Chuchow ... | 3,822 | 3,762 | 3,762 | 4,037 | 4,037 | 3,961 |
| Canton-Kowloon ... ... | 1,017 | 1,042 | 1,085 | 1,085 | 1,085 | 938 |
| Canton-Sanshi ... ... | 1,122 | 1,103 | — | — | — | — |
| Changchow-Amoy ... ... | 631 | 714 | 642 | 642 | 642 | 642 |
| Canton-Hankow ... ... | — | — | — | — | 2,053 | 2,048 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 712 | 867 |
| Average ... ... | 4,468 | 4,389 | 4,399 | 4,440 | 4,434 | 5,028 |
| South Manchuria Railway ... | 7,806 | 7,839 | 8,351 | 10,175 | 11,639 | 13,673 |

Average Number of Persons Transported per km.

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 2,075 | 2,374 | 2,574 | 2,751 | 3,072 | 3,036 |
| Peking-Mukden ... ... | 3,557 | 3,625 | 3,896 | 3,667 | 3,603 | 5,204 |
| Tientsin-Pukow ... ... | 2,148 | 2,481 | 1,974 | 2,211 | 2,344 | 2,900 |
| Shanghai-Nanking ... ... | 16,632 | 17,494 | 17,687 | 19,563 | 21,778 | 25,054 |
| Shanghai-Hangchow-Ningpo.. | 15,511 | 14,380 | 16,3[illegible]6 | 17,730 | [illegible] | [illegible] |
| Peking-Suiyuan ... ... | 1,634 | [illegible],747 | 1,980 | [illegible] | [illegible] | [illegible] |
| Cheng-Tai ... ... ... | 1,017 | 977 | 1,047 | 1,126 | [illegible] | [illegible] |
| Chinghua-Taoku ... ... | 1,429 | 761 | 1 407 | 1 562 | 1 800 | 2,068 |
| Pienlo ... ... ... ... | 2,814 | 3,046 | 3,020 | 3,204 | 4,101 | 5,282 |
| Kirin-Changchun ... ... | 2,058 | 2,071 | 2,914 | 3,003 | 2,520 | 3,822 |
| Pinghsiang-Chuchow ... | 3,601 | 3,913 | 3,357 | 1,422 | 3,671 | 3,776 |
| Canton-Kowloon ... ... | 15,397 | 14,405 | 14,321 | 12,305 | 12,973 | 13,554 |
| Canton-Sanchui ... ... | 85,207 | 133,157 | — | — | — | — |
| Changchow-Amoy ... ... | — | 7,382 | 7,226 | 4,234 | — | 720 |
| Canton-Hankow ... ... | — | — | — | — | 1,752 | — |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 896 | 2,162 |
| Average ... ... | 4,811 | 5,531 | 4,663 | 2,825 | 4,674 | 5,241 |
| South Manchuria Railway ... | 3,335 | 3,966 | 5,256 | 6,737 | 8,362 | 7,344 |

Average Passenger Receipts per km. Tickets Receipts only.
Yuen (silver dollar)

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 2,958 | 3,334 | 3,369 | 4,036 | 4,903 | 5,585 |
| Peking-Mukden ... ... | 5,629 | 6,128 | 8,721 | 7,833 | 7,600 | 10,375 |
| Tientsin-Pukow ... ... | 2,989 | 3,488 | 3,766 | 4,498 | 4,977 | 5,728 |
| Shanghai-Nanking ... ... | 7,166 | 7,747 | 8,185 | 8,700 | 9,911 | 11,338 |
| Shanghai-Hangchow-Ningpo. | 4,702 | 4,386 | 5,102 | 5,508 | 5,900 | 6,752 |
| Peking-Suiyuan ... ... | 1,836 | 1,820 | 1,852 | 1,748 | 2,341 | 2,494 |
| Cheng-Tai ... ... ... | 1,782 | 1,831 | 1,835 | 2,097 | 2,323 | 2,635 |
| Chinghua-Taoku ... ... | 703 | 804 | 845 | 891 | 1,124 | 1,223 |
| Pienlo ... ... ... | 2,943 | 3,074 | 2,924 | 3,009 | 3,921 | 4,723 |
| Kirin-Changchun ... ... | 2,574 | 2,638 | 2,911 | 4,141 | 4,468 | 5,388 |
| Pinghsiang-Chuchow ... | 1,146 | 1,187 | 684 | 528 | 1,302 | 1,316 |
| Canton-Kowloon ... ... | 4,754 | 4,542 | 3,735 | 5,168 | 5,809 | 6,202 |
| Canton-Sanshui ... ... | 16,530 | 18,184 | — | — | — | — |
| Changchow-Amoy ... ... | — | 1,483 | 1,700 | 803 | — | 77 |
| Canton-Hankow ... ... | — | — | — | — | 919 | 1,227 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 1,112 | 2,706 |
| Average ... ... | 3,705 | 3,998 | 4,209 | 4,703 | 4,782 | 5,397 |
| South Manchuria Railway ... | 4,085 | 5,034 | 6,813 | 9,788 | 11,879 | 12,341 |

Average Metric Tonnage Transported per km. metric ton.

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 2,705 | 2,669 | 2,746 | 2,992 | 3,627 | 3,509 |
| Peking-Mukden ... ... | 5,629 | 5,164 | 5,545 | 6,169 | 6,805 | 7,207 |
| Tientsin-Pukow ... ... | 1,826 | 1,940 | 1,792 | 2,217 | 2,404 | 2,615 |
| Shanghai-Nanking ... ... | 2,568 | 2,740 | 2,973 | 3,458 | 4,134 | 4,275 |
| Shanghai-Hangchow-Ningpo. | 1,733 | 1,276 | 1,621 | 1,623 | 1,728 | 2,043 |
| Peking-Suiyuan ... ... | 2,465 | 3,901 | 2,363 | 2,625 | 2,785 | 2,995 |
| Cheng-Tai ... ... ... | 2,560 | 3,290 | 3,491 | 4,656 | 4,771 | 4,983 |
| Chinghua-Taoku ... ... | 3,726 | 5,477 | 6,439 | 6,133 | 6,116 | 5,906 |
| Pienlo ... ... ... | 1,493 | 2,119 | 2,537 | 2,127 | 2,658 | 2,588 |
| Kirin-Changchun ... ... | 2,979 | 2,983 | 2,408 | 3,513 | 3,905 | 5,196 |
| Pinghsiang-Chuchow ... | 6,499 | 6,828 | 5,618 | 4,183 | 6,405 | 4,838 |
| Canton-Kowloon ... ... | 438 | 547 | 688 | 663 | 564 | 555 |
| Canton-Sanshui ... ... | 179 | 420 | — | — | — | — |
| Changchow-Amoy ... ... | — | 69 | 90 | 197 | 76 | 35 |
| Canton-Hankow ... ... | — | — | — | — | 2,740 | 2,881 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 1,218 | 2,786 |
| Average ... ... | 2,941 | 3,033 | 3,069 | 3,353 | 3,547 | 3,693 |
| South Manchuria Railway ... | 4,781 | 5,083 | 5,933 | 6,799 | 8,260 | 8,329 |

Average Total Metric Tonnage per km. 1000 metric tons.

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 515 | 634 | 576 | 832 | 943 | 1,049 |
| Peking-Mukden ... ... | 744 | 678 | 825 | 933 | 1,031 | 1,075 |
| Tientsin-Pukow ... ... | 332 | 489 | 542 | 650 | 703 | 800 |
| Shanghai-Nanking ... ... | 523 | 599 | 612 | 773 | 930 | 930 |
| Shanghai-Hangchow-Ningpo. | 154 | 120 | 169 | 182 | 204 | 253 |
| Peking-Suiyuan ... ... | 236 | 250 | 225 | 270 | 319 | 421 |
| Cheng-Tai ... ... ... | 101 | 264 | 289 | 369 | 401 | 467 |
| Chinghua-Taoku ... ... | 289 | 408 | 437 | 440 | 441 | 440 |
| Pienlo ... ... ... ... | 117 | 152 | 162 | 155 | 172 | 195 |
| Kirin-Changchun ... ... | 166 | 178 | 207 | 343 | 341 | 346 |
| Pinghsiang-Chuchow... ... | 607 | 638 | 527 | 324 | 553 | 422 |
| Canton-Kowloon ... ... | 23 | 31 | 41 | 45 | 35 | 36 |
| Canton-Sanshui ... ... | 5 | 4 | — | — | — | — |
| Changchow-Amoy ... ... | — | 1 | 2 | 2 | 1 | 15 |
| Canton-Hankow ... ... | — | — | — | — | 128 | 144 |
| Ssupingkai-Chengchiatun ... | — | — | — | — | 85 | 183 |
| Average ... ... | 416 | 477 | 502 | 616 | 641 | 758 |
| South Manchuria Railway ... | 1,508 | 1,709 | 1,982 | 2,239 | 2,721 | 3,017 |

Average Freight Traffic Receipts per km. Yuen (silver dollar)

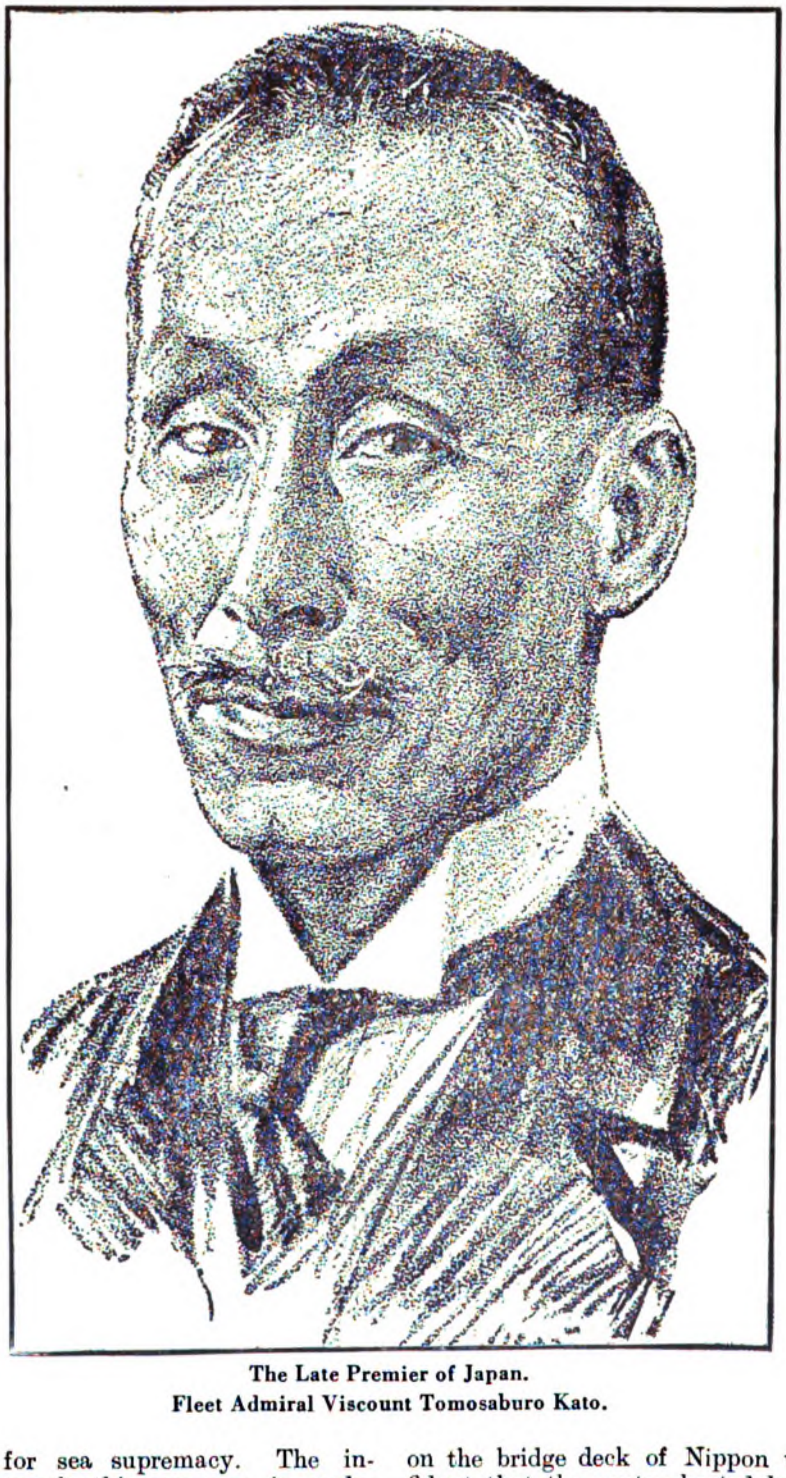
| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 |
|---|---|---|---|---|---|---|
| Peking-Hankow Railway ... | 9,291 | 10,663 | 9,783 | 12,516 | 13,863 | 13,437 |
| Peking-Mukden ... ... | 9,124 | 7,948 | 9,539 | 11,760 | 10,605 | 11,945 |
| Tientsin-Pukow ... ... | 3,525 | 4,509 | 4,518 | 5,374 | 5,898 | 7,141 |
| Shanghai-Nanking ... ... | 2,501 | 2,962 | 3,609 | 4,627 | 5,510 | 5,564 |
| Shanghai-Hangchow-Ningpo. | 1,987 | 1,553 | 1,927 | 2,365 | 2,564 | 2,965 |
| Peking-Suiyuan ... ... | 5,619 | 5,664 | 5,338 | 6,289 | 6,611 | 8,052 |
| Cheng-Tai ... ... ... | 6,414 | 6,189 | 7,519 | 9,775 | 10,162 | 11,935 |
| Chinghua-Taoku ... ... | 3,343 | 4,526 | 5,131 | 5,024 | 4,949 | 4,964 |
| Pienlo ... ... ... | 3,048 | 3,730 | 3,513 | 2,949 | 4,255 | 4,283 |
| Kirin-Changchun ... ... | 3,961 | 3,926 | 4,854 | 8,573 | 9,098 | 10,171 |
| Pinghsiang-Chuchow ... | 5,772 | 6,293 | 5,223 | 4,277 | 6,093 | 4,838 |
| Canton-Kowloon ... ... | 518 | 752 | 864 | 913 | 350 | 913 |
| Canton-Sanshui ... ... | 338 | 834 | — | — | — | — |
| Changchow-Amoy ... ... | — | 44 | 49 | 55 | 39 | 46 |
| Canton-Hankow ... ... | — | — | — | — | 1,448 | 1,453 |
| Ssupingkai Chengchiatun ... | — | — | — | — | 2,062 | 4,606 |
| Average ... ... | 6,003 | 6,331 | 6,446 | 7,961 | 7,839 | 8,454 |
| South Manchuria Railway ... | 15,522 | 17,880 | 21,391 | 27,318 | 41,754 | 57,746 |

# Tomosaburo Kato

It is barely two years since Takashi Hara, the great commoner and leader of liberal Japan was stricken down by the dagger of an assassin at a time when the nation was passing through the most eventful crisis of its long history. Many there were, even in Japan, who believed that he was the one statesman who weilded the power to dominate the situation and pilot the government through the perilous seas of international intrigue, distrust and hostility. The forward movement, however, had carried Japan so far towards the goal of liberal ideals, that his death could not alter the course and when he died the helm was taken over by Viscount Takahashi only to be surrendered in a few months to the capable hands of Admiral Viscount Kato who navigated the ship of state to a safe anchorage in the haven of world sympathy, confidence and good-will.

Death has again deprived Japan of her guiding spirit. Premier Kato has passed on. Japan has lost a grand and noble son, a warrior and statesman incarnating the traditional chivalry and those sterling qualities of the Samurai which have carried the nation to its present proud place amongst the great powers of the world. Japan's loss is a loss to the world. Few indeed are the great men of the day who have attained to such a high place in the esteem of other nations as the gallant sailor-son of Nippon who gladly accepted the scrapping of a navy he had labored years to create in order that peace might come to his people and would confidence in their government restored.

Amongst the great fleet captains of other nations whose names go thundering down the pages of history are few who have equalled the exploit of this silent, grim and effective tactician, who as Togo's chief of staff, directed and won the most decisive naval battle of modern times. Few indeed are the great naval commanders who have lived to see their cherished plans developed to a point where other powerful nations have been influenced into calling a halt in the race for sea supremacy. The indomitable will which carried through this program in order that the empire would retain its hard won place in a hostile world, typifies the spirit which animates Japan in her determination to defend herself at all costs against any menace to her national existence.



The Late Premier of Japan.
Fleet Admiral Viscount Tomosaburo Kato.

At the Washington conference, the brilliant statesmen and seasoned diplomats of the West were brought face to face perhaps for the first time in their long careers, with the real Japan. Admiral Baron Kato, the warrior-statesmen, come as a revelation which dispelled all previous conceptions. His candor, straightforwardness and sincere desire to work in friendly accord with the powers of the west won for him a fame which outshines the honors accorded to other delegates. Kato was the outstanding figure of the conference. His face, it was said, looked a little like the map of his country, inscrutable, cold and hard. "It would be murder to sit in a poker game with him" said a brilliant American correspondent. These careless remarks, however to the point, ignored the past history of the man who stood silently on the bridge of the *Mikasa* awaiting with folded arms the fateful moment to give the command which would decide his country's fate for all time. He stood in the same position at Washington facing a hostile conference, cool, calm and collected, speaking sparingly and to the point when speech became necessary, reserving until the proper time the final word which once more would decide the fate of Japan.

Kato sat in a poker game in which the future of nations was at stake. Others, with immense reserves of wealth could afford to smile, crack jokes and take liberties with their play. Japan, however. could take no chances, so Kato played his cards with a face which betrayed no sign of his emotions and only when satisfied that the game was honest, a fair give and take on all sides, did the cold, set, poker face relax revealing to the onlookers a countenance which truly reflected the dauntless spirit which shines through the soul map of Japan.

Kato is gone but his work will go forward. His successor on the bridge deck of Nippon will steer the same course confidant that the route charted by the gallant admiral will maintain the position of the nation abreast the other liberal powers in the vanguard of civilization.

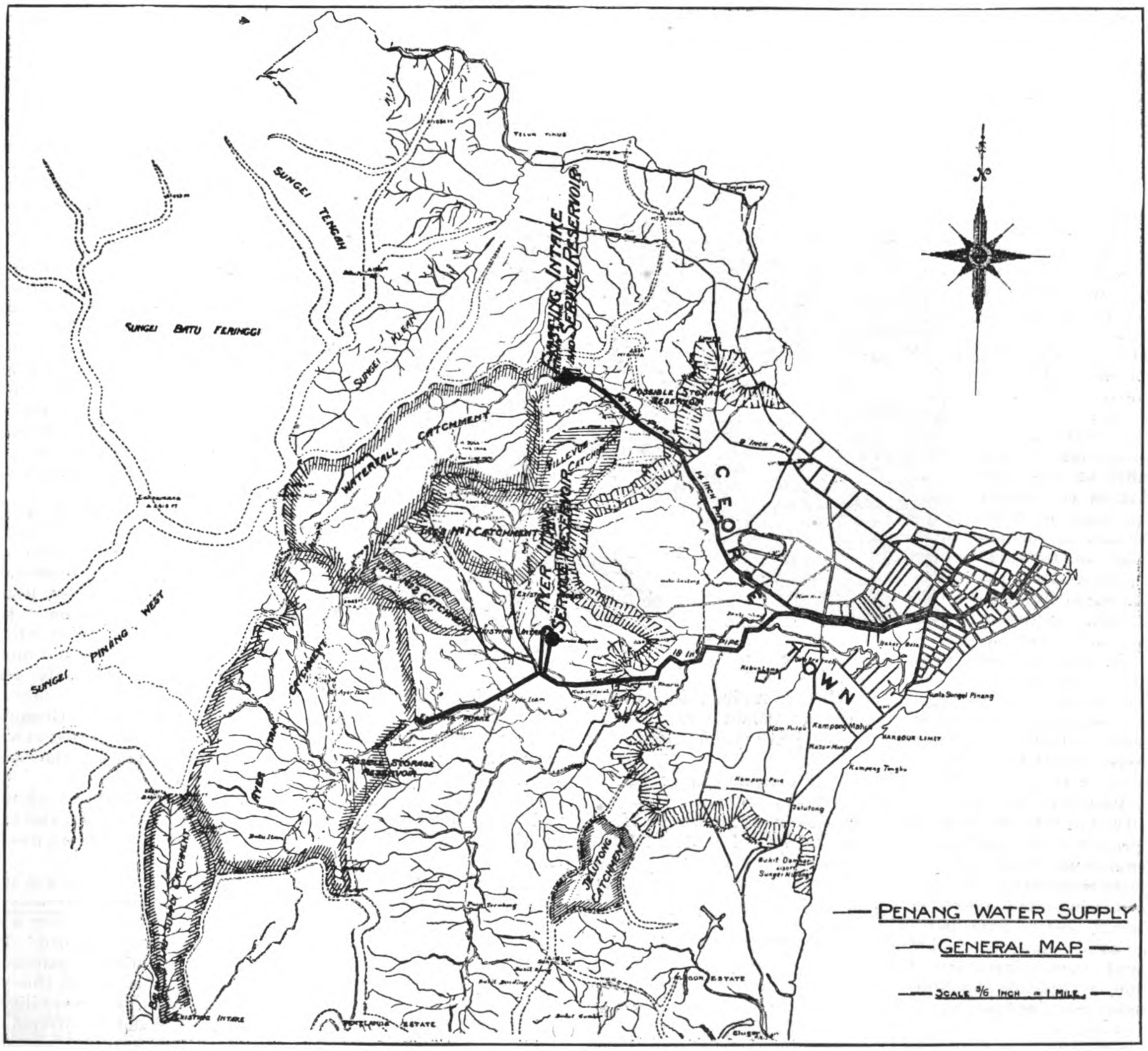
# Notes on the Penang Water Supply

## 1

### Paper Read Before the Engineering Association of Malaya

*By J. D. Fettes, Assoc. M. Inst. C.E.*

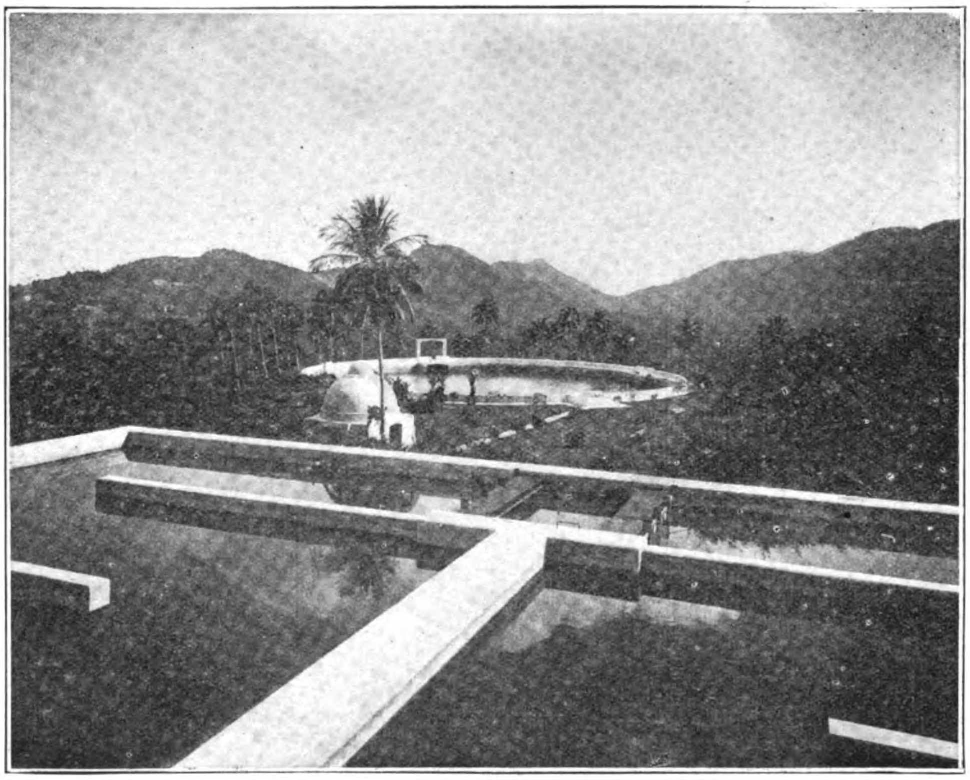
THE Ayer Itam service reservoir and its dependent works may be said to be the latest addition to the water supply works of the municipality of George town. Before describing the reservoir it will be interesting perhaps to give shortly some of the history of the water supply prior to the construction of the reservoir (so far as it has been found possible to trace it).




It was in 1803 that Macalister, a captain of artillery, who had lived ten years in Penang, put out a suggestion that a pipe be laid from the waterfall stream to a suggested jetty near the point at Fort Cornwallis for the supply of his majesty's ships. In 1804 the town drew its water supply wholly from wells, and boats were in the habit of going up the Sungei Pinang on the flood tide, filling their water casks from the river at half-ebb, then waiting for the flood tide or its succeeding ebb-tide to get back with water to their ships. "As the men employed in the water boats are very careless, frequent complaints are made of the quality of the water, owing to the casks being filled too soon. To remedy these serious inconveniences, to expedite the departure of ships (particularly men-of-war, who are often pressed for time) and to add, in some degree, to the revenue by taking the watering of the ships entirely into the hands of government, it is pro-

posed to bring one of the small streams down to town either by pipes, or an aqueduct, to form a large reservoir near the present hospital, and from thence convey the water by pipes to a pier head where the boats may come and have their casks filled without trouble or delay; the town could also be furnished with water, if required, by pipes from the reservoir." In 1827 "good water, the source of which is a waterfall from one of the hills, is conveyed in an aqueduct of clay to the English town, and it goes through our grounds." Then we read that in 1830 "An aqueduct extending for several miles conducts water from one of the hills to the harbor, where ships' boats are readily and expeditiously supplied. This, however, has got into disrepair and being uncovered is frequently made the receptacle of every kind of filth, so that the water, by the time it reaches the town, it not always of the purest description. A new and more commodious one, therefore in which water is conveyed by iron pipes underground, is now in progress and is nearly completed. By this not only the shipping, but the town and various public establishments will be supplied with this indispensable article of life in a state of great purity."

The date of the construction of the open aqueduct referred to in para. 2 has not been traced but it is probable that it commenced at an intake on the waterfall stream in grounds that are now known as hill rise (from the name of the house that not long ago stood there about 100 yards to the eastward of the botanical gardens gate) and which water course seems to have followed the right-of-way or reserve road on the north side of the river more or less parallel to the river as far as the Chetty temple where it turned north and ran roughly parallel to Gottlieb-road, then down the north side of Burmah-road and eventually found an outlet at Prangin, but supplied the town probably by way of Hutton lane or Argyle-road. The iron pipe referred to in para. 2 was apparently a 6-in. pipe which was laid from a tank or reservoir in Burmah-road at College Lane just beyond what is now the village of Pulau Tikus.



The Ayer Itam Service Reservoir, Penang

About 1856 or 1857 a 9-in. fire clay pipe was laid from the same Pulau Tikus reservoir to supplement the supply.

Then in 1867 we know that a 9-in. cast iron pipe was laid from the present high level waterfall intake by way of Waterfall-road, Burmah-road, Pulau Tikus, Hutton lane, Argyle-road, Chulia-street to Beach-street, the old 6-in. pipe from Pulau Tikus reservoir or tank being lifted and partly re-laid in Beach-street (and possibly in Carnarvon-street and part of Northam-road). The 6-in. pipe in Beach-street, now, it is believed to be over 90 years old, is still in use and standing pressures of 80-lbs. per square inch. No information is available regarding the old 9-in. fire clay pipe which probably was also taken up, it being useless for the higher waterfall pressures.

During 1877 to 1878 a 16-in. cast iron main was substituted for the 9-in. cast iron main from the waterfall high level intake along Waterfall-road as far as the Chetty temple where it was reduced to 14-in. and continued by way of Western-road and Datok Kramat-road to Magazine corner. As the 9-in. main between the waterfall and the Chetty temple was to be lifted, a connection was made at the Chetty temple between the older 9-in. main and the 16-in. main, so that the 16-in. main supplied then, as it is doing to-day, the 14-in. main down Western-road and the 9-in. main down Burmah-road.

It was in 1878 that the government considered the proposal to establish botanical gardens in the waterfall valley.

In 1884 the supply was extended by tapping the two Tat's streams, but at a lower level than the intakes of to-day, by an intake apparently on No. 2 Tat's with an open channel from No. 1 Tat's to this intake, which was situated close to what is now to be the lower station of the hill railway, and the elevation of which was only 74-ft. above sea level. It is probable that this intake was originally the old Amie's mill dam, of which a picture is to be found in the library. From the intake a 12-in. pipe was laid by way of Ayer Itam-road and Datok Kiamat-road to town.

In 1890 the small supply in the Batu Lanchang hills was opened for the supply of the village of Jelutong.

In 1891 further additions were commenced by the construction of the waterfall service reservoir and the tapping of the main Ayer Itam stream at the old intake of a defunct electrical power company. From here an 18-in. main was laid along the Ayer Itam-road to about Kampong Bharu where it connected up with the 12-in. pipe already laid to town from Tat's, part of which 12-in. pipe was lifted. Both the waterfall reservoir and the 18-in. Ayer Itam main, as far as Kampong Bharu, were finished in 1892 and there can be no doubt that the supply from the Tat's sources tapped in 1884 automatically stopped, the Tat's intake being at too low level to be of any further service. Owing to defects the waterfall reservoir was not brought into use until 1894.

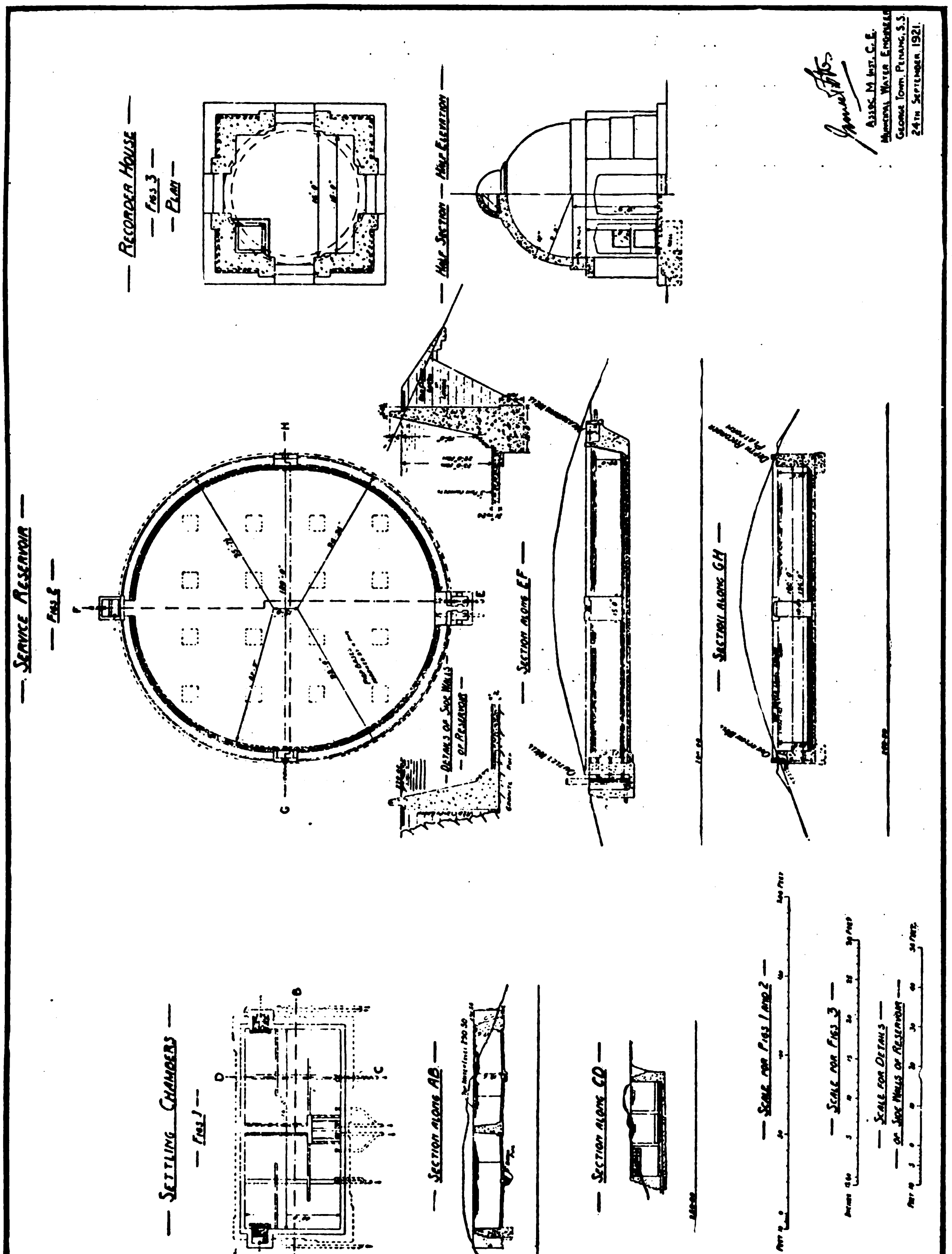
In 1894 we are told there was a drought and the supply was temporarily increased by leading the stream from Moniot's-road into the Ayer Itam intake. This probably refers to part of the Ayer Itam side stream.

In 1895 the 18-in. Ayer Itam main was extended to Green lane and the 12-in. pipes released thereby were re-used to bring in water from Tat's No. 1 but at a much higher level than was the case in 1884.

In 1896 the 18-in. Ayer Itam main was extended to York-road, in 1897 to Dunlop-road and in 1900 to Magazine corner, the 12-in. pipe laid in 1884 being lifted in sections as the 18-in. main was laid down.

In 1901 there was a drought and Tat's No. 2 stream was again tapped but at the higher level. It was also found necessary to pump water by fire engine into the 18-in. main from the river where it crossed the Ayer Itam-road just beyond Scotland-road. It is stated that the water available amounted to 3,676,000 gallons per day to meet a demand of 9,000,000 gallons. It was in this year that the municipal health officer referred to the possibility of dispensing with the supply from Tat's intakes and the diversion of drainage from the inhabited portion of the waterfall gathering ground.

The water supply position was so bad about this time that in 1903 it was recommended to the commissioners that "if supply by meter be not adopted construct large impounding reservoirs in the waterfall valley and at Paya Terubong, only one such to be




**PENANG WATER SUPPLY**

**Ayer Itam Service Reservoir Works**

constructed in the near future. . . . . .The remaining site to be utilized when the increased supply calls for it."

In 1909 the position was still very bad and the construction of the waterfall reservoir was again recommended, as was also the Ayer Itam service reservoir.

In 1909 the number of metered services was 1,568 and the number of unmetered services was 5,857, the average daily consumption being 7,297,000 gallons. In 1917 the metered services amounted to 7,067 and the unmetered services amounted to 891, the average consumption being 5,299,000 gallons per day. In 1918, which was a very dry year, the average daily consumption was 5,145,000 gallons but this was in part due to a scarcity of water and the town being on intermittent supply for a time. The town, however, continues to grow and there is now for the first six months in 1921 an average consumption of about 5,595,000 gallons per day, there being 8,582 metered services and 28 unmetered services, the latter being municipal supplies. The charges for water consumed vary from 5 cents per 1,000 gallons when the consumption is less than 12,000 gallons per month to 40 cents per 1,000 gallons for 50,000 gallons and over per month. There are other rates for special supplies such as shipping, etc. The population according to this year's census (1921) is approximately 123,000 persons living in 15,189 houses. The number of houses, etc., which are connected with the water supply amounted at 30th June, 1921 to 10,883. There are still many wells especially in the poor country districts which will be closed as the water supply is extended.

The Ayer Itam service reservoir works were constructed during the period 1911 to 1915 by administration.

In 1918 there was a severe drought and an emergency supply was drawn from the Villevue area (being part of the lower waterfall area).

There are no impounding reservoirs and the water supply system to-day is as follows :—

| | gall. per day |
|---|---|
| Waterfall catchment of 1,200 acres, driest flow .. | 1,600,000 |
| Additional, due to storage in service reservoir .. | 125,000 |
| Ayer Itam catchment of 2,050 acres, driest flow .. | 2,400,000 |
| Additional, due to storage in service reservoir .. | 125,000 |

| | gall. per day |
|---|---|
| Jelutong catchment of 220 acres, driest flow .. | 10,000 |
| Villevue (emergency) catchment of 200 acres, driest flow equals say .. .. .. .. .. .. | 50,000 |
| Tat's No. 1 catchment of 440 acres, driest flow .. | 350,000 |
| Tat's No. 2 catchment of 187 acres, driest flow .. | 140,000 |
| Total .. .. .. .. .. | 4,800,000 |

The two Tat's areas have become much polluted owing to diversion of drainage, construction of hill railway and cultivation and are not now used. Deducting these areas there remain some 4,310,000 gallons per day which are available during severe drought to meet a present demand of 5,595,000 gallons as an average as stated under para. 17 and probably 5,800,000 gallons as a minimum on a hot day.

As has been stated above, the Ayer Itam service reservoir works were built by administration during the years 1911 to 1915. As the site of these works was nearly a half-mile from the line of the Ayer Itam main in the Ayer Itam-road it was necessary to lay an 18-in. supply pipe from that main to the new works and an 18-in. delivery pipe back to the main in such a way that the return pipe should join the main above the point where a Venturi meter had been fixed in 1905.

A cement concrete bridge with floor of steel girder frame-work encased in concrete, costing $3,620 and let out to contract, was constructed across the Tat's stream to carry the Approach-road and the two lines of 18-in. cast iron pipes laid between the reservoir and the older main in the Ayer Itam-road.

The Approach roadway 10-ft. wide and tar-sprayed has gradients of 1 over 9.80 for the lower half of its length and 1 over 8.50 for the upper half and was mostly done by contract.

The 18-in. supply main may discharge into the settling chambers (top water level 290.50) the water after passing through these chambers being discharged into the service reservoirs (top water level 270.00), or it may discharge direct into the service reservoir. In either case the water is measured.

The works were designed to allow of mechanical filters being installed between the settling chambers and the service reservoir; and lest it should be found necessary to cover the reservoir when used as a clear water reservoir after filtration, cement concrete foundations, 10-ft. square, were put down in the floor of the reservoir to support the pillars that would carry the roof.

The two settling chambers are each nominally 60-ft. square with an average depth of 18-ft. and a capacity of about 700,000 gallons. They are constructed to be used separately but except when being cleaned they are used as one chamber, the water passing first through one and then through the other. The inlet wells to these chambers are 10-ft. by 4-ft. and 6½-ft. deep to overflow level, the water rising and overflowing into the main chamber. When the main chamber is empty, the incoming water overflows from the inlet well and runs down an incline of 4½ over 1 with curved bottom to the floor of the main chamber without shock. The floor of the main chamber slopes 1 over 30 to central sludge channel 2-ft. 6-in. in width and with depth varying from one foot at its upper end to two feet at the scour end. Training walls are provided so that the water in passing through the chambers will move with slow velocity along the greatest length of channel. The water is screened half way along its passage by two screens and again before leaving the second chamber. The inlet and outlet wells are cleaned every week and the main chambers every three months. All concrete work is of 1—2—3 cement concrete, laid in courses 3-ft. high bonded and grooved for water-tightness rendered on the exposed face with 1 to 1 cement mortar except the training walls which are of cement concrete bricks laid in cement mortar and rendered. The upper face of the floor is of fine concrete about 3-in. thick, rammed, cement dusted and floated to a smooth surface and of a mixture which works out to 1 of cement to 1.636 of granite crush. The outer walls are 3-ft. wide at the top and are stepped on the back 1-foot out at every 3-ft. down, the lowest course 8-ft. wide and 3½-ft. deep having a ¾-in. mild steel rod running along its centre. The intermediate or division wall is 4-ft. wide at the top with batters of 15 over 1 on a square base 8-ft. wide. The greater part of these chambers is on rock except at the south-west corner, where to prevent any chance of a breakaway, the foundation trench under the south and west walls was stepped down to a depth of about 25-ft. at the corner and this was filled with 1—2—3 cement concrete with displacers.

From the settling chambers the water passes through an 18-in. main to the inlet well of the service reservoir where it is measured over a rectangular weir 110-in. long, the depth on the weir being recorded automatically on a Kent float recorder fitted in the domed recorder house, a 1-in. pipe being laid between the inlet well of the reservoir and the float well of the recorder house for this purpose. An angle iron plate has also been fixed level with the top of the weir for check measurements. The water having passing over the gauge flows down an incline of 4¾ over 1 with curved bottom to the floor of the reservoir when empty without shock.

The reservoir is 205-ft. long by 190-ft wide at top water line made up of two semi-circles set off from centre points 15-ft. apart, these semi-circles being joined by a straight line of 15-ft. The mean depth is 22-ft. 6-in. and the capacity is four million gallons. The two outlet wells at the opposite end to the inlet well are provided with screens which can be lifted by an overhead chain block moving on an I-girder. The 18-in. draw-off valves between the reservoir and each outlet well are three in number, their inverts being 5, 13 and 21-ft. below top water level. The 12-in. scour or washout pipe fixed in the reservoir and the invert of which is at 24-ft. below top water level passes beneath the division wall of the outlet wells and to it are connected the 6-in. washout pipes from these wells.

The foundations of the reservoir are partly on solid granite, partly on granite badly fissured and partly on granite earth. Where on earth, the foundations are deeper by some 6-ft. and are stepped up to meet the higher foundations on the rock, and in one case the concrete work was carried up as much as 15-ft. with a straight vertical joint (provided with necessary grooves) so as to provide against subsequent settlement and cracking between the work on the earth and the work on the rock. The top of loose and fissured rock was taken off and the fissures filled with cement grout. When the concrete forming the wall foundations was being put in, care was taken to extend the concrete of the walls into the floor area a distance of about 3-ft. 6-in. and 12 inches deep to meet the lower layer of the floor and so make bond between the floor and the walls. The walls are of 1—2—3 cement concrete stepped on the inner face at the base for a height of 3-ft. and then with a batter of 4¾ over 1 to the top. The wall has a vertical back and in each course two ¾-in. mild steel rods were embedded horizontally and in addition one row of vertical rods of same diameter were placed 7-ft. 6-in. apart. These extended nearly the full height of wall and were hooked on to one of the lowest horizontal rods; otherwise they were free. The inner face is rendered with 1 to 1 cement mortar. There is no puddle either behind the walls or under the floor. The walls were built in courses 3-ft. high, bonded and grooved for water-tightness, the joint thoroughly picked, washed and spread with cement mortar before the next course was laid down.

The floor 21 to 24 inches thick was laid in three courses, the lower two courses of 1—2—3 cement concrete being put down in 15-ft. alternate squares, the second course breaking joint with the first; and finished with a 3-in. layer of crush concrete in the proportion of 1 cement to 1.636 granite crush, rammed, dusted with cement and floated to a smooth surface. This last layer was put down in panels 15-ft. by 7½-ft. which again broke joint with the second floor course. The floor has a slope of 1 in 200 from the inlet side to the outlet. Foundations 10-ft. square of 1—2—3 cement concrete have been put down beneath the floor at 40-ft. and 36½-ft. centres to take pillars should the reservoir ever be covered. The positions of the centres of these bases are marked by steel pins which project about 1 to 3 inches above the floor surface. When the reservoir was finished it was filled and allowed to stand for some days. It was then emptied and examined and found good. Water was again let in and it was filled to a depth of some two or three feet only. When this water was let out it was found that two fine cracks had developed along the joint of the floor with the wall where the wall and the floor were on soft. In one case about 3-ft. 6-in. off the wall and in the other along the face of the wall and probably on account of unequal expansion due to the upper wall being very hot and the floor being cool owing to the water on it. No trouble has been experienced owing to these fine cracks. The reservoir is cleaned once every year.

The domed recorder house, 15-ft. square inside, is built entirely of 1—2—3 cement concrete. The dome itself, 16-ft. inside diameter, made of blocks " cast " to shape on the ground, is 12-in. thick, a ⅞-in. diameter steel rod being embedded in the circular course immediately below the dome.

The total cost amounted to some $280,000.

The cost of settling chamber excavation, running it to spoil and refilling behind walls amounted to 90 cents per cubic yard. This included 25 per cent. of rock.

The cost of service reservoir excavation running it to spoil and refilling behind walls amounted to 62 cents per cubic yard. This included about 5 per cent. of rock.

Cement concrete mixture 1—2—3 in floor and walls of settling chambers inclusive of rendering was $15.45 per cubic yard. Cement delivered on works was reckoned to cost $5.25 per cask of 375-lbs.

Cement concrete mixture 1—2—3 at service reservoir was $14.50 per cubic yard.

Fine concrete in floor 3-in. thick cost $2.10 per square yard.

Approximate overhead cost of 18-in. cast iron pipes complete, inclusive of trenching and refilling, specials and valves was $26.00 per lineal yard.

With regard to the method of working, it will be understood that there are no filtration works on the Penang water supply but care is taken to shut off the supply from the river whenever it is discoloured during rains. When the rainstorm lasts for the greater part of a day the reservoir is very much drawn down and it would be better from every point of view were the capacity of the service reservoir equal not to one day's supply but to three days' (or even five days' supply where the works are likely to be extended) and constructed in two halves, the water passing from one to the other.

Generally it may be said that the Penang water is of a very high quality chemically and would be so from a bacterial point of view also, were it not for the amount of pollution it receives from houses, cultivation and paths still existent on the catchment areas. Much has been done in the way of buying up houses and lands on these areas and it is hoped that the whole of the pollution will be removed in the course of time.

The distributary mains from the service reservoirs to town although probably large enough to supply th emaximum quantity which would be allowed for a supply of about4,000,000 gallons per day, are very much overtaxed wtih the result that pressures in the town at 8 o'clock in the morning are down to something like 15-lbs. per square inch all over the more densely populated part of the town. This means that upstair floors and even shipping have difficulty in getting water ; and in case of fire in the daytime (although not at night) there is water shortage until blocks of the town have been shut off to reduce consumption and increase pressure which can be concentrated in the zone of fire. This too is a state of affairs which will be remedied in the course of time by the laying of new distributary mains probably from new sources of supply.

# Prai Water Supply

## 2

### Paper Read Before the Engineering Association of Malaya

*By D. W. Brisbane, Assoc. M. Inst. C E.*

AT the present time Prai does not possess a sufficient water supply and practically all the water requred by the railway department and other large users is obtained either by rail or water boat.

With the completion of the new wharves at Prai, shipping and other additional demands will have to be met and in order to provide for all these requirements the Prai water supply scheme is now being constructed.

The scheme comprises a masonry dam and storage erservoir at Bukit Serayah, a pipe line to Prai, an elevated storage tank and service mains at the latter place, and is designed to supply 500,000 gallons per day.

### Catchment Area

The catchment area is situated on the southern slope of Bukit serayah and has an area of 217 acres.

The surface slopes are steep ; but except for very small areas, are covered with soil. Over a considerable portion of the area small terraces—with dry stone retaining walls—have been constructed by the early spice growers and cultivators. At present the catchment is covered with a growth of coconuts, penang palms, fruit trees and blukar.

No rainfall records for the catchment area are available but we have the following for comparison. :—

| | |
|---|---|
| Parit Buntai (15 miles distant). | |
| Mean annual rainfall since 1888 | 95.7-in. |
| Bukit Mertajam Village (3 miles distant). | |
| Mean annual rainfall since 1912 | 95.3-in. |
| Pari River Wharves (11 miles distant). | |
| Mean annual rainfall since 1918 | 106.3-in. |

It is considered that the rainfall at Bukit Serayah is not less than at Parit Buntar, and a mean annual precipitation of 95.7 inches and a minimum of 65 inches have been assumed for the catchment.

In a year of minimum rainfall the total yield from 65 inches would be 319,000,000 gallons, which would give an estimated run-off of 185,000,000 gallons.

Gaugings of the stream at dam site have been taken since December 1920 and a minimum daily flow of 304,000 gallons has been recorded to date. This occurred on 30th August last after about three months of fairly dry weather. The dry weather gaugings always record a larger flow in the mornings than in the afternoons.

The water was submitted to a chemical and physical examination by the institute of medical research, Kuala Lumpur, and was found to be of considerable organic purity and the analysis did not disclose any reason why the water should not be suitable for domestic use.

The oxygen-absorbed figure was low and very little chlorine or free ammonia was present. Only a trace of nitrates was found, and contamination from animal sources is evidently very slight and not of recent origin.

The total solids per 100,000 parts was 6.05. Permanent hardness was 1.95 and temporary hardness nil. The water should therefore by very suitable for boilers. It is very slightly alkaline.

Appendix No. 1 contains the institute's report on this water.

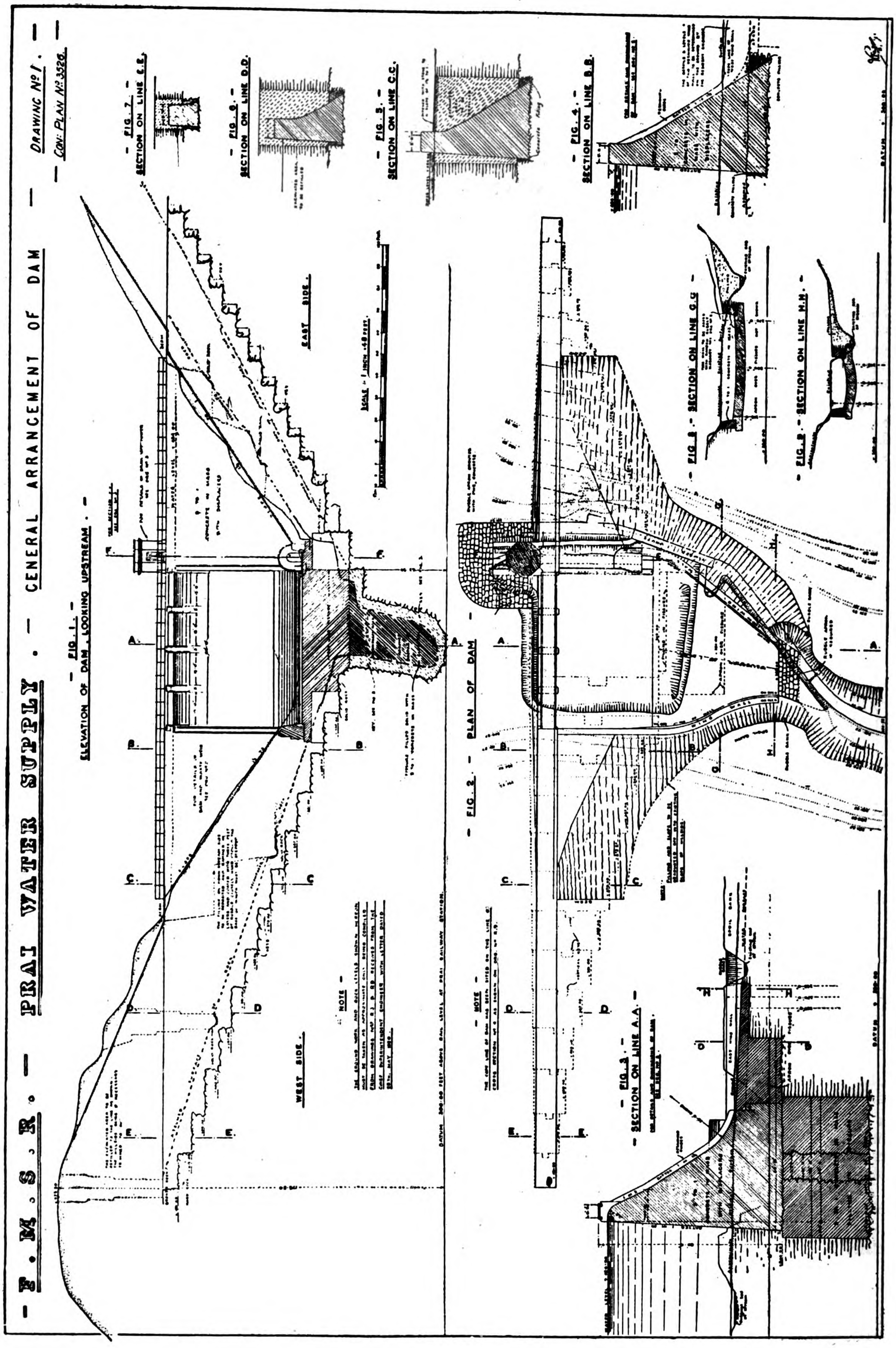
The whole of the catchment area has been acquired and all dwellings are being removed or destroyed in order to avoid the risk of contamination.

### Reservoir

The minimum annual run-off available for storage is estimated at 185,000,000 gallons. Evaporation, absorption and other losses are expected to amount to 35,000,000 gallons, leaving a gross available supply of 150,000,000 gallons. Deducting from the last figure the quantity in bottom of reservoir that cannot be drawn off—the nett available supply is 147,000,000 gallons.

The reservoir has been designed to have a capacity of half this amount and the actual nett capacity of the reservoir when complete will be 72,000,000 gallons.

This is enough for 4½ months supply at the maximum daily draft of 500,000 gallons, and as the rainfall is distributed throughout the year it is considered sufficient.


F. M. S. R. — PRAI WATER SUPPLY. — GENERAL ARRANGEMENT OF DAM —
DRAWING No 1.
CON: PLAN No 3526.
FIG. 1. — ELEVATION OF DAM, LOOKING UPSTREAM.
FIG. 2. — PLAN OF DAM
FIG. 3. — SECTION ON LINE A.A.
FIG. 4. — SECTION ON LINE B.B.
FIG. 5. — SECTION ON LINE C.C.
FIG. 6. — SECTION ON LINE D.D.
FIG. 7. — SECTION ON LINE E.E.
FIG. 8. — SECTION ON LINE G.G.
FIG. 9. — SECTION ON LINE H.H.
EAST SIDE.
WEST SIDE.
NOTE

Another factor in determining the capacity of the reservoir was the foundation of the dam on the western side, where the solid rock only rises to about R. L. 424—the level now fixed for the spillway.

The surface area of the reservoir when full will be eleven acres.

The site is situated below the junction of two small streams and between two fairly steep spurs. Below this sites the valley falls very quickly.

The dam is of the gravity type and is to be constructed in cement concrete to the section shown on plan.

The maximum height from toe to spillway level at any section will be about 80-ft., and the maximum available depth of water when reservoir is full will be 55-ft.

The total crest length will be about 450-ft., including a spillway 60-ft. wide. The coping of spillway is 424-ft. above rail level at Prai station.

The calculated maximum pressure on upstream toe when reservoir is empty is 4.99 tons per square foot.

With the reservoir full and overflowing to a depth of one foot over spillway the maximum pressure on down stream toe becomes 5.40 tons per square foot.

The weight of the concrete for these calculations has been taken at 150-lbs. per cubic foot. The concrete specified is a 1 to 5 mix with granite displacers.

The lines of resultant pressures are within the middle third as indicated on the section.

The foundation of the dam is granite, but unfortunately a large fissure about 30 to 40-ft. wide extends across the site and runs approximately parallel to the general direction of the valley. A trial shaft bottomed on rock at about 70-ft. below the surface. The fissure is now being excavated and has reached a depth of about 50-ft. below the original surface. The material filling the fissure is decomposed granite. The government geologist has examined the site. He reports that this extent of softening is not unusual and considers that the decomposition is due to an absence of clay cover and to the chief joints in the granite being parallel to the valley.

A concrete apron over fissure is to be provided on downstream side of dam and will extend far enough away to minimise the risk of erosion at the toe.

A footway 6-ft. wide is to be constructed across the dam with a reinforced concrete gantry over the spillway.

The draw-off tower is to be built of concrete with cast iron lining, and fitted with four 10-in. dia. intake valves at different levels, and a 24-in. sluice valve. A grating and 40-in. flap valve will admit the water to sluice valve. A tunnel through the dam will carry the 10-in. supply main through dam from draw-off pipe. It will also carry the waste water from sluice.

A valve house of dressed granite ashlar with necessary fittings is to be built on top of draw-off tower.

## Pipe Line

A 10-in. dia. cast iron main will convey the water from the reservoir to an elevated storage tank at Prai, a distance of 10½ miles, and is calculated to deliver 38,000 gallons per hour or 916,000 gallons per day.

The discharge has been calculated by Kutter's formula with a co-efficient of roughness of .013.

Direct from the 10-in. supply main—at foot of storage tank—a 7-in. cast iron service main leads to the outer end of jetty and is to be fitted with the necessary valves, hydrants, etc. At the outer end of jetty a Glenfield and Kennedy water tower with radial arm is to be fixed for the rapid filling of the water boats.

Service mains are also to be laid for railway and other requirements.

The arrangements of valves at the storage tank will permit of the supply for the 7-in. jetty main being drawn therefrom—whenever required—instead of direct from the 10-in. supply main.

The discharge rates of 7-in. service main at outer end of jetty will be

(1) Drawing direct from 10-in. main—30,000 gallons per hour =130 tons per hour.

(2) Drawing from storage tank—17,000 gallons per hour=76 tons per hour.

The maximum head on the pipes will be 420-ft. The pipes are of the spigot and socket type with lead joints. They are tested to a pressure of 800-ft. head and receive a coating of Angus Smith composition.

## Storage Tank at Prai

The elevated storage tank proposed is to consist of three cast iron tanks capable of being used singly, in pairs, or altogether. The total capacity of the tanks will be 110,000 gallons.

They are to be supported on reinforced concrete columns 50-ft. high. The foundations are to be piled.

## Supply of Water to Shipping

Appendix No. 2 gives particulars of the supply of water to shipping at port of Penang. These particulars were obtained from the manager, Penang harbour board, by the chief superintendent engineer.

## Construction

*Transport.*—The site of the reservoir is about four miles from the nearest railway station—Bukit Mertajam—and a fleet of motor lorries provides transport from the railway to foot of approach to site.

Owing to the steepness of the approach to the reservoir site, it has been necessary to provide inclines worked with winding engines. Two double track inclines have been constructed with a winding engine at top of each.

The first incline is 1,100 feet long and rises 200-ft. and the second one is 700-ft. long and rises 165-ft.

A petrol locomotive has been provided for the haulage of materials from top of inclines to the dam site, a distance of about ¾ mile. A second loco of the same type will provide haulage power from the quarry site.

## Quarry

A granite quarry is being opened up about half a mile from the dam site. A complete plant, consisting of an Ingersoll-Rand compressor of 528 c.ft. per minute capacity, a Leyner drill sharpener, rock drills, crushers and crane has been obtained. An ample supply of small and large stone is expected from this quarry.

## Concrete Plant

Two concrete mixers of 1 c.yd. capacity each will supply the concrete, and two cranes have been provided for work at dam.

It is proposed to build a trestle on downstream side of dam to carry the cranes that will lower the concrete into place, with exception of that required for fissure.

The latter concrete will be mixed by machine alongside of fissure and lowered directly into place from there.

## Workshops

The necessary workshops are now being erected. The carpenters' shop will be equipped with saws, planing machines, etc., to deal with the shuttering.

## Water Supply

A small gravity supply provides for all construction requirements.

## Materials

Stone is obtained from the quarry.

Sand is not obtainable locally in any quantity, and practically all of it will be sea sand brought by tongkangs to Prai and from there delivered by rail to Bukit Mertajam.

Cement is being obtained through the crown agents and is again tested locally by the consulting engineers.

## Labor

Most of the labor employed on the works is Chinese. For some special portions of the work other nationalities are employed. The health of the labor force has been causing some anxiety owing to prevalence of malaria, and is receiving special attention.

## Estimate

The estimated cost of the works is $2,186,900.

*(Continued on page 603).*

# China's Cotton Industry.—2

*By Theodore Chen, B.A.*

## II. The World's Cotton Supply and Demand

THE world's cotton consumption is growing year by year and a shortage of supply is always keenly felt. If the *per capita* consumption is 15-lbs. of raw cotton, then a world population of 15,000,000,000 needs 45,000,000 bales (4 piculs a bale) to supply the demand. The production of the last decade ranges, however, only from 7,000,000 to 26,000,000 bales. The demand is far above the supply. The British empire has a very far-sighted policy in investing a large amount of capital for the raising of more and better cotton in Egypt, South Africa and India. It is evident that rapid development is about to take place in the cotton manufacturing industry in China and an enormous amount of raw cotton is needed.

The following table shows the number of spindles, production and consumption of cotton in different countries from March, 1919 to June, 1920 :—

| Countries | Spindles | Production (in bales) | Consumption (in bales) |
|---|---|---|---|
| Great Britain ... | 6,692,410 | 1,139,000 | 3,185,314 |
| India ... ... | 6,689,680 | 4,316,000 | 1,695,365 |
| Canada ... ... | 1,200,000 | - | 118,446 |
| U.S.A. ... ... | 35,872,000 | 11,000,000 | 6,425,244 |
| Mexico ... ... | 720,000 | 200,000 | 44,321 |
| Russia ... ... | | 420,000 | |
| Brazil ... ... | 1,600,000 | 536,000 | 75,552 |
| Peru ... ... | | | |
| China ... ... | 1,600,000 | 1,100,000 | 690,398 |
| Japan ... ... | 3,600,000 | 150,000 | 2,082,432 |
| Belgium ... | 1,572,500 | | 3,124,906 |
| France ... ... | 9,400,000 | | |
| Germany... ... | 9,400,000 | | |
| Italy ... ... | 4,514,800 | | |
| Jugo-Slav ... | 3,584,420 | | |
| Spain ... ... | 1,800,000 | | |
| Other Countries | 5,115,582 | | |
| Total ... | 145,701,462 | 19,842,000 | 17,236,941 |

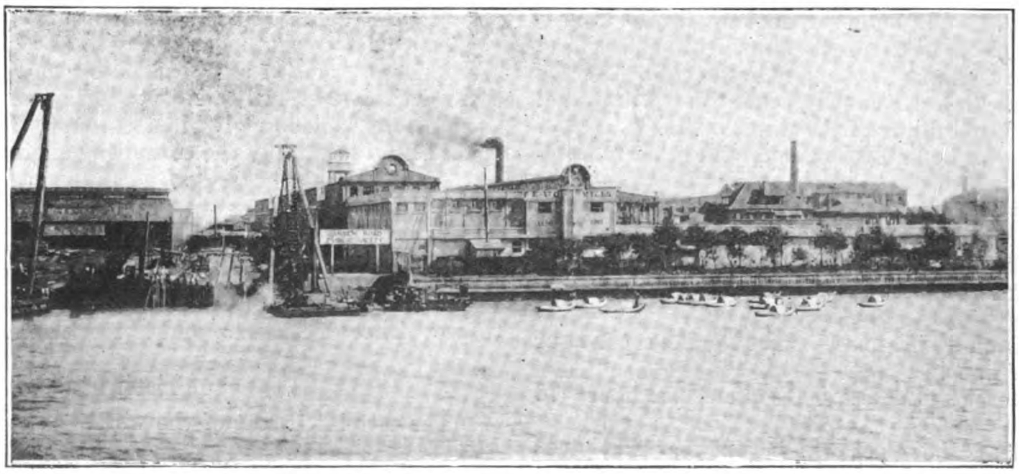
The above table indicates that only the United States, China, India and Brazil are sufficiently supplied with their own production, while others are all dependent upon the four leading producing countries for their consumption. With the rapid development of cotton manufacturing and keen competition in the near future, it is really a grave problem for the world to face in regard to the supply of raw cotton. According to the latest available statistics, the number of spindles in the United States, Great Britain and Japan are rapidly increasing in the following manner:—

| Countries | 1907 | 1919 | 1920 | Av. Annual Increase |
|---|---|---|---|---|
| U. S. A. .. .. | 26,350,000 | 34,200,000 | 34,700,000 | 600,000 |
| Great Britain .. | 50,700,000 | 59,000,000 | 59,300,000 | 470,000 |
| Japan .. .. | 1,500,000 | 3,200,000 | 3,400,000 | 140,000 |

The above figures indicate clearly the rapid growth of cotton industry and it is natural for China, the most hopeful cotton-producing country, to exert greater efforts in the cultivation of cotton in order to relieve the sure to come world's cotton shortage. According to expert investigation, China is capable of yielding more than 20 catties of cotton on each *mow* of land, while the United States 25, Egypt 20 and India 12½. In 1921 there were over 28 million *mow* of land under cotton cultivation. If this acreage is to be extended to 150 million *mow* in the future with an average yield of 20 catties per *mow*, the yield of cotton in China will be 7,500,000 bales (400 catties each) or easily to 10,000,000 bales. Since China is producing, without any special effort of the people, with very little help from her government and lack of scientific knowledge in cultivation, a crop equal to possibly a seventh of that of the United States, there is every evidence to see that it would be no great task for China to become the world's greatest cotton country.

## III. Cotton Goods Trade in China

On account of the enormous population of China and the mild climate throughout the country, a very large amount of cotton goods is required for clothing. This makes naturally the imports of cotton manufactures by far the largest single item in foreign trade. During 1922 the import of cotton goods from foreign countries amounted to 22,978,286 pieces and valued at Hk. Taels 218,523,000

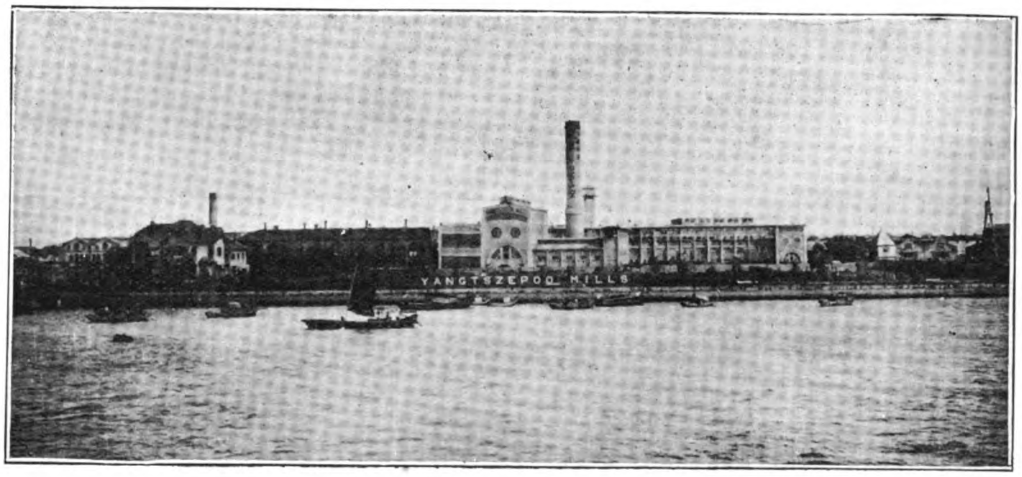


The table on next page shows the value in Hk. taels of the import into China of all trades and of cotton manufactures and the percentage that the latter bears to the total import trade during the years 1880-1918.

| Year | | Total imports of all articles | Import of cotton manuf. | Per cent. of total |
|---|---|---|---|---|
| 1880... | ... | 79,293,452 | 23,382,957 | 30.54 |
| 1881... | ... | 91,910,877 | 26,045,836 | 28.34 |
| 1882... | ... | 77,715,228 | 22,706,784 | 29.21 |
| 1883... | ... | 73,567,702 | 22,046,785 | 30.00 |
| 1884... | ... | 72,760,758 | 22,141,222 | 30.43 |
| 1885... | ... | 88,200,018 | 31,493,823 | 35.70 |
| 1886... | ... | 87,479,323 | 29,114,622 | 33.28 |
| 1887... | ... | 102,263,669 | 37,041,931 | 36.23 |
| 1888... | ... | 124,782,893 | 44,437,525 | 35.61 |
| 1889... | ... | 110,884,355 | 36,135,596 | 32.60 |
| 1890... | ... | 127,093,481 | 45,020,302 | 35.41 |
| 1891... | ... | 134,003,863 | 53,290,200 | 39.76 |
| 1892... | ... | 135,101,198 | 52,707,432 | 39.71 |
| 1893... | ... | 151,362,819 | 45,137,970 | 29.82 |
| 1894... | ... | 162,302,911 | 52,105,448 | 32.14 |
| 1895... | ... | 171,696,715 | 53,074,164 | 30.99 |
| 1896... | ... | 202,589,994 | 79,243,431 | 39.12 |
| 1897... | ... | 202,828,625 | 78,663,280 | 38.78 |
| 1898... | ... | 209,579,334 | 77,618,824 | 37.04 |
| 1899... | ... | 264,748,456 | 103,463,048 | 39.07 |
| 1900... | ... | 211,070,422 | 75,606,360 | 35.82 |
| 1901... | ... | 268,302,918 | 99,651,999 | 37.14 |
| 1902... | ... | 315,363,905 | 127,524,120 | 40.43 |
| 1903... | ... | 326,739,133 | 128,625,604 | 39.36 |
| 1904... | ... | 344,060,608 | 124,048,311 | 36.05 |
| 1905... | ... | 447,100,791 | 181,452,953 | 40.58 |
| 1906... | ... | 410,270,082 | 152,727,845 | 38.41 |
| 1907... | ... | 416,401,369 | 118,915,923 | 28.56 |
| 1908... | ... | 394,505,478 | 110,898,379 | 28.11 |
| 1909... | ... | 418,158,067 | 137,288,196 | 32.83 |
| 1910... | ... | 462,294,894 | 130,679,235 | 28.22 |
| 1911... | ... | 471,503,943 | 143,802,025 | 30.50 |
| 1912... | ... | 473,097,031 | 144,088,874 | 30.45 |
| 1913... | ... | 570,162,557 | 182,419,023 | 31.99 |
| 1914... | ... | 569,241,382 | 183,328,473 | 32.21 |
| 1915... | ... | 454,475,719 | 149,300,513 | 32.85 |
| 1916... | ... | 516,406,995 | 136,679,386 | 26.47 |
| 1917... | ... | 549,518,774 | 158,950,267 | 28.93 |
| 1918... | ... | 554,893,082 | 151,380,423 | 27.28 |

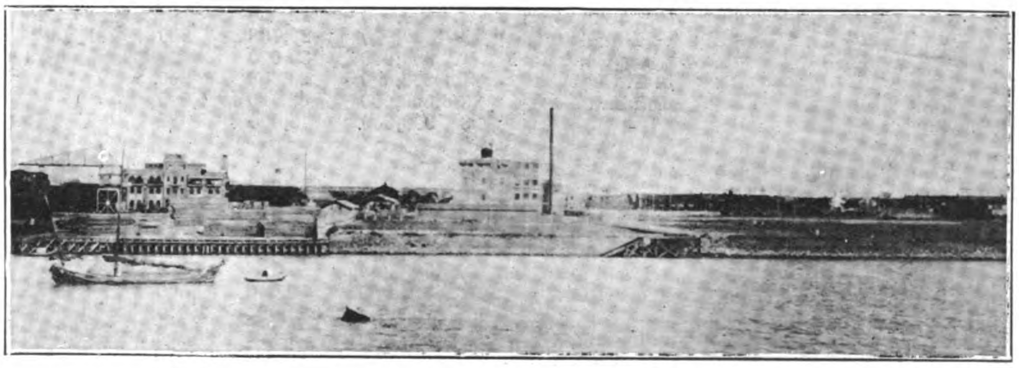
The following figures show the growth of imports of cotton goods from abroad in Hk. taels into China during the years of 1913, 1921 and 1922: 1913—182,420,000; 1921—208,663,000; 1922—218,523,000.

Shanghai is by far the most important port of enter for cotton goods, followed by Tientsin, Dairen, Hankow, Swatow, Kiaochow, Canton, Wuchow, and Mengtsz.




The principal sources of supply for the large volume of cotton manufactures consumed in China are England, Japan, India, the United States and Russia, with smaller quantities from France, the Netherlands, Canada, Germany and Italy. The true origin of the imports into China is difficult to determine because of the intervening ports of transhipment, particularly Hongkong, Antwerp and Hamburg.

It is most gratifying to say that in 1922 China instead of importing a little over 200,000,000 Hk. taels worth of cotton goods from abroad annually, exported to foreign countries various kinds of cotton piece goods in addition to Hk. Taels 150,521 of cotton yarn. It is easy to see that China will soon export a large quantity of cotton manufactures since there is an abundant and cheap supply of labor and raw material.



## IV. Cotton Manufacturing in China

Cotton manufacturing in China, in a modern sense, is of comparatively recent development. Before 1890 cotton spinning and weaving in China, there was only the so-called "household handcraft" type. It was in 1889 that Li Hung-chang, the noted diplomat of the Manchu dynasty, launched a campaign, under his official capacity as viceroy of Peiyang for the erection of a modern cotton mill, under the name of "Foreign Cloth Factory" which was most unfortunately destroyed by fire after three years' careful planning and construction. The Modern Spinning and Weaving Factory which started at the same time was completed, however, in 1890. Li's plan was later on brought up before the attention of Sheng Kung-pao who was at that time a Tientsin customs' governor general, Sheng was fully aware of the importance of such an establishment, consequently he took up the responsibility for raising Tls. 800,000 by public subscription. As a matter of fact, Chinese merchants at that time were unfamiliar with the idea of subscription by shares, and cotton spinning and weaving by machinery was quite novel to them. Hence they were not bold enough to make generous subscription and only one-third of the required capital was paid up. While the construction of the mills was under way and the order for 65,000 spindles and 600 looms was being placed, the balance of the required capital was arranged for by other means. The mill was completed in 1894, with a new name as Hwa Shen Cotton Mill. In 1891, Chang Tze-tung also started a weaving factory in Wuchang and in 1894 added a spinning factory.

After the Sino-Japanese war, with the conclusion of Shimenoseki treaty of 1895, foreigners were then permitted "to engage in all kinds of manufacturing industries in all the open cities, towns and ports of China," according to Article VI of the said treaty. This made another epoch in the history of cotton manufacturing in China. Those foreign firms like Jardine, Matheson & Co., Ilbert & Co. (British) and Arnhold, Kerberg & Co. (German) who originally were engaged in piece goods and cotton yarn business, suddenly stepped into cotton manufacturing enterprises and cotton mills under the names of Ewo, Laou Kung Mow, Hung Yuen and Shui Kee were established in Shanghai. This movement had a great influence upon the Chinese merchants, who realized more and more the importance of the cotton manufacturing industry, and mills were then established in many provinces. Up to 1896, there were already five mills owned by the Chinese, namely Ta Shun and Yui Yuen of Shanghai, Nieh Cheng of Wusih, including Modern Spinning and Weaving Factory and Hwa Shen Cotton Mill of Shanghai, and the four foreign mills, making a total of nine mills. Then followed later on the establishment of Soo Lun in Soochow, Ta Sung in Nantung, and Yui

Tung and San Tai (Japanese) in Shanghai. At the same time Ta Shun was sold to Japanese interests and changed into Shanghai Cotton Spinning and Weaving Mill No. 1 and San Tai as Mill No. 2. This marks the invasion of Japanese competition into the cotton manufacturing field of China.

It is to be noted that although cotton spinning was making quite rapid strides during such a brief space of time, yet nothing was done to encourage weaving. At the conclusion of the Russo-Japanese war of 1906, piece goods found a good market in Manchuria and China Propei as well. This influenced most of the mills to install weaving machinery and resulted in a large output of shirtings and jeans.

The following table shows the mills established during the Manchu dynasty :—

| Name | Site | Nationality | Est. | Spindles | Looms | Remarks |
|---|---|---|---|---|---|---|
| Hengfoong | Shanghai | Chinese | 1890 | 15,576 | 356 | Originally known as Modern Spinning and Weaving Factory |
| Jihcheng ... | ,, | ,, | ,, | 65,520 | 600 | |
| Yueyuen ... | ,, | ,, | 1895 | 26,936 | | |
| Yuetung ... | ,, | ,, | 1898 | 18,200 | | |
| Chinghwa ... | ,, | ,, | 1905 | 11,648 | | |
| Tungchong . | ,, | ,, | 1908 | 11,200 | | |
| Ewo ... | ,, | British | 1895 | 72,354 | 524 | |
| Laoukungmow | ,, | ,, | ,, | 30,548 | | |
| Hongyuen... | ,, | ,, | ,, | 40,000 | 300 | |
| Kungyik ... | ,, | ,, | 1910 | 25,576 | 400 | Sino-British in management |
| Shuikee ... | ,, | German | 1895 | 40,768 | | |
| Shanghai 1... | ,, | Japanese | ,, | 20,392 | 376 | |
| ,, 2... | ,, | ,, | 1900 | 25,480 | 510 | |
| Kiucheng ... | ,, | ,, | 1907 | 9,424 | | Sino-Japanese in management |
| Naigai Wata | ,, | ,, | 1911 | 23,040 | | |
| Nihcheng | ...Wusih | Chinese | 1895 | 13,832 | | |
| Chinghsing . | ,, | ,, | 1906 | 10,192 | | |
| Soolung | ...Soochow | ,, | 1897 | 22,568 | | |
| Tasung 1 | ...Nantung | ,, | 1899 | 40,500 | | |
| ,, 2 | ...Tsungming | ,, | 1907 | 26,000 | | |
| Yuetai | ...Changsuh | ,, | 1906 | 10,192 | | |
| Tsitai | ...Taichang | . ,, | 1907 | 12,700 | | |
| Liyung | ...Kiangyin | ,, | 1908 | 15,000 | | |
| Total ... | | | | 587,646 | 3,066 | |

Within a period of two decades (1890-1911), as indicated in the foregoing paragraphs, the cotton manufacturing industry in China had grown up into 23 mills with 587,646 spindles and 3,066 looms. Its progress, however, was checked by the revolution of 1911, when the nation was in such a chaotic situation that it nearly ruined the cotton industry. Fortunately during the European war, the importation of cotton yarn and piece goods from abroad decreased to such an extent that it enabled the cotton mills in China to have a good market for their productions. Up to the present time there are 120 mills with 3,550,108 spindles and 27,514 looms, which compared with that of Manchu dynasty shows an increase of 500 per cent.

The following table shows the yearly progress of cotton mills in China :—

| Year | Mills | Spindles | Year | Mills | Spindles |
|---|---|---|---|---|---|
| 1891 | 11 | 65,000 | 1916 | 42 | 1,145,000 |
| 1896 | 12 | 417,000 | 1918 | 49 | 1,478,000 |
| 1902 | 17 | 565,000 | 1919 | 54 | 1,650,000 |
| 1911 | 32 | 831,000 | | | |

The following table shows roughly the yearly progress of yarn production in China (lack of accurate statistics, this is taken from the Chinese Bankers' Association Magazine) :—

| Yeai | Production | Year | Production |
|---|---|---|---|
| 1907 | .. .. 900,000 | 1911.. | .. .. 750,000 |
| 1908 | .. .. 1,050,000 | 1912.. | .. .. 1,200,000 |
| 1909 | .. .. 1,050,000 | 1913.. | .. .. 1,200,000 |
| 1910 | .. .. | 1914.. | .. .. 1,600,000 |

It is evident that China in the past 40 years had no spinning and weaving mills in a modern sense. In the past 30 years the Chinese yarn market was entirely controlled by the Indian yarn. At this time, Chinese were beginning to erect cotton mills. In the past twenty years there has been a great influx of Japanese yarn into China. Until 1914 the Japanese practically held the yoke of yarn business in the Far East. On account of the European war, the output of Japanese yarn was greatly reduced and prominent merchants like Chang Chien, C. C. Nieh and H. Y. Moh began to step forward, organizing cotton mills and up to the present time there are 120 mills and more than 3,550,108 spindles and 27,514 looms in China.

The tollowing is a list of all the mills in China :—

| Name | Site | Nationality | Estab. | Proprietor or Manager | Capital | Spindles | Looms | Employees | Cotton Consumption | Power |
|---|---|---|---|---|---|---|---|---|---|---|
| Heng Foong Cotton Mfg. Co.... | Shanghai | Chinese | 1890 | C. C. Nieh | T. 900,000 | 41,280 | 454 | 2,872 | 98,172 | Electric |
| San Sing do. | do. | do. | do. | E. Y. Sheng | T.1,500,000 | 69,880 | 1,000 | 4,887 | 146,000 | Electric & Steam |
| Ching Hwa do. ... | do. | do. | 1905 | Sih Wen Tai | T. 300,000 | 13,548 | | 700 | 28,000 | Steam |
| Shun Hsing Cotton Mill 1 ... | do. | do. | 1916 | Yung Tsung Ching | $ 3,000,000 | 39,752 | 1,100 | 4,000 | 82,500 | Electric |
| do. do. 2 ... | do. | do. | 1919 | do. | $ 1,000,000 | 34,934 | | 1,850 | 41,000 | Electric & Steam |
| Teh Dah Cotton Spinning Co. | do. | do. | 1915 | Moh Su Tsa | T.1,000,000 | 29,388 | | 834 | 43,000 | do. |
| Hong Yue Cotton Mill ... | do. | do. | 1916 | Chen Bei Tse | T.1,800,000 | 43,900 | 240 | 3,400 | 80,580 | do. |
| Poh Yik Cotton Mill 1 ... | do. | do. | 1917 | Zee Zing Ren | T.1,000,000 | 27,720 | | 1,600 | 60,000 | do. |
| do. do. 2 ... | do. | do. | 1922 | do. | T.1,000,000 | 24,000 | 500 | | | do. |
| Hou Sung Cotton Mfg. Co. ... | do. | do. | 1918 | H. Y. Moh | T.1,200,000 | 61,792 | 396 | 2,800 | 74,304 | do. |
| Pao Zung Cotton Mill 1 ... | do. | do. | 1919 | Liu Pah Sung | T.1,600,000 | 41,472 | 200 | 2,500 | 140,580 | do. |
| do. do. 2 ... | do. | do. | 1921 | do. | T.2,400,000 | 69,952 | | 4,300 | 223,650 | do. |
| Wei Tung do. ... | do. | do. | do. | Chen Yuoh Ting | $ 1,200,000 | 23,808 | 200 | 1,200 | | do. |
| Dong Chong do. ... | do. | do. | 1908 | Sung Ming Yen | T. 335,000 | 11,592 | | 760 | 26,495 | do. |
| Tung Yik do. ... | do. | do. | 1921 | Wu Ling Su | T.1,800,000 | 45,912 | | 3,400 | 116,650 | do. |
| Heng Da do. ... | do. | do. | do. | Moh Su Tsa | $ 1,000,000 | 15,552 | | 970 | | do. |
| Hwa Foong Cotton Mfg. Co.... | do. | do. | do. | C. T. Wong | T.2,000,000 | 25,000 | | 1,000 | | do. |
| Ta Chung Hwa Cotton Mfg. Co. | do. | do. | do. | C. C. Nieh | T.3,000,000 | 45,000 | | 2,200 | 41,946 | do. |
| Yung Yue Cotton Mill ... | do. | do. | do. | Hsu Song Chun | T. 400,000 | 12,000 | | 280 | | Steam |
| Ta Foong do. .. | do. | do. | do. | Loh Wee Yung | $ 1,000,000 | 20,736 | 200 | 1,500 | | Electric |
| Ching Tai do. ... | do. | do. | do. | Wong Chi Yu | T. 800,000 | 30,000 | | | | do. |
| Hong Chang Cotton Mfg. Co... | do. | do. | do. | B. T. Chen | T.1,500,000 | 25,808 | 260 | | | do. |
| Wing On do. ... | do. | do. | do. | Koh Shun | $ 6,000,000 | 60,720 | 1,000 | | | |
| Ming Sung Cotton Mill ... | do. | do. | do. | | $ 300,000 | 5,000 | | | | |
| Tsung Sing do. ... | do. | do. | do. | | | | | | | |
| Chin Wei do. ... | do. | do. | do. | | | | | | | |
| Total Chinese-owned Mills in Shanghai 26 | | | | | | 828,746 | 6,140 | | | |
| Ewo Cotton Mill ... ... | Shanghai | British | 1895 | J. M. & Co. | T.6,000,000 (Ewo, Yangtszepoo, Kung Yik) | 73,952 | 1,900 (Ewo, Yangtszepoo, Kung Yik) | 13,000 (Ewo, Yangtszepoo, Kung Yik) | 300,000 (Ewo, Yangtszepoo, Kung Yik) | Steam |
| Yangtszepoo Cotton Mill ... | do. | do. | 1914 | do. | | 56,532 | | | | |
| Kung Yik Cotton Mill ... | do. | do. | 1910 | do. | | 25,576 | | | | Steam |
| Oriental Cotton S. &. W. Co.... | do. | do. | 1895 | Arnhold & Co. Ld. | T.1,500,000 | 54,768 | 440 | | | Electric & Steam |
| Laou Kung Mow do. ... | do. | do. | do. | Ilbert & Co. | T. 800,000 | 50,096 | 500 | | | Steam |
| Total British-owned Mills in Shanghai 5 | | | | | | 260,924 | 2,840 | | | |
| S'hai Cotton Mfg. Co. Mill 1... | Shanghai | Japanese | 1908 | Mitsui Bussan Kaisha, Ltd. | Y.4,000,000 (Mills 1–3) | 20,392 | 376 | 7,677 (Mills 1–3) | 272,580 (Mills 1–3) | Electric & Steam |
| do. do. 2... | do. | do. | do. | do. do. | | 25,480 | 510 | | | Steam |
| do. do. 3... | do. | do. | do. | do. do. | | 50,592 | | | | do. |

| Name | Site | Nationality | Estab. | Proprietor or Manager | Capital | Spindles | Looms | Employees | Cotton Consumption | Power |
|---|---|---|---|---|---|---|---|---|---|---|
| Japan-China S. & W. Co. 1 ... | Shanghai | Japanese | 1895 | | Y.10,000,000 | 42,000 | | | | Steam |
| do. do. 2 ... | do. | do. | | | | 11,056 | 500 | | | |
| do. do. 3 ... | do. | do. | | | | 30,000 | | | | |
| Naigai Wata Kaisha, Ltd. 3... | do. | do. | 1911 | | | 23,040 | | | | Electric |
| do. do. 4... | do. | do. | 1913 | | | 41,536 | | | | do. |
| do. do. 5... | do. | do. | 1915 | | | 65,420 | | | | do. |
| do. do. 7... | do. | do. | | | | | 600 | | | |
| do. do. 8... | do. | do. | | | | 20,416 | | | | |
| do. do. 9... | do. | do. | | | | 26,936 | 1,000 | | | |
| do. do. 12... | do. | do. | | | | 20,800 | | | | |
| do. do. 13... | do. | do. | | | | 24,000 | | | | |
| do. do. 14... | do. | do. | | | | 24,000 | | | | |
| Toyoda Cotton S. & W. Co. 1 | do. | do. | | | | 30,720 | | | | |
| do. do. 2 | do. | do. | | | | 15,312 | | | | |
| Doko Cotton Mill ... ... | do. | do. | | | | 58,240 | | | | |
| Kung Ping Cotton Mill ... | do. | do. | | | | 40,704 | | | | |
| Dah Kung do. ... | do. | do. | | | | 27,372 | | | | |
| Tokwa Boseki K.K. Mill 1 ... | do. | do. | | | $ 9,000,000 | 10,000 | | | | |
| do. do. 2 ... | do. | do. | | | | 15,360 | | | | |
| do. do. 3 ... | do. | do. | | | | 20,000 | | | | |
| Toyo Cotton Mill ... ... | do. | do. | | | | 50,000 | | | | |
| Total Japanese-owned Mills in Shanghai 24 | | | | | | 693,376 | 2,986 | | | |
| Naigai Wata Kaisha, Ltd. 6... | Tsingtao | Japanese | | | | 20,000 | | | | |
| do. do. 10... | do. | do. | | | | 20,000 | | | | |
| do. do. 11... | do. | do. | | | | 23,200 | | | | |
| Dai Nippon Cotton Mill 1 ... | do. | do. | | | | 25,344 | | | | |
| do. do. 2 ... | do. | do. | | | | 25,000 | | | | |
| Nisshin Boseki K.K. Mill ... | do. | do. | | | | 30,000 | | | | |
| Fuji Cotton Mill ... ... | do. | do. | | | | 30,000 | | | | |
| Kung Dah Cotton Mill ... | do. | do. | | | | 40,000 | | | | |
| Nagasaki Cotton Mill... ... | do. | do. | | | | 20,000 | | | | |
| Da kung Cotton Mill ... ... | do. | do. | | | Y.3,000,000 | 50,000 | | | | |
| Liao Yang Cotton Mill ... | Mukden | do. | | | Y.10,000,000 | 30,000 | | | | |
| Total Japanese-owned Mills in Outports 11 | | | | | | 293,544 | | | | |
| Ta Sung Cotton Mfg. Mill, 1... | Nantung | Chine.e | | Chang Chien | T.2,500,000 | 77,380 | 700 | 5,000 | 160,700 | Steam |
| do. do. 2... | Tsungming | do. | | do. | T.1,200,000 | 35,000 | 200 | 2,000 | 72,000 | do. |
| do. do. 3... | Haimen | do. | | Chang Cha | T.2,000,000 | 34,000 | 420 | 2,300 | 126,000 | |
| do. do. 4... | Nantung | do. | | | | 50,000 | | | | |
| do. do. 5... | Shukao | do. | | | | 25,000 | | | | |
| do. do. 6... | Tungtai | do. | | | | 25,000 | | | | |
| do. do. 7... | Yencheng | do. | | | | 25,000 | | | | |
| do. do. 8... | Nantung | do. | | | | 23,000 | 400 | | | |
| Shun Hsing Cotton Mill 3 ... | Wusih | do. | | Yung Tsung Ching | $ 2,000,000 | 50,000 | 500 | 3,800 | 94,500 | Electric |
| do. do. 4 ... | Hankow | do. | | do. do. | $ 5,000,000 | 15,000 | | 1,200 | 31,000 | Steam |
| Pao Zung Cotton Mill 3 ... | Tientsin | do. | | Liu Pah Sung | $ 3,000,000 | 51,072 | | 1,700 | 70,290 | Electric |
| Ta Tung do. ... | Tsungming | do. | | Yao Sih Tan | $ 640,000 | 10,000 | | 662 | | Steam |
| Kiu An Cotton Mfg Co. ... | Nantung | do. | | Koo Hong Ken | $ 800,000 | 10,440 | | | | Electric |
| Nih Ching Cotton Spinning Co. | Wusih | do. | | Yang Sung Chung | $ 200,000 | 13,832 | | 1,200 | 22,750 | |
| Ching Hsing do. | do. | do. | | Tai Loh Ching | $ 1,000,000 | 30,000 | | 2,558 | 48,128 | |
| Kwang Ching Cotton Mfg. Co. | do. | do. | | Yang Han Hse | $ 1,000,000 | 22,848 | 52 | 2,000 | 30,000 | Steam |
| Tsing Foong do. ... | do. | do. | | | $ 800,000 | 14,800 | 250 | | | Electric |
| Yue Kang Cotton Mill ... | do. | do. | | Fong Shou Yi | T. 800,000 | 14,000 | | 900 | 26,400 | Steam |
| Pao Tung do. ... | Soochow | do. | | Liu Pah Sung | T. 100,000 | 22,568 | | 1,450 | 41,964 | do. |
| Shun Kee do. ... | Changsuh | do. | | Hong Ming Tu | T. 150,000 | 12,740 | | 1,095 | 25,000 | do. |
| Tsi Tai do. ... | Taichang | do. | | Tsiang Pah Yen | T. 500,000 | 22,700 | | 1,170 | 22,660 | |
| Li Yung do. ... | Kiangyin | do. | | Chien E Hsiang | T. 720,000 | 15,000 | | 1,200 | 20,500 | Steam |
| Changchow do. ... | Changchow | do. | | Chien E Ching | $ 1,000,000 | 20,612 | | 695 | 14,268 | Electric |
| Ta Lung Cotton Mfg. Co ... | do. | do. | | Tsiang Pan Fah | $ 1,000,000 | 10,000 | 260 | 1,300 | 22,000 | Steam |
| Kwan Hsing Cotton Mill ... | do. | do. | | Ko Lien Sung | T. 560,000 | | | 300 | 1,400 | do. |
| Li Ming do. ... | do. | do. | | | | | | | | |
| Fou Chong Cotton Mfg. Co.... | Shukao | do | | Sha Yuen Ping | $ 1,500,000 | 15,000 | 200 | | | |
| Hwa Hsing do. ... | Tientsin | do. | 1918 | Yang Cha Yun | $ 2,700,000 | 30,000 | | 1,200 | 60,000 | Electric |
| Hwa Hsing do. ... | Tsingtao | do. | | Chow Tsih Tse | $ 2,700,000 | 32,000 | | 3,000 | 105,000 | Steam |
| do. do. ... | Tangshan | do. | | Li Hsi Ming | $ 2,200,000 | 24,000 | | 800 | 22,000 | Electric |
| do. do. ... | Weihaiwei | do. | | | $ 2,800,000 | 22,000 | | 1,000 | 28,000 | do. |
| Yue Yuen Cotton Mfg. Co. ... | Tientsin | do. | 1918 | Wong Tsoh San | $ 5,100,000 | 50,680 | 500 | 4,200 | 157,500 | do. |
| Heng Yuen do. ... | do. | do. | 1914 | Tsao Chien Ting | $ 5,000,000 | 42,500 | 300 | 2,500 | 87,000 | Electric & Steam |
| Pei Yang Cotton Mill... ... | do. | do. | 1921 | Wong Sien Chen | $ 2,000,000 | 25,000 | | 1,300 | 62,000 | do. |
| Yue Ta do. ... ... | do. | do. | 1922 | Chen Hwai Sung | $ 3,000,000 | 35,000 | | 660 | 44,520 | do. |
| Hsing Chih do. ... ... | Wutui | do. | | Lu Chun Hwa | $ 150,000 | 19,480 | | 110 | 4,500 | |
| Ta Hsing do. ... ... | Shichiachuan | do. | | Chang Ying Fu | | 20,000 | | | | |
| Tsoo Hsing do. ... ... | Wuchang | do. | | Zee Yung Ting | $ 780,000 | 90,000 | 700 | 5,100 | 12,000 | Steam |
| Hankow Dee Yi Cotton Mill... | do. | do. | | T. Y. Li | $ 3,000,000 | 83,592 | 1,200 | 3,500 | 44,419 | do. |
| Yue Hwa do. ... | do. | do. | | Sung Tse Tang | T.1,560,000 | 40,000 | 300 | 1,100 | | do. |
| Ching Kuan do. ... | do. | do. | | Liu Tse Ching | T.1,000,000 | 20,736 | | | | |
| Kwan Yih do. ... | Anyang | do. | | Yuan Shao Ming | $ 1,500,000 | 38,592 | | 1,800 | 50,000 | |
| Yue Foong do. ... | Chengchow | do. | | H. Y. Moh | T.2,000,000 | 50,000 | 200 | 3,900 | 85,200 | Electric |
| Chen Hsing do. ... | Paoti | do. | | Lu Lien Cheng | $ 2,500,000 | 3,000 | | 230 | 2,450 | Steam |
| Ting Hsing do. ... | Hangchow | do. | | Kao Yi Tsung | $ 400,000 | 18,864 | 375 | 1,830 | 38,500 | Electric & Steam |
| Ho Foong do. ... | Ningpo | do. | | Koo Yuen Sung | $ 900,000 | 23,200 | | 2,500 | 86,400 | do. |
| Tung Wei Kung do. ... | Siaoshan | do. | | Liu Chin Hwei | $ 450,000 | 14,560 | | 738 | 24,000 | do. |
| Lu Foong do. ... | Tsinan | do. | 1918 | Pan Tsing Hong | $ 1,200,000 | 27,376 | | 1,634 | 39,000 | do. |
| Yue Chung do. ... | Wuhu | do. | | Chen See Fu | $ 800,000 | 10,000 | | 1,000 | 43,200 | do. |
| Hwa Shih do. ... | Changsha | do. | | H. C. Pang | | 40,000 | | 2,260 | 84,516 | |
| Ching Hwa do. ... | Yuts | do. | | Liu Shiu Tang | $ 1,500,000 | 25,000 | | | | Steam |
| Fengtien do. ... | Mukden | do. | | Sung Tsoo Chong | $ 4,000,000 | 20,000 | 200 | | | Electric |
| Kiu Hsing do. ... | Kiukiang | do. | | Dao Hsing Shu | T.1,000,000 | 15,360 | 300 | | | do. |
| Hsing Nih do. ... | Canton | do. | | | | 10,000 | | | | |
| Total Chinese-owned Mills in Outports 54 | | | | | | 1,475,932 | 6,357 | | | |
| do. do. do. China 80 | | | | | | 2,304,678 | 20,745 | | | |
| do. British do. do. 5 | | | | | | 260,924 | 2,840 | | | |
| do. Japanese do. do. 35 | | | | | | 1,070,750 | 3,964 | | | |
| do. Cotton Mills do. do. 120 | | | | | | 3,550,108 | 27,514 | | | |

It is apparent, from the above list, that the prosperity of cotton manufacturing industry in China, is not due entirely to the efforts of the Chinese. Out of 120 mills with 3,550,108 spindles and 27,514 looms, only 80 are entirely owned and managed by the Chinese with 2,221,486 spindles and 20,745 looms. The rest being five of British interests with 257,866 spindles and 2,800 looms; 35 of Japanese interests with 1,070,756 spindles and 3,969 looms. In Shanghai the number of mills, spindles and looms owned and managed by the Chinese and Japanese is practically the same. Competition between the Chinese and Japanese is therefore very keen. In 1918 Japan had but 294,000 spindles, but in 1921 the number of spindles had increased to 867,000. Furthermore, the Japanese are constantly investing in the cotton industry in the name of the Chinese.

The following table shows very well the position oi foreign mills in China :—

| Name | Site | Nationality | Agents | Estab. | Capital | Spindles | Looms |
|---|---|---|---|---|---|---|---|
| Ewo No. 1 ... | S'hai | Brit. | Jardines | 1895 | | 73,952 | |
| ,, ,, 2 ... | ,, | ,, | | 1914 | T. 6,000,000 | 56,532 | 1,900 |
| ,, ,, 3 ... | ,, | ,, | | 1910 | | 25,576 | |
| Oriental ... | ,, | ,, | Arnhold | 1895 | 1,500,000 | 54,768 | 440 |
| Laou Kung Mow | ,, | ,, | | ,, | 800,000 | 50,096 | 500 |
| Total of British Mills (5) in Shanghai | | | | | 8,300,000 | 260,924 | 2,840 |
| Shanghai 1 ... | S'hai | Jap. | | 1908 | | 20,392 | 376 |
| ,, 2 ... | ,, | ,, | | ,, | Y. 4,000,000 | 25,480 | 510 |
| ,, 3 ... | ,, | ,, | | ,, | | 50,592 | |
| 1 ... | ,, | ,, | | 1895 | | | |
| 2 ... | ,, | ,, | | | Y.10,000,000 | 83,056 | 500 |
| 3 ... | ,, | ,, | | | | | |
| Naigai Wata 3... | ,, | ,, | | 1911 | | 23,040 | |
| ,, ,, 4... | ,, | ,, | | 1913 | | 41,536 | |
| ,, ,, 5... | ,, | ,, | | 1915 | | 65,420 | |
| ,, ,, 7... | ,, | ,, | | — | | | 600 |
| ,, ,, 8... | ,, | ,, | | — | | 20,416 | |
| ,, ,, 9... | ,, | ,, | | — | | 26,936 | 1,000 |
| ,, ,, 12... | ,, | ,, | | — | | 20,800 | |
| ,, ,, 13... | ,, | ,, | | — | | 24,000 | |
| ,, ,, 14... | ,, | ,, | | — | | 24,000 | |
| 1... | ,, | ,, | | | | 30,720 | |
| 2... | ,, | ,, | | | | 15,312 | |
| | ,, | ,, | | | | 58,240 | |
| | ,, | ,, | | | | 40,704 | |
| | ,, | ,, | | | | 27,372 | |
| 1... | ,, | ,, | | | } $9,000,000 | 10,000 | |
| 2... | ,, | ,, | | | } | 15,360 | |
| 3... | ,, | ,, | | | } | 20,000 | |
| | ,, | ,, | | | | 50,000 | |
| Total of Japanese Mills (24) in Shanghai | | | | | | 693,376 | 2,968 |

The above table does not include the Japanese mills in other parts of China, such as Tsingtao and Mukden, where eleven mills are either already established, or still under construction.

The table also shows how the British interests took the lead at first and then later it was taken over by the Japanese. It is reported that Japanese are also planning mills in other places.

The marked success of the well-managed foreign mills in Shanghai and the extent to which they have increased their producing capacity in the past few years are ample proof of the fact that China offers a splendid field for the development of the cotton manufacturing industry.

The fact that Kiangsu is the leading cotton manufacturing province is simply because in it exists Shanghai, the principal cotton manufacturing centre in China. The rapidity with which the industry has developed in Shanghai is indicated by the statistics of the cotton yarn and piece goods manufactured in local mills exported from the port through customs (native and maritime) to other parts of China and foreign countries during the years 1899 to 1918 :—

| Year | Yarn (in pounds) Maritime Customs | Native Customs | Piece Goods (in Hk. Tls.) |
|---|---|---|---|
| 1899 ... ... | 35,588,266 | | 48,400 |
| 1900 ... ... | 28,192,933 | | 29,360 |
| 1901 ... ... | 28,019,466 | | 23,460 |
| 1902 ... ... | 24,529,866 | | 35,095 |
| 1903 ... ... | 13,327,466 | | 31,840 |
| 1904 ... ... | 18,896,800 | | 89,026 |
| 1905 ... ... | 18,560,933 | | 70,980 |
| 1906 ... ... | 11,361,466 | 18,810,400 | 29,940 |
| 1907 ... ... | 24,852,800 | 4,191,200 | 86,304 |
| 1908 ... ... | 46,798,533 | 6,263,066 | 214,496 |
| 1909 ... ... | 51,003,600 | 3,946,133 | 330,251 |
| 1910 ... ... | 36,490,533 | 6,668,400 | 249,538 |
| 1911 ... ... | 45,657,866 | 7,522,266 | 462,211 |
| 1912 ... ... | 64,775,733 | 11,512,000 | 889,030 |

| Year | Yarn (in pounds) Maritime Customs | Native Customs | Piece Goods (in Hk. Tls.) |
|---|---|---|---|
| 1913 ... ... | 59,746,000 | 8,135,066 | 600,477 |
| 1914 ... ... | 88,302,266 | 3,618,666 | 743,745 |
| 1915 ... ... | 99,815,067 | 2,986,800 | 1,057,577 |
| 1916 ... ... | 102,253,467 | 3,302,800 | 1,321,455 |
| 1917 ... ... | 124,071,600 | 2,636,933 | 1,586,380 |
| 1918 ... ... | 134,481,733 | 3,681,200 | 1,717,957 |

The following is a list showing the number of Chinese-owned mills in different provinces (up to January 1922) :—

| Province | Mills | Spindles | Looms | Hands | Cotton Consumption | Yarn Production |
|---|---|---|---|---|---|---|
| Kiangsu ... | 48 | 1,337,882 | 9,124 | 67,707 | 1,975,443 | 560,836 |
| Chihli ... ... | 9 | 308,552 | 800 | 12,470 | 507,810 | 144,510 |
| Hupeh ... | 5 | 249,328 | 1,500 | 10,900 | 195,419 | 45,659 |
| Honan ... | 4 | 113,000 | 200 | 6,930 | 165,650 | 47,920 |
| Chekiang ... | 3 | 56,624 | 375 | 5,158 | 148,900 | 40,000 |
| Shantung ... | 2 | 58,000 | | 4,634 | 144,000 | 40,000 |
| Anhwei ... | 1 | 10,000 | | 1,000 | 43,200 | 10,800 |
| Hunan... ... | 1 | 40,000 | | 2,260 | 84,516 | 25,488 |
| Kiangsi ... | 1 | 15,360 | 300 | | | |
| Shansi ... | 1 | 12,880 | | | | |
| Fengtien ... | 1 | 20,000 | 200 | | | |
| Kwangtung ... | 1 | 10,000 | | | | |
| Total ... ... | 77 | 2,237,486 | 12,459 | | | |

The above list indicates that Kiangsu is leading in the cotton manufacturing industry with Chihli in second place and followed by Hupeh, Chekiang, Honan, Shantung, etc., while Anhwei, Hunan, Kwangtung and Fengtien are still in the infant stage.

It may not be out of place to mention some principal factors that have contributed to the establishment and growth of the cotton manufacturing industry in Shanghai. It is true that Shanghai is a treaty port where foreigners are permitted to engage in manufacturing industries which make it an outstanding figure, still there are other factors why Shanghai is capable of developing into a leading industrial centre, viz.: (1) Shanghai and its vicinity such as Taichang, Changshuh, Nantung, etc., are the most prosperous cotton-producing section, with a supply of sufficiently good quality for spinning low counts yarn. The cotton supply is very accessible for transportation to the mills in Shanghai; (2) China ranks first and second in the world's consumption of yarn and cotton cloth respectively. Shanghai is the principal port where foreign goods enter: it is natural for Shanghai to establish mills, where products can be easily distributed; (3) Shanghai's abundant supply of both Chinese and Japanese coal and the usually low rate charged for electric power make the mills in Shanghai lower in first cost and running expenses; (4) Shanghai has better financial facilities than any other part of China and an abundance of very cheap labor; (5) Shanghai is the starting place of modern mills and it is natural to have more mills in Shanghai where mills can be better equipped with hands and experts.

## V. Machinery Used in Chinese Cotton Industry

The modern cotton spinning and weaving industry started in the British empire, where cotton machinery was first invented. Naturally, the British are leading the rest of the world in supplying the bulk of cotton machinery used in China. Recently, however, with the return of American-trained students, American-made machinery is coming in very rapidly.

British Make—Asa Lees 287,916 spindles; Howard and Bullough 216,148 spindles; Dobson and Barlow 212,792 spindles; Brooks and Doxey 191,308 spindles; J. Hetherington 189,564 spindles; Platt 28,118 spindles; Tweedales Smalley 14,560 spindles; manufacturers unknown 40,000 spindles; Total 1,190,406 spindles.

American Make—Saco-Lowell 614,820 spindles; Whitin 36,836 spindles; Woon socket 35,000 spindles; Moson 5,000 spindles; manufacturers unknown 10,440 spindles: Total 722,096 spindles; other makes: Total 164,080 spindles. Total cotton spindles in China 2,066,582 spindles.

## VI. Future of Chinese Cotton Manufacturing Industry

A country with multitudes of people dependent largely upon cotton, both in its raw and weaved state, as a material for clothing and in many sections where climate is sufficiently mild throughout the greater part of the year to permit the general use of cotton cloth, China certainly has a very bright future in cotton manufacturing industry. The following table shows the yarn consumption in China during the last decade (1912-1921):—

| Year | Yarn manufactured in China | Yarn imported | Per cent. of import | Total Consumption |
|---|---|---|---|---|
| 1912 | ... 800,000 | 2,300,000 | 74 | 3,100,000 |
| 1913 | ... 1,200,000 | 2,700,000 | 70 | 3,900,000 |
| 1914 | ... 1,600,000 | 2,500,000 | 60 | 4,100,000 |
| 1915 | ... 1,600,000 | 2,600,000 | 61 | 4,200,000 |
| 1916 | ... 2,500,000 | 2,400,000 | 50 | 4,900,000 |
| 1917 | ... 2,600,000 | 2,000,000 | 43 | 4,600,000 |
| 1918 | ... 2,700,000 | 1,100,000 | 29 | 3,800,000 |
| 1919 | ... 3,300,000 | 1,400,000 | 30 | 4,700,000 |
| 1920 | ... 4,000,000 | 1,300,000 | 25 | 5,300,000 |
| 1921 | ... 4,500,000 | 1,200,000 | 21 | 5,700,000 |

It is apparent from the above table that although cotton yarn manufactured in China has increased five or six times, yet the import of yarn still has 1,200,000 piculs as the lowest figure. There is no doubt for the great possibilities to develop the cotton manufacturing industry into bigger scale. The great possibilities of the cotton industry in China can also be shown by the fact that with a population of 45,000,000 in Great Britain, there are 57,000,000 spindles in operation. The population of China is ten times that of the British Empire, yet there is a spindleage of but one-seventeenth to that of the British Empire. The *per capita* spindles in China is only one to every 200 people, while in the British Empire there are 250 to every 200 people. Moreover, the British people wearing more woollen, while the Chinese are almost entirely dependent upon cotton fabrics.

| Country | Population | Spindles | Per capita |
|---|---|---|---|
| China ... ... | 400,000,000 | 1,500,000 | 266 |
| Germany ... | 65,000,000 | 11,750,000 | 58 |
| France ... ... | 40,000,000 | 7,300,000 | 56 |
| India ... ... | 315,000,000 | 6,875,000 | 56 |
| U.S.A. ... ... | 92,000,000 | 33,800,000 | 27 |
| Japan ... ... | 50,000,000 | 3,100,000 | 16 |
| Great Britain ... | 45,407,000 | 57,000,000 | 8 |
| Canada ... ... | 7,250,000 | 10,000,000 | 7 |
| Italy ... ... | 35,000,000 | 5,000,000 | 7 |
| Spain ... ... | 20,000,000 | 3,300,000 | 6 |

China has now more than 30 years' experience in the cotton manufacturing industry. It is, therefore, for the Chinese to enter into the field with more energy in order to facilitate more progress. The following are the necessary steps to be taken for the development of the modern cotton manufacturing industry in China:—

1. *Development of Cotton Cultivation.*—Cotton is the only raw material required in this industry. With the recent development in cotton mills, the demand of cotton is already over its supply. Much cotton has been imported into China during the last few years. In 1922, because of the flood in Kiangsu and military destruction in Shensi, the production of both provinces was reduced considerably. In 1918 the import of raw cotton from abroad was only 180,000 piculs, while in 1922 the figure increased to 1,680,000 piculs, the increase being nine times, which is comprised one-third of American and two-thirds of Indian cotton. China is primarily an agricultural country with an annual export of a large quantity of raw cotton. Since the operation of the cotton mills, with 2,000,000 spindles, large amounts of raw cotton are already required from abroad; then there will be a still further shortage if the industry is to be properly developed. It is clear enough that more attention is needed in cotton cultivation. Seed selection, improved cultivation, extension of cotton fields and the establishment of various organizations and a few essential steps are to be taken.

2. *The Training of Experts.*—The success of an industry depends much on the expert knowledge. Since the cotton manufacturing industry is a very highly specialized one, it needs more expert management and supervision. It is urgently needed to have a great number of persons well trained for these positions in the cotton mills. The establishment of a technical school for this purpose is urgently needed to work toward this end.

3. *Better Treatment of Employees.*—According to the principle of economics, land, labor and capital are the three essential things in any industry. It is plain enough that labor plays an essential part in the industry. In order to relieve future labor uneasiness in China, precautious steps have to be taken. Ways and means have to be devised for the better treatment of laborers. An intelligent and efficient labor force will add much to the prosperity of the industry.

4. *Better Management of Mills.*—A well managed mill is apt to achieve great success. It is essential for the managing staff to study the improvement of production in order to bring down the cost. Definite steps in reserving more funds for strengthening the foundation of the mills are not to be overlooked.

5. The need of organizations for mutual benefit and improvement. The work and service rendered by the Chinese mill owners' association is self-evident. It is hoped that more of such organization will be started to work from different angles to bring together the result as a whole for the development of the Chinese cotton manufacturing industry.

## PRAI WATER SUPPLY

*(Continued from page 597).*

### Design, Etc.

The works are being constructed for the F.M.S. railway administration, and are being carried out departmentally by the construction department under the chief resident engineer.

Messrs. Coode, Matthews, Fitzmaurice and Wilson, consulting engineers, designed the works which are being supervised locally by their chief superintendent engineer.

The original location and survey of the reservoir site was made by Mr. H. S. Smail, irrigation engineer, of the P. W. D.

The pipe line was located and surveyed by Mr. John Leggate of the construction department.

Mr. A. T. O'Kelly was in charge of the works until July last, when the author took charge.

In conclusion the author expresses his thanks to Mr. James Brown, chief superintendent engineer of Messrs. Coode, Matthews, Fitzmaurice and Wilson, for the assistance he has given—which includes most of the figures given in this paper.

Also to the Chief Resident Engineer, Mr. F. D. B. Openshaw, for permission to read this paper, for placing departmental papers and records at author's service, and for his assistance in other directions.

### Appendix

Institute for Medical Research,
Kuala Lumpur, F.M.S.,
14th April, 1919.

Examination of a sample of water from Bukit Serayah—proposed supply for Prai—received on 1.4.1919.

The sample was contained in two Winchester quart glass bottles labelled "Sample from stream just above site of proposed dam at Bukit Serayah, and about one mile below source, Bukit Mertajam hills. Collected 27.3.1919."

RESULTS OF CHEMICAL AND PHYSICAL EXAMINATION.

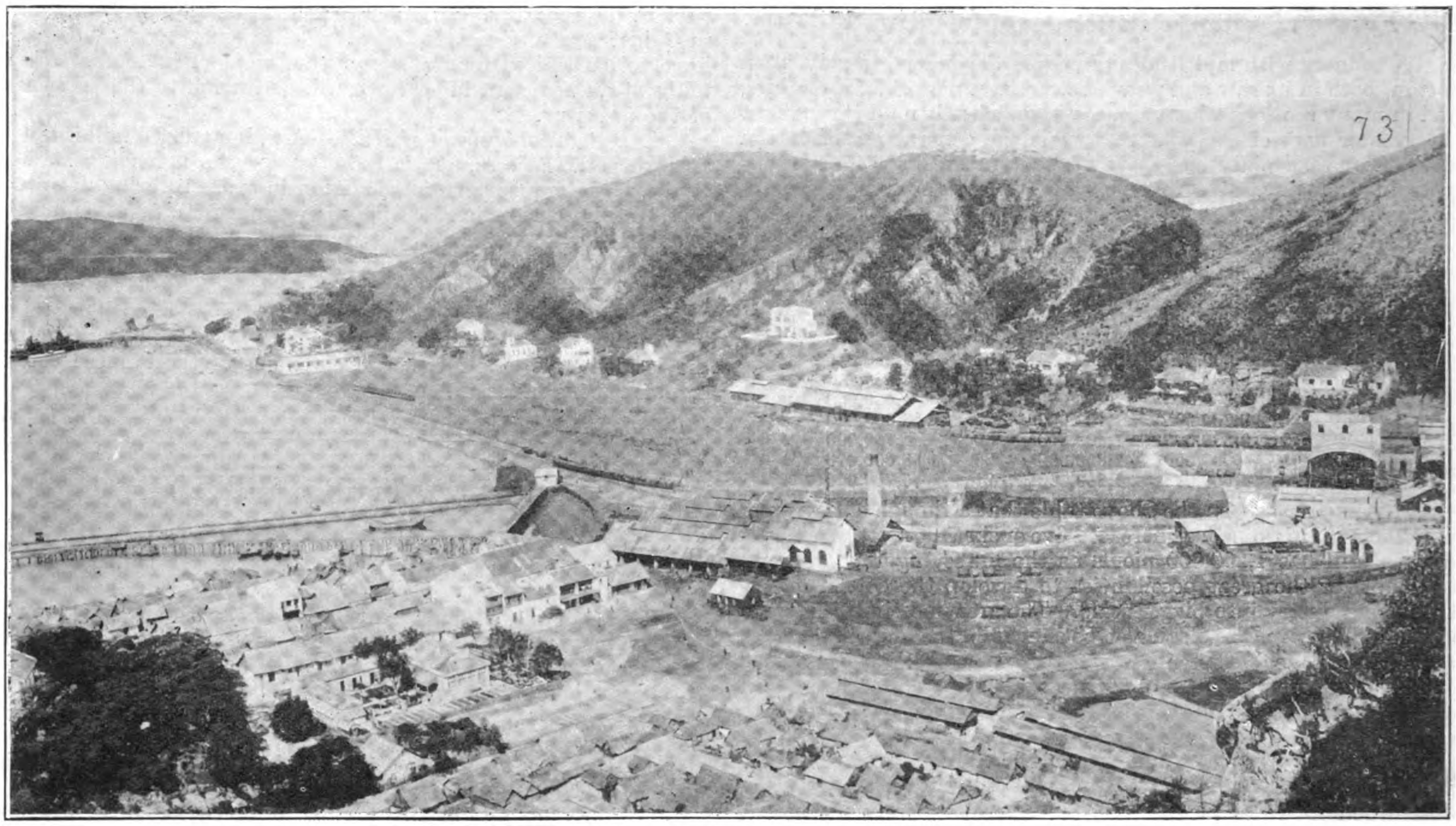
Colour—very slightly brownish.
Turbidity—slightly turbid.
Other suspended matter—a little brown.
Reaction—very slightly alkaline.

| | parts per 100,000 |
|---|---|
| Free ammonia ... ... ... ... ... | 0.0012 |
| Albuminoid ammonia ... ... ... ... | 0.0064 |
| Oxygen absorbed in 3 hrs. ... ... ... ... | 0.0490 |
| Chlorine ... | 0.20 |
| Nitrates—slight trace. | |
| Nitrites—nil. | |
| Total solids ... ... ... ... ... ... | 6.05 |
| Hardness, permanent ... ... ... ... | 1.95 |
| " Temporary "—nil. | |

REMARKS.—The water is one of considerable organic purity and the analysis does not disclose any reason why the water should not be suitable for domestic use.

The very low total solids should render the water suitable for industrial use.

(Sd.) H. MARSDEN,
Ag. Government Chemist.



General View of the Hongay Coal Mines

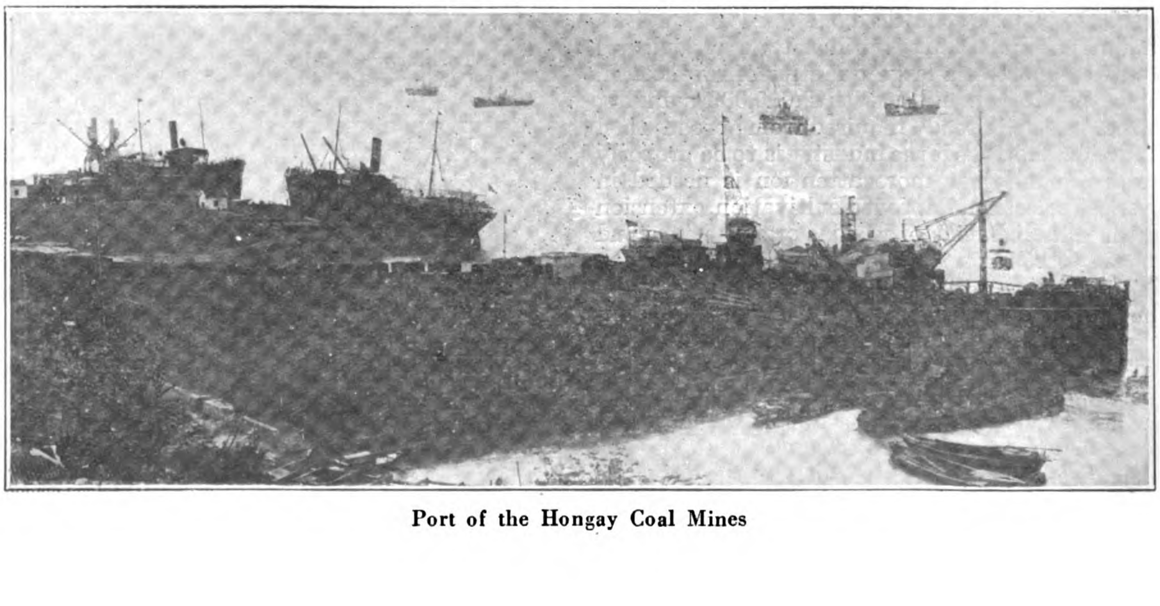
# The Mines of Indo-China

## Written by the Mines Department of the Indo-Chinese Government

### Development of Mining.

FROM the curve showing the development of mining in Indo-China during the last fifteen years, it will be seen that the output of the collieries has, almost always, been on the rise. At the present time trade is flourishing and the demand exceeds the means of supply, so that we may expect the owners will make a special effort to increase this output.

On the other hand the other mines are passing through a serious crisis due to the abnormal after-war economic conditions. No doubt better days are ahead as soon as increasing and less erratic business calls for increased supplies of metals.



Port of the Hongay Coal Mines

Of the five countries of the Union, Tonkin has been the most fully explored and appears to be the richest in mineral wealth. Minerals have been discovered in Annam and Laos, but nothing serious can be done until the means of communication have been further developed, thus permitting of real prospecting and a more facile opening up of mines in districts already known to contain deposits.

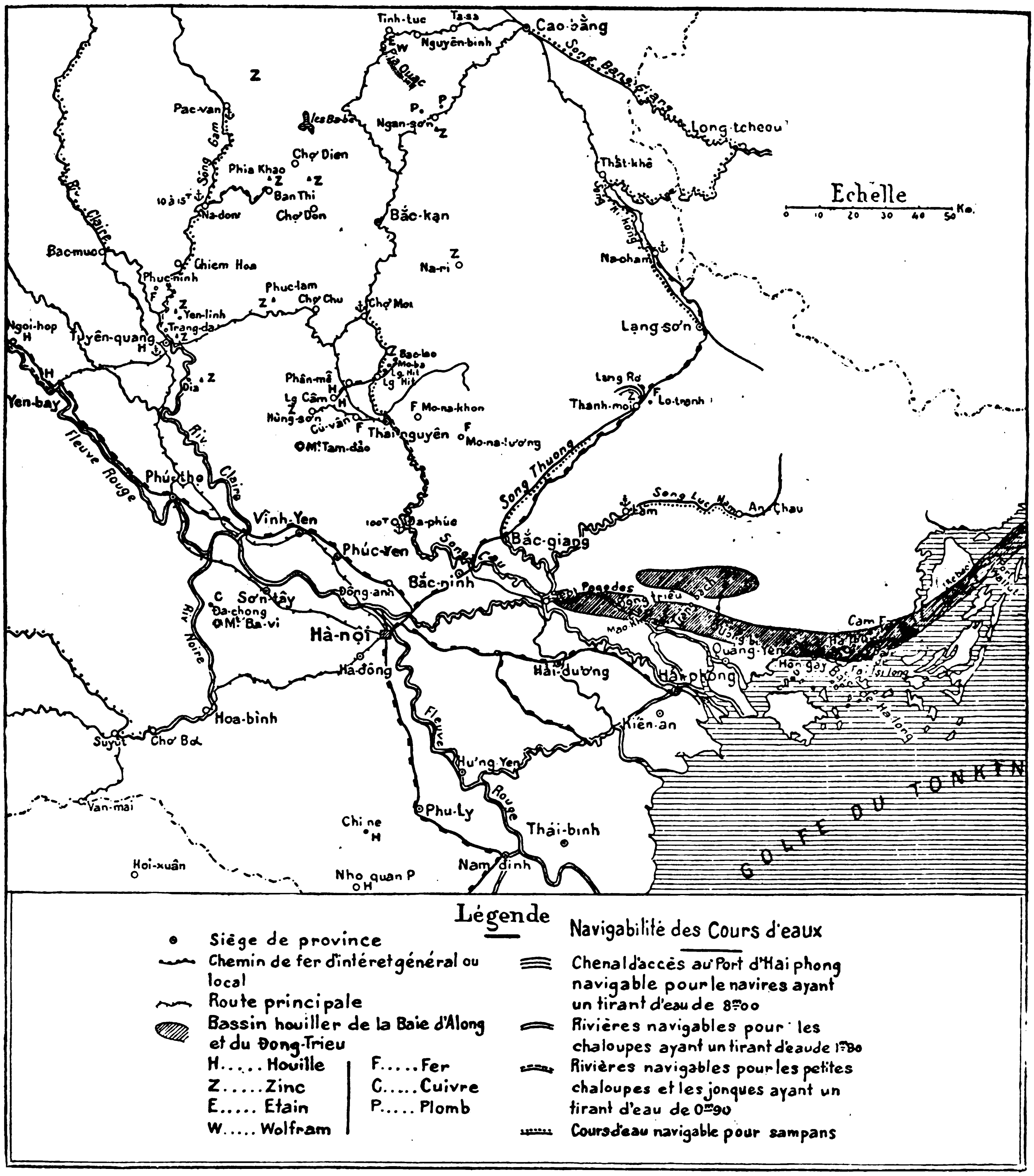
Both Cambodia and Cochin-China being composed largely of lowlands are not likely to have much mineral wealth, though a few interesting mines are to be found in the former country.

### Mining Legislation.

The basis of the present regulation is the decree of 26th January, 1912, modified by the decrees of 24th December, 1913 and 12th November, 1916, which decree is founded on the principle of the mine belonging to the finder.

Instead of employing the usual French method of royalties and all that it implies it was considered better, in view of the difficulties of the situation, to reserve to the prospector the deposit that he discovered.

The right to prospect within certain defined limits is acquired by the first comer after the payment of low fees and without it being




**Principal Mineral Deposits of Tonkin**

necessary to prove beforehand that deposits actually exist there. The explorer is thus put into sole possession for three years of the right of prospecting within a square having sides of 3 km. (1.86 mile) parallel with the lines of longitude and latitude, and the centre of which is officially marked by a post.

He has the right of changing this temporary occupation of the land into a permanent concession provided that he applies for this within three years and pays a fixed and very moderate fee.

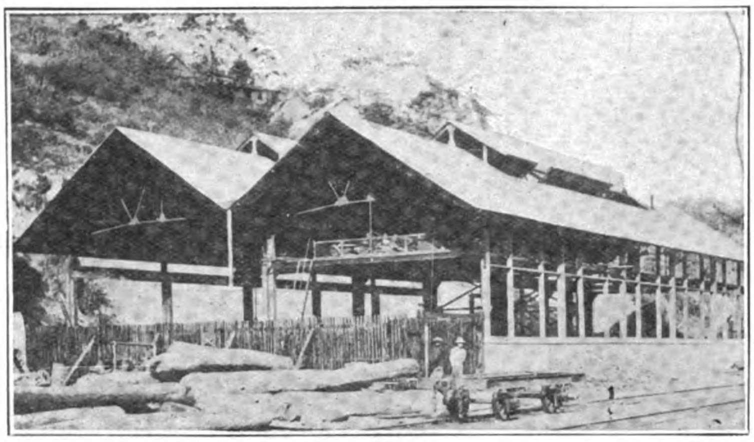
This is the normal method of obtaining concessions, but to prevent monopolies the authorities have the right to create reserved districts in which the concessions are let by public auction. Two of such reserves are already to be found in the Dong-Trieu coalfield, and the Thai-Nguyen mining district.

The holder of a concession has to pay a yearly fee of gradually increasing value during the first ten years, after which it becomes uniform.

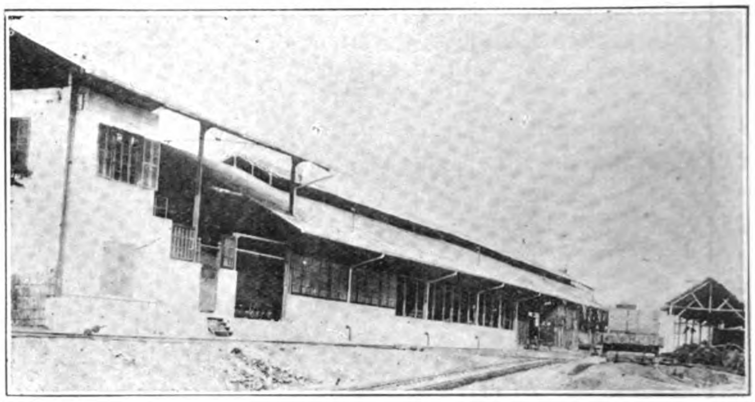
It may be mentioned that according to the decree of 28th July, 1918 all demands for the right of prospecting or mining must be accompanied by a personal authorization signed by the local authorities.

PROSPECTING.

The variations in the number permits granted annually for prospecting is shown by the government reports in recent years the prospecting has been specially for fuel, metalliferous mines being neglected owing to the bad times.



New Foundry

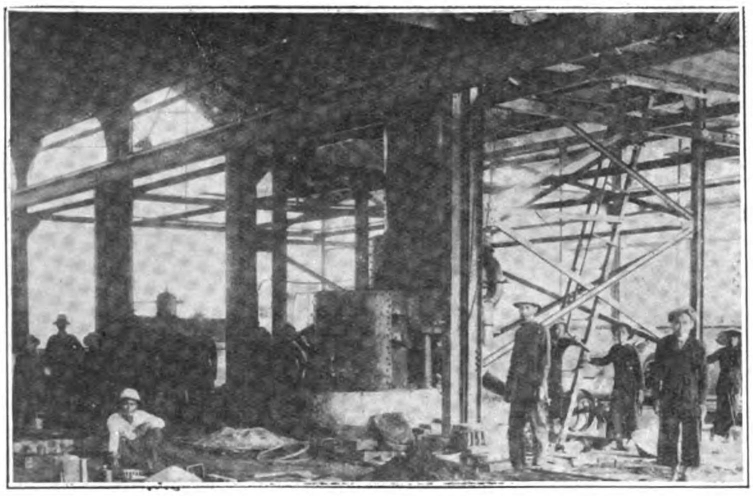


Machine Shop

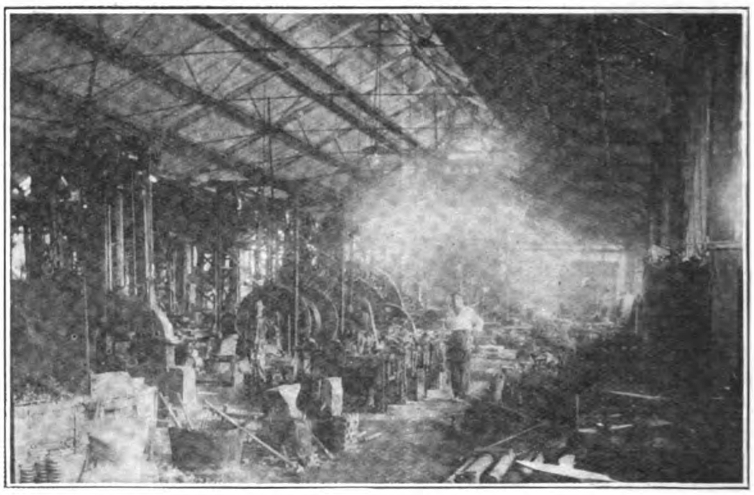
HONGAY COAL MINES

LABOR EMPLOYED IN MINING.

This labor consists chiefly of Annamites from the lowlands, together with some Chinese. Some coolies come from the mountain districts, although generally they do not take to regular work; they prove of use, however, to prospectors owing to their knowledge of the country.



Interior of Foundry



Interior of Machine Shop

HONGAY COAL MINES

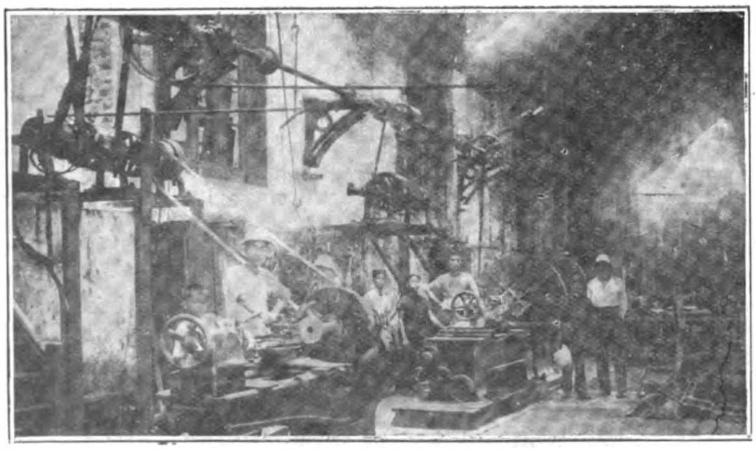
The Annamites do not like working in the mines as they are much attached to their native rice-fields and find the climate of the hills too cold, and they do not leave the lowlands except through necessity, for they easily catch fevers and are generally not very robust. On the other hand they are intelligent, skilful, and easily managed.

Chinamen, who have no such objection to leaving their country, are bigger, and stronger and can adapt themselves more easily to different climates, but they are more exacting* and not so reliable while they do not readily accept the necessary restraints of work and are fond of collective action against the management. They are adapted especially for all hard physical jobs.

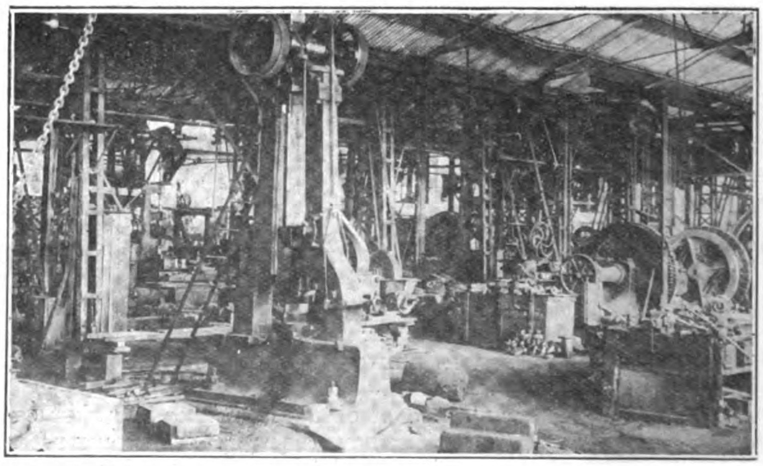
In Indo-China the piastre contains 375 grains Troy of silver, and since the beginning of 1922 the notes issued by the Banque de l'Indochine may be exchanged into piastses at sight, so that they remain practically equal to the value of silver. At the present time

*The average wages are:

| | | |
|---|---|---|
| Chinaman ... ... ... ... ... | ... .50 | piastres per day |
| Annamite ... ... ... ... ... | ... .35 | — — |
| Native woman ... ... ... ... | ... .27 | — — |

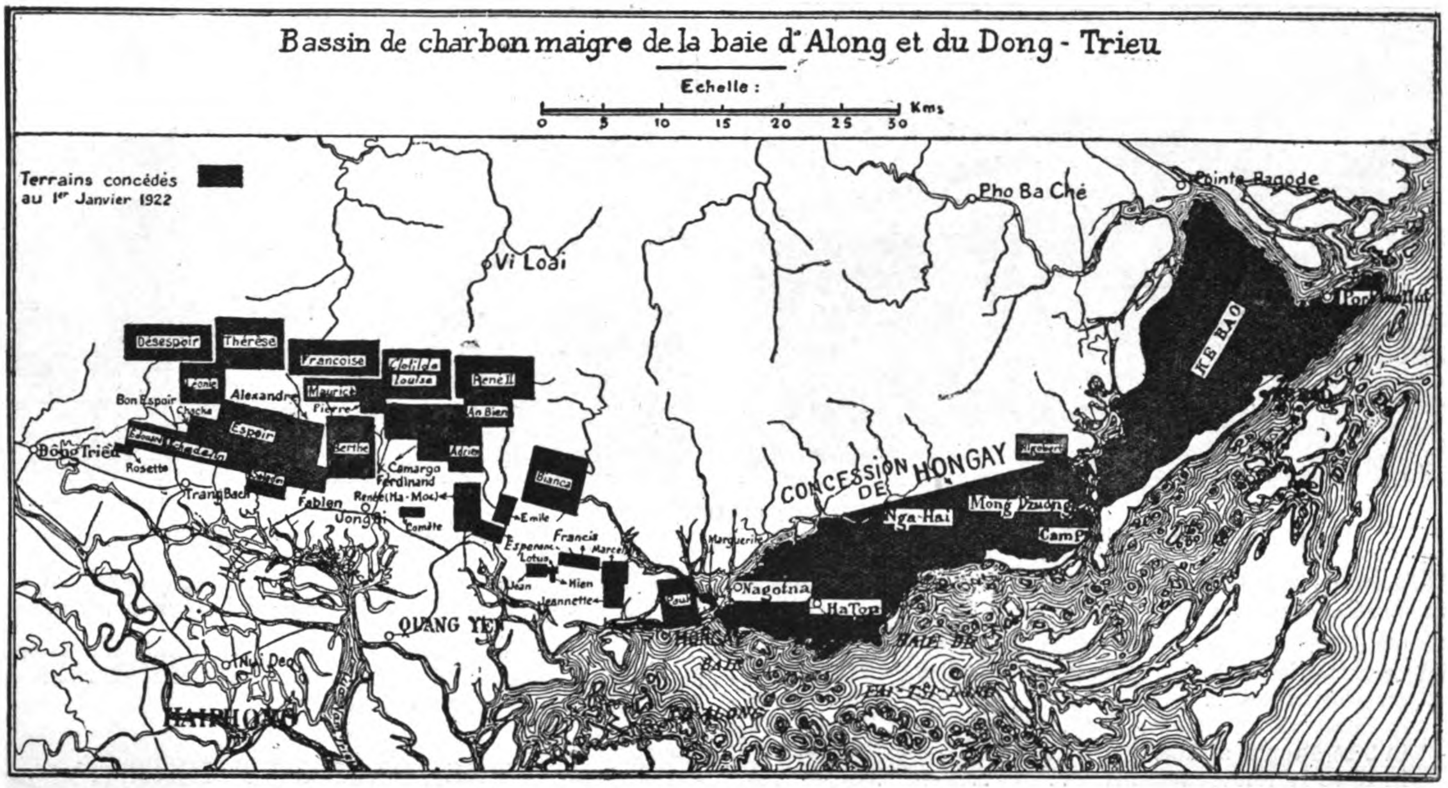


Machine Shop—Lathe Room



Machine Shop

HONGAY COAL MINES




Non-Bituminous Coal Field of Along Bay and Dong Trieu

the piastre is worth a little more than half a dollar in gold, that is to say but slightly different from its pre-war value.

The recruiting of labor and its retention near the mines is a problem of the highest importance, but Tonkin with its 7,000,000 inhabitants, packed, especially in the delta of the Red River, to the extent of 1,300 to 1,550 to the square mile, happily forms a handy reservoir of labor. The gradual penetration of the Annamite population into the mountain districts, where trade centres are being formed and where the increased means of communication enable the home-sick native to more easily pay his periodic visit to his old home, is tending to improve the recruiting of this labor, so that if the various companies and private owners do all they can to improve the lot of their work-people, the problem will soon be successfully solved.

The output of the coolies is small, especially on heavy jobs, but owing to their low rate of pay their labor is still cheaper than that of Europeans. For a long time skilled workers were recruited from among the Chinese, but now-a-days the Annamites are taking their places, as they are very satisfactory when well superintended.

### European Staff.

The European managing and administrative staff should be chosen with the greatest of care, especially where the board of directors, as is too often the case, are in France, in which case they should be given the very widest possible powers both in matters of decision and in questions of initiative if serious loss of time and costly mistakes are to be avoided. The salaries of such officials, which average about three times those obtaining in France, should, therefore, be calculated largely.

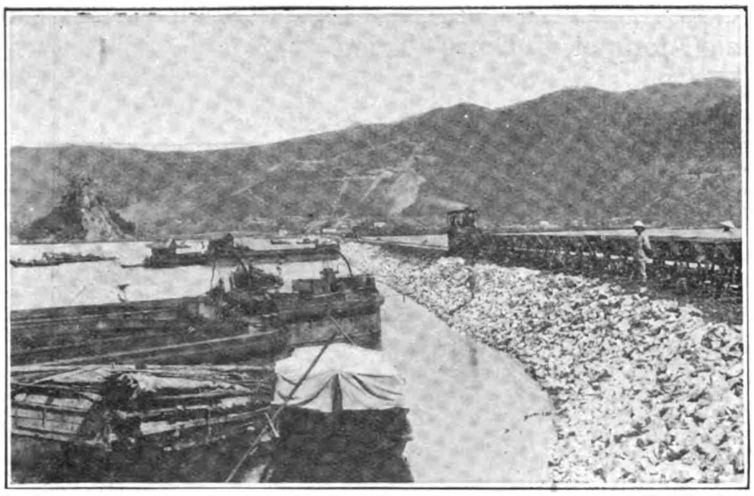
Yard-masters or works-managers are often chosen from local labor, but their lack of professional education throws a very large amount of extra work and responsibility on the shoulders of the European engineer.

### Transportation.

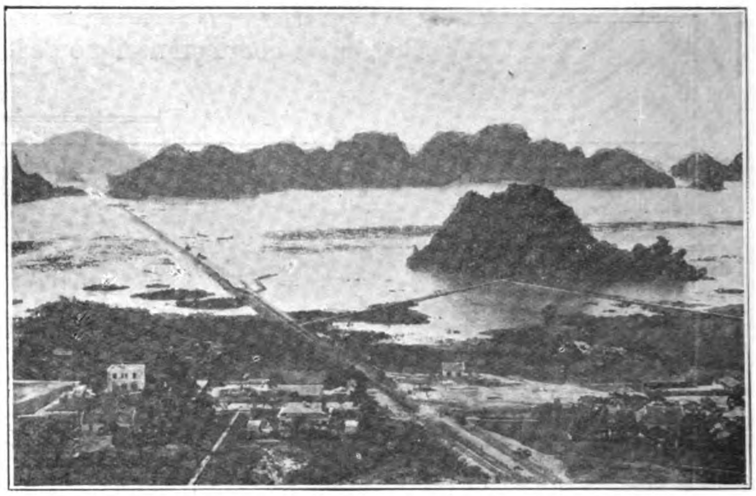
In a new country like Indo-China the question of transportation is as important as that of the richness of the ore. Every mode of transportation is employed according to the country and the value of the product carried, thus in the highlands of Tonkin wolfram and cassiterite (oxide of tin) are packed in 33-lbs. bags and carried on the backs of men or horses to the nearest road and thence on carts to the railway which brings it down to the port of exportation. It would not pay to carry zinc ore, of much less value except in bulk by railway or water.

The following figures and prices will enable anyone having a good map of the country showing existing roads, railways and navigable waters, to arrive at some idea of the cost of transportation from any given mine to the sea. A small map of the known ore deposits of Tonkin is given above. It should be noted, of course, that Upper-Tonkin, Upper-Laos and the Annamite mountain chain are exceedingly undulating and where neither railway nor road are marked it would be prudent to reckon on either small packs carried by men or animals or the building of costly roads or railways. On the contrary in the open forests of the Me-kong valley are to be found innumerable cart tracks which can be utilized in the dry season and can easily be extended.

Hongay Mines: Erecting the Central Electrical Plant at Kilometre 5



General View of the Campha Mine



Causeway at the Campha Mine

HONGAY COAL MINES

The cost of transporting one ton (2.240-lbs.) one mile in Tonkin may be taken as about :

| | | Piastres |
|---|---|---|
| Carried on men's backs .. .. .. .. | from | .98 to 1.31 |
| — on pack-horses .. .. .. .. | — | .83 — 1.14 |
| — in small carts .. .. .. .. | — | .33 — .49 |
| — in 3 to 5 tonne sampans .. .. | — | .114 — |
| — in 10 to 15 tonne sampans .. .. | — | .05 — .08 |
| — in 15 to 30 tonne sampans .. .. | — | .16 — .049 |
| — in launches, junks and towed barges of 50 tonne and over .. .. .. | — | .013 — .01 |
| — by railway, not less than .. .. | — | .033 |

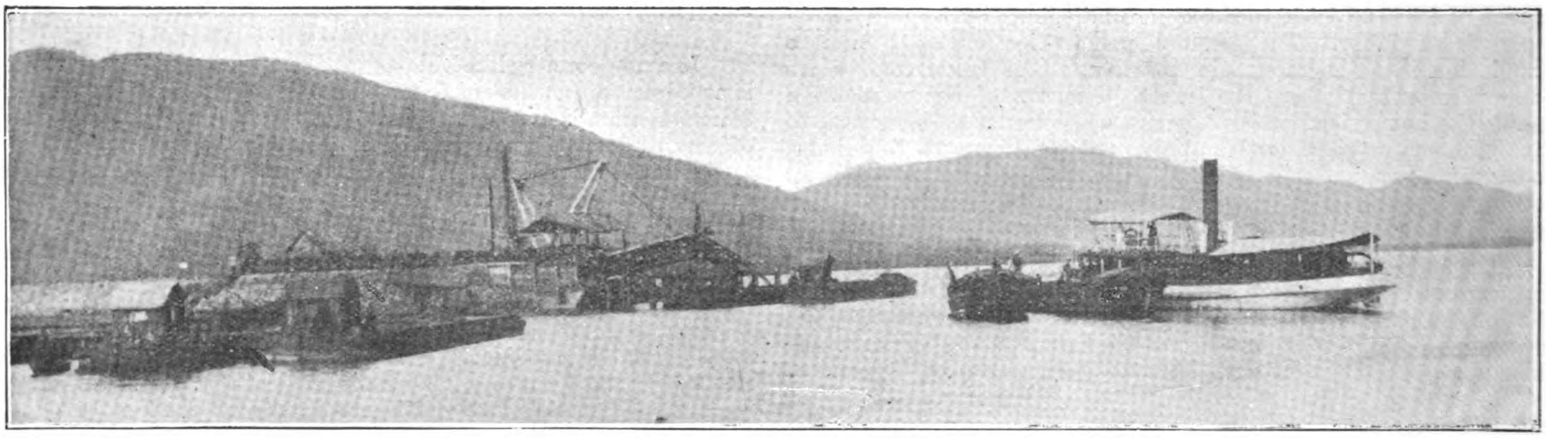
Rates of freight to Europe which were prohibitive during and after the war have recently fallen considerably and at the beginning of 1922 were below the pre-war rate calculated in gold or piastres, but their rapid changes make it impossible to give any figures.

Below will be found some notes on the principal ore deposits of Indo-China, noteworthy either on account of their richness or of some past or present circumstance.

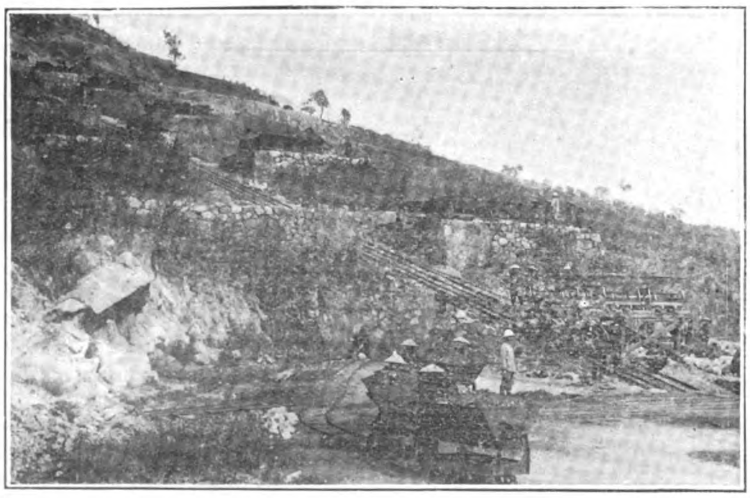
## THE MINES OF TONKIN

### I.—Coal and Lignite

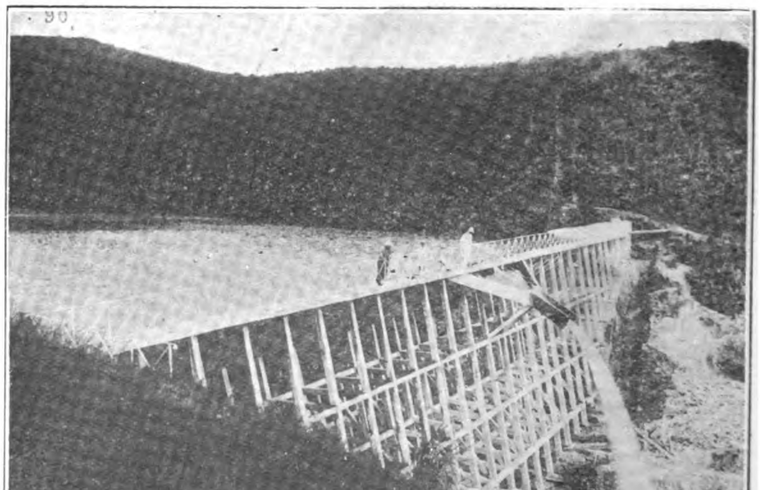
The principal mineral wealth of Tonkin lies in her collieries, of which the attached table shows the exports for 1921.



Coal Loading Device at the Campha Mines



Inclined Plane for Coal Cars at the Campha Mine



Barrage at Kilometre 3

HONGAY COAL MINES

### COAL.

The principal coal-field, first worked in 1884, is that lying along the bay of Along and in the Dong-Trieu forming an arc some 112 miles long from near Mon-kai on the east to Seven Pagodas on the west. This coal is non-bituminous and is extracted from strata of the Rhetian secondary period. Its average composition is as follows :

| | |
|---|---|
| Volatile matter .. .. .. .. | .. from 8 to 12 % |
| Ash .. .. .. .. .. .. | .. — 2.5 — 7 — |
| Fixed carbon .. .. .. .. .. | .. — 87 — 88 — |
| Sulphur .. .. .. .. .. | .. — less than 1 — |
| Heating value .. .. .. | .. from 7,000 to 8,400 calories (280,000 to 333,000 B. T. U.) |

It is a first-class coal burning without smoke and producing no clinker ; with forced draught—such as the Howden system in ships —it can be used alone, even unscreened as at a pinch in fine pieces. When mixed with bituminous coal it forms a good steam coal capable of being burnt in locomotives and ships. Before bituminous coal was discovered in Tonkin it had to be imported from Japan, but the big shipping companies are now beginning to ship the following mixture at Haïphong : 60 per cent. of non-bituminous Hongay coal and 40 per cent. of Tonkinese bituminous coal.

### SITUATION OF THE COLLIERIES.

The collieries of Along Bay are privileged as the coal can be won chiefly in open cuts and there are natural deep-water harbors in close proximity where vessels of from 4,000 to 6,000 tons can easily be berthed (Hongay, Port Courbet and Port Wallut).

Coal can be shipped from the Dong-Trieu coal-field in 100-ton barges from the principal mines lying not far from the Song-Da-Bach to Haïphong at an average cost of .80 piastres per ton.

### BITUMINOUS AND SEMI-BITUMINOUS COAL.

Two deposits of bituminous or semi-bituminous coal have been recently discovered in Tonkin, belonging to the same geological period as the non-bituminous coal, and though they are by no means so extensive or so accessible as these fields, yet they are of interest to the colony, which has, hitherto, had to be tributary to Japan for this kind of coal.

### THE COAL TRADE.

Several markets are open to the coal of Tonkin of which the following table gives the output and the principal destinations :—

| Stock on Jan. 1, 1921 | Output during 1921 | Consumed in the Colony | EXPORTED to Hongkong, Japan, China and other countries in the Far East | Stock on Jan. 1, 1922 |
|---|---|---|---|---|
| 175,550t | 920,900t | 451,061t | 525,767t | 119,642t |

| DISTRICTS | Mine | Sort of Coal | Output — Tons | Exports — Tons |
|---|---|---|---|---|
| Along bay* | Hongay | Non-bituminous | 720.000T | 497.163T |
| | Kébao | — | 8.311 | 7.759 |
| Port-Courbet to Dong Trieu | Francis | — | 8.580 | 12.000 |
| | Paul (Vu Oai) | — | 600 | |
| | Margot | — | 1.800 | |
| | Hien | — | 2.126 | 4.300 |
| | Espérance | — | 1.450 | |
| | Renée | — | 22.113 | |
| | Clotilde Louise | — | 24.857 | |
| | Fabien | — | 12.900 | |
| | Espoir | — | 5.900 | |
| | Schœdelin | — | 26.859 | |
| | Edouard | — | 23.156 | |
| | Chacha | — | 4.707 | 4.545 |
| | Marcelle | — | 2.256 | |
| | Sarah | Lignite | 765 | |
| Phan-Me | | Bituminous | 13.766 | |
| | Louisette | Bituminous with | 13.766 | |
| | Co-Loung | 23% of vol. matter | 18.287 | |
| Phu Nho Kwan and Shine | Paul | | 8.500 | |
| | Doi Hoa | Semi-bituminous | 2.294 | |
| Tuyen Kwan | Alice | Lignite | 11.562 | |
| Cao-Bang | Henri | — | 111 | |
| Nong Son | Nong Son (1) | Non-bituminous | | |
| | | Total | 920.900T | 525.767T |

*Not worked in 1921.

The Société des Charbonnages du Tonkin being by far the most important colliery owners the following table dealing with the port of Hongay for the year 1921 will give a fair idea of the principal markets for Tonkin coal :—

| Flag | No. of Ships | Net Tonnage | No. of Tons Exported |
|---|---|---|---|
| Japanese .. .. .. | 113 | 161.535 | 364.498 |
| British .. .. .. | 58 | 91.839 | 152.473 |
| Chinese .. .. .. | 4 | 4.147 | 5.694 |
| French .. .. .. | 3 | 3.763 | 6.300 |
| American .. .. .. | 2 | 3,230 | 5.709 |
| Russian .. .. .. | 1 | 1.492 | 2.600 |
| Totals .. .. .. | 181 | 266.006 | 537.274 |

The following table shows the pre-war and present prices of coal :—

| | Pre-war Piastres | Pre-war Gold Francs | 1921 Piastres | 1921 Gold Francs |
|---|---|---|---|---|
| Screened coal, at Tonkinese port | $6.50 | fr.16.25 | $9.50 | fr.24.50 |
| Small and nuts — | $6.00 | fr.15.00 | $8.50 | fr.21.90 |
| Fine coal — | $2.50 | fr. 6.25 | $4.00 | fr.10.30 |
| Bituminous coal delivered station Jialam or Phu-Ly .. .. | $6.00 | fr.15.00 | $11.00 at $12.50 | fr.28.40 at fr. 3.25 |

The local demand has outstripped the means of production in spite of the efforts of the owners to increase the output, hence the present rise.

The Société des Charbonnages du Tonkin, the output of which rose from 550,000 tons in 1920 to 720,000 tons in 1921 and will probably reach 800,000 tons in 1922, is thinking of reducing its exports in order to meet the home demand.

At the present time Indo-Chinese buyers use but little fine coal from Hongay letting the Chinese take it at a low price, but the unscreened coal sold by this Company contains 42 per cent. of good coal and 57 per cent. of fine. Efforts are therefore being made to utilize this latter in the form of dust, and the Société des Distilleries de l'Indochine, having already obtained satisfactory results from a boiler fired by means of a pulverizing burner supplied by the Société des Combustibles Pulvérisés, is planning a central pulverizing station for a whole battery of boilers.

### DEVELOPMENT OF OUTPUT.

Every colliery owner is doing his utmost to increase his output. The Société de Hongay intends to spend 26,000,000 francs on new work. The Société des Anthracites du Tonkin, a new Company who has bought the Maokné and Trang-Bach collieries in the Dong-Trieu district, is preparing to work these splendid deposits in the best manner.

The Société des Charbonnages du Dong-Trieu proposes to improve its means of transport by prolonging its mining railway on to the Song Da-Bach where a river port will be established.

The output of bituminous and semi-bituminous coals is also increasing, but is still far from meeting the demands of the local manufacturers. The Phan-Me coalfield (20,000 tons in 1920 and 32,000 tons in 1921) cannot be properly exploited until the canal running from the mining district of Thai-Nguyen to the waterways of Tonkin near Phu-Lang-Thuong has been cut : it is hoped to commence this work in 1922.

### KEBAO COLLIERIES

#### NON-BITUMINOUS COAL.

Since the concession of this colliery in 1888 some 400,000 tons of coal has been extracted having the following composition: Ash, 5 per cent.; volatile matter, 7 per cent.; sulphus, 1 per cent.; fixed carbon, 85 per cent. and water, 2.5 per cent.

Much money was inconsiderately and prematurely wasted at first, more especially on a metre-gauge railway 8½ miles long from the splendid harbor of Port Wallut to the centre of the island, rich in coal, and the original Company went bankrupt, the colliery being left in the hands of Chinese middlemen, who merely scratched the surface. The present owners are trying to get things straight and are confining themselves for the present to working the western

side of the island rich in thin and medium seams of coal (output in 1921 was 8,311 tons) and is utilizing the old railway extended by a contractor's line.

### Hongay Collieries.

*Société Française des Charbonnages du Tonkin.*

NON-BITUMINOUS COAL

The Chinese in 1865 were the first to work this coal-field. After Fuchs had prospected in 1882 and Sarran in 1886 the "Coal-field of Along Bay" (56,800 acres) were conceded to the Company now working them.

For want of markets the early days were hard, but since 1900 success has been assured and the shares of the Company issued at 500 francs (present nominal value is 250 francs) were quoted at 5,800 francs at the beginning of October 1922, although the value of the shares had been halved in 1919.

### How the Coal-field is Worked.

The known seams of coal may be divided into two levels: *the coal Hatou level* containing four seams, of which the *Grande Couche* (main seam) is from 165 to 200-ft. thick (with about 100-ft. of good coal), and the others which make up in the aggregate some 50-ft. of good coal, and the *Nagotna level* containing about ten seams varying from 3 to 20-ft. thick.

At Hatou is extracted from the Grande Couche in three open workings, whence it is carried to Hongay by a metre gauge railway eight miles long ; in 1921 257,000 tons were extracted.

Open workings on this same seam are to be found at Campha whence the coal (321,597 tons in 1921) reaches Hongay by steam launches or junks of 60 to 100 tons. The exceptionally favored position of this colliery on the sea-coast, with a seam 500-ft thick, of which 260 are pure coal, and the numerous known outcrops in the neighborhood, all point to a successful future.

Mention should also be made of the underground workings of Nga-Hai and Mong-Dzuong which supplied in 1921 66,933 and 74,465 tons respectively. This coal screened at the pits is sent by barges or junks either to the depôt at Hongay or direct to the customers.

### Screening, Washing, etc.

At the Hongay depôt the coal is sorted into various sizes—0/12, 12/30, 30/50 (up to 1/2-ins., from 1/2 to 1-ins., from 1 to 2-ins.—and screened for sizes over 50 m (2 ins.), while nuts of 12/30 are washed.

A patent fuel plant is also to be found here, the four presses of which are capable of turning out 130 to 150,000 tons a year. Brai (a sort of pitch) is used to agglomerate 70 per cent. of Hongai small coal and 30 per cent. of Japanese bituminous coal.

This patent fuel is much appreciated ; appended are analyses of the two sorts made.

Patent Fuel.

| | ordinary | war |
|---|---|---|
| Volatile matter without water | 17.5 to 18 % | 18 to 18.25 % |
| Fixed carbon | 76 — 77 — | 78. — 81 — |
| Sulphur | .90 — .95 — | .70 — .75 — |
| Ash | 7 — 8 — | 5 — 6 — |
| Heating value | 7,500 to 7,600 | 7,850 to 8,100 calories |
| Cohesion | 70 | 70 |

Boulets (patent fuel in a circular or oval form) are also turned out at the rate of 20 tons per machine.

There is further a battery of nine coke ovens capable of turning out from 25 to 30 tons of coke per day, but producing actually but 1,000 tons yearly. This coke is made from a mixture of 30 per cent. Hongay small coal and 60 per cent. Japanese bituminous coal.

The port of Hongay is equipped with a landing-stage 250-ft. long and two quays of 230 and 260-ft., fitted with seven steam cranes and two hydraulic cranes handling from 2,000 to 2,500 tons per day per quay.

The fleet of the Company is composed of six steam launches, ten 65-ton barges and thirty 100-ton junks.

### Staff.

The native staff of the Company amount to 800 Chinese and 7,000 Annamites, but it is estimated that some 40,000 natives, including workmen's families, shopkeepers, etc., are supported by the collieries.

### Proposed New Works.

It is proposed to create in the immediate future a new port as the eastern end of the concession a few miles from the open workings of Campha, with a landing-stage 820-ft long at which two ships of 8,000 tons and drawing 26-ft. could be loaded at the same time and equipped with five electric travelers, each of which would be capable of loading normally 150 tons an hour or 200 to 250 tons at "rush" times.

Nearby, screening and washing plants would be erected to deal with 250 tons of coal per hour, while the mines would be connected to the port and screens, etc., by a metre gauge railway.

A central electric station of 2,000 kw situated between Hongay and Hatou would supply all the power required at the open workings and ports.

## DONG-TRIEU MINES

### Anthracite Coal.

The two ranges of hills at Dong-Trieu, running from east to west and separated by the valley of the Song-Ky both contain several seams of coal. In the southern range bordered by the Song Da-Bach, by which the coal is transported, the principal colliery is that belonging to the "Société des Anthracites du Tonkin" (concession "Edouard" and "Schoedelin" and containing about twenty seams with from 3 to 20-ft. of coal, not yet worked except on the face and of which the 1921 output was 50,000 tons. Numerous other concessions are being worked in this southern range and they comprise from west to east:

| | | | |
|---|---|---|---|
| Chacha | .. .. with an output of | 4,707 | tons in 1921 |
| Espoir | .. .. .. — | 5,900 | — |
| Fabien | .. .. .. — | 12,900 | — |
| Renée | .. .. .. — | 22,113 | — |
| Espérance | .. .. — | 1,450 | — |
| Francis, Hien | .. .. — | 10,706 | — |
| Margot | .. .. .. — | 1,800 | — |
| Marcelle | .. .. .. — | 2,257 | — |

The output is increasing everywhere owing to the increased demand and the corresponding rising prices.

In the northern range of hills the "Clotilde-Louise" pit owned by the "Société des Charbonnages du Dong-Trieu" possesses some ten seams, of which it is working at present but four with a total thickness of from 50 to 65-ft. of coal (hard anthracite having but 3 per cent. of volatile matter). This coal is carried by a mining railway to the landing-stage, some nine miles away, of Uong-Bi on the Song Da-Bach : the output in 1921 was 24,857 tons.

## PHAN-ME COLLIERIES

### Bituminous Coal.

This field, discovered only in 1910, includes some ten seams of which the total thickness of coal is in some parts—the prospecting is far from complete—at least 65-ft., while one seam of lenticular shape is sometimes 33-ft. thick.

This coal contains on an average 22 per cent. of volatile matter, 18 per cent. of ash and from 1 to 1.5 per cent. of sulfur and burns well, being much in demand for mixing with small non-bituminous coal. It yields a light and hard coke which, according to experiments made both in a laboratory and in a cupola appears to be suitable for all metallurgical operations.

Unfortunately transportation from the collieries is still bad, as the coal has to be brought down by a narrow contractor's railway to the landing-stage on the Song-Cau, whence 4 to 5-ton sampans take it to Thai-Nguyen where it is transhipped into 15-ton junks which bring it to the railway or to some large river-port. The output has, however, increased from 20,000 tons in 1920 to 32,000 tons in 1921 and when the canal now being cut to this coal-field is completed this colliery should boom.

## COAL-FIELD OF PHU-NHO-KWAN AND SHI-NE

### Semi-Bituminous Coal.

The deposit of Phu-Nho-Kwan, 7½ miles from a river up which junks of 50 tons may be towed and which is connected by water to the railway station of Ninh-Binh, 25 miles further on, comprises a considerable number of seams of lenticular shape of thicknesses varying from 16-ins. to 16-ft. The coal contains on an average 17 per cent. of volatile matter and 5 per cent. of sulphur and is much sought after for mixture with non-bituminous coals in spite of its high percentage of sulphur.

The production in 1921 was 8,500 tons in spite of the two transhipments between the collieries and Ninh-Binh.

At Shi-ne working, started in 1912, was abandoned in 1914, but a fresh start was made in 1920.

The strata, much twisted, contains some ten seams of coal of lenticular shape. This coal contains an average of 20 per cent. of volatile matter, 7.5 per cent. of ash and 4.2 per cent. of sulphur and the output in 1921 amounted to 2,294 tons. From the colliery a contractor's line of five furlongs runs down to a neighboring river, navigable by 20-ton junks.

### Tertiary Coal.

Numerous small fields of tertiary coal (of the nature of lignite) are to be found in Tonkin.

That of Dong-Jiao, near the Hanoï and Vinh railway and which was actively worked from 1905 to 1911, supplied 106,000 tons of lignite to the Tonkin railways from a 30-ft. seam the working of which was abandoned at the depth of 115-ft.

The colliery at Tuyen-Kwang, equally well situated and in work since 1915, furnishes an excellent lignite which contains on an average 35 to 40 per cent. of volatile matter, 8 to 12 per cent. of ash and 1½ to 2 per cent. of sulphur. At the present time a seam, 8-ft. thick, is being worked underground ; the output was 20,000 tons in 1915, but only 11,562 tons in 1921 owing to inadequate means of raising it. After being washed, the coal is taken by a contractor's railway some five furlongs long to a landing-stage on the Clear River were it is dumped into 50 and 100-ton junks.

Mention may be made of the as yet unworked tertiary deposits of Yen-Bay and of Langson, of those of Cao-Bang, occasionally worked, and of Dong-Ha, worked since the end of 1920 and daily producing at the present time 6 to 8 tons of lignite.

## II.—Zinc Mines

### General.

Zinc ore, which is second in importance to coal, is to be found chiefly in the extensive group of limestone mountains of the primary period bounded by the Clear River, the Red River and the railway between Hanoï and Langson.

In the outcropping workings of to-day the ore is found in the form of calamine or oxydized ore (carbonate and silicate of zinc) in pockets in the limestone, often where this lies on the schist of the same period, while it becomes blende (sulphide of zinc) as the depth increases and is found more in lodes, such as has been already worked in some old mines, for instance at Lang-Hit.

Many of these old mines were worked by the Chinese who often left most of the zinc ore in favor of the argentiferous lead, sometimes keeping a little for the minting of sapeks. The ore was occasionally reduced at the mine, but more frequently it was taken to a coal-field or at least to some water-way and reduced in works, ruins of which have been found near Thai-Nguyen and near the post of Trang-Bach in the Dong-Trieu district.

From 1905, when it became possible to peacefully prospect for minerals, a series of discoveries were made, such as, to mention only the principal ones, the deposits of Trang-Da in 1905, of Lang-Hit in 1906, of Thanh-Moi in 1907, of Chodien in 1908 and of Yen-Linh in 1909.

The following table gives the output of zinc since 1905 and also show the effect of the present world depression in the metal market :—

Totla Output of Zinc Mines from the Beginning of European Working Until 1921 Inclusive.

| Year | Mine | Province | Output (weight) | % of zinc | Staff in 1917 Europeans | Annamites | Chinese |
|---|---|---|---|---|---|---|---|
| 1905 | Trang-Da | Tuyen-Kwang | 134.482 | 45 | 11 | 1,280 | — |
| 1907 | Lang-Hit | Thai-Nguyen | 131.458 | 50 | 15 | 1,100 | — |
| 1908 | Thanh-Moi | Lang-Son | 27.590 | 52 | 4 | 200 | — |
| 1911 | Yen-Linh | Tuyen-Kwang | 16.754 | 50 | 7 | 570 | — |
| 1911 | Van-Lang | Thai-Nguyen | 5.272 | 45 | | | |
| 1914 | Bac-Nhung | Tuyen-Kwang | 1.110 | 50 | | | |
| 1914 | Cho-Dien | Bac-Kan | 64.170 | 49 | 13 | 1,280 | 200 |
| 1916 | Pac-Van | Bac-Kan | 10.935 | 48 | 4 | 370 | 150 |
| | | | 391.711T | | 54 | 4,800 | 350 |

Prior to 1914, the Tonkin zinc mines exported all their output to Europe. In the early days of the war a few consignments were sent ; but the rise in the price of freight since 1915 has killed that trade for the time being at any rate. The rise in the price of zinc co-incided happily with the arrival of Japanese buyers who bought this metal at very remunerative prices, but when Russia broke down during 1918 the Japanese ceased to buy.

The ore was then stocked at Haiphong and at the end of 1919 freights came down, so that with the aid of export-bounties granted by the government of Indo-China it was possible in 1920 and 1921 to get rid of this stock of 60,000 tons which had become a heavy charge on the mine owners.

In spite of the gravity of the crisis which is paralyzing the mines of the whole world, two Companies have kept their mines going, Trang-Da with an output of 6,614 tons in 1921 and Chodien with 3,477 tons in the same year but much of their activity is devoted to prospecting.

The confidence which the industrial world has ever manifested in the future of the zinc mines of Tonkin is shown by the decision arrived at in 1920 and 1921 by the Compagnie Minière et Métallurgique de l'Indochine, a company with a capital of 16 million francs and founded by the Compagnie Minerais et Métaux, the Société de la Vieille Montagne, the Compagnie Royale Asturienne, the Société de Penarroya, etc., to acquire the important mines of Chodien and to erect at Kwang-Yen, close to the coal-fields and on the banks of one of the chief water-ways of Tonkin, works for the treatment of calamine and capable of turning out yearly 6,000 tons of metal—in pigs and rolled*. Later, these works will be enlarged in order to reduce the sulphur ores of zinc, lead and similar metals.

Towards the end of 1921 work was begun on a jetty in the Song Da-Bach accessible to barges of 120 tons, and it is hoped that the first of the three furnaces, each of the yearly capacity of 2,000 tons of metal will be ready by April 1923.

At the same time the Company states it will very shortly resume active operations at its mines at Chodien.

### Trang-da Mine.

This mine, now belonging to the Société des Mines de Trang-Da is very advantageously situated on the bank of the Clear River opposite the town of Tuyen-Kwang, whence 50 to 100-ton barges can transport the ore to Haïphong, 155 miles away.

This deposit which crosses a rocky eminence on the edge of the river and then strikes downwards had been worked by the Chinese in search of argentiferous galena. The ore is found in strata in the limestone or else in perpendicular faults, and since the mine has been rediscovered and worked on European lines practically nothing but calamine has been extracted, but gradually sulphatic ores, such as blende and galena, are now being found.

*In view of the help given by the British government to similar enterprises in its colonies it is as well to call attention to the fact that the *Compagnie Minière et Métallurgique de l'Indochine* anxious to maintain its commercial independence, more especially as regards the purchase of rail material, eventually declined to accept the Indo-Chinese government's subsidy which it had originally asked for, as this would have entailed restrictive regulations.

The mine possesses a fairly complete crushing plant capable of dealing with 20 tons a day, such being necessary when dealing with this class of ore, and also 8 kilns (five with 12-ton coppers for reducing the bigger pieces of ore, and 3 reverberating kilns for the small pieces, capable of producing, if all working at the same time, 78 tons of calcined calamine* a day.

This Company places four kinds of ore on the market:

1st quality with over 50 per cent. of zinc;

2nd quality with from 45 to 50 per cent. of zinc:

3rd quality with from 34 to 40 per cent. of zinc.

Ferruginous quality, with from 34 to 40 per cent. of zinc, suitable for making oxyde of zinc.

### Chodien Mines.

The mining district of Chodien is situated to the north of the halmet of Ban-Thi, some 12 miles as the crow flies to the east of the Song-Gam, a tributary on the left bank of the Clear River into which it flows near Tuyen-Kwang. The ore is transported from Na-Don on the Song-Gam in 8 to 15-ton sampans according to the season and transhipped at Tuyen-Kwang, 37 miles further on, into 50 to 100-ton barges which are towed down the river.

But to connect the mines with Na-Don through a hilly country has necessitated the building of a railway 20 miles long having a gauge of 23⅝-ins., maximum gradients of $30^{0}_{00}$. curves of a radius as low as 27 yds., 21-lb. rails and 5-ton locomotives. Further, as the station of Ban-Thi stands at 918-ft. above sea-level while the actual mines lie between 1,850 and 3,000-ft. above sea level it was necessary to connect the working faces by means of surface railways with a two mile long self-working aerial rope-way, carried on wooden pillars at a slope of 1 in 5.6 and capable of delivering 10 tons an hour in 440-lb. skips. It is proposed to erect a collecting cable with skips weighing 770-lbs. and capable of delivering 25 tons per hour.

Such important installations are not often found in connection with mines of calamine, but the extreme richness of the large pockets of ore found in the limestone at Chodien fully justifies this expense.

The ore is calcined at Banthi, after such washing as may be necessary, the larger pieces being treated in a coppers (5 kilns produce 18 tons of calcined ore per day) and the smaller in a reverberating kiln (6 of 3½ tons each); these kilns are heated by wood.

### Langhit Mines.

The mines of Langhit, situated not far from the Song-Cau, some ten miles to the north of Thai-Nguyen, were formerly extensively worked by the Chinese.

These mines (concession Métis) as well as those of Mo-Ba (Mo-Ba concession) and Bac-Lao (concession Lucie) are all sunk in a series of faults in the limestone and schist and at a very slight depth the mineral changes to blende. Since 1905 they have been actively worked by Europeans, but work had to be suspended in February 1918.

At the Langhit mine (260-ft. above sea level) the Company had erected a central station of 250 h.p. supplying power for lighting the underground workings, for working the drills and for pumping as well as a small hand worked washing plant.

At Mo-Ba (660-ft), two miles from the Langhit mine, there was a small washing plant and a 20 h.p. steam engine, but it was at Bac-Lao (1,300-ft.), some 1¼ miles from Mo-Ba, where from the very first the output has been the highest; here was to be found a 50 h.p. steam engine.

These three mines were connected to each other and to the landing-stage on the Song-Cau, known as the Langhit River and and 2½ miles from Langhit, by a system of small railways, inclined planes and aerial rope-ways. The ore was sorted at the pit-head and the better class was sent down to the landing-stage, while the mixed and low-grade ores were stocked near each pit. Close to the landing-stage were five kilns with coppers capable of producing from 12 to 15 tons of calcined ore per day.

At Langhit River a factory for making zinc white, and capable of turning out daily 2 tons of oxide containing 70 per cent. of zinc from the low-grade ores had recently been erected. Here were to be found also the general repairing-shops, which obtained their power from a 50 h.p. thermo-electric station, the stores, stocks of ore and the offices.

From here 4-ton sampans carried the ore to Thai-Nguyen, where it was transhipped into 15-ton junks, and again at Dap-Cau into steam launches.

### Than-Moi Mines.

The Société Minière de Than-Moi, which stopped in 1918, worked pockets of calamine and strings of lodes containing both calamine and blende in the limestone group of mountains, close to the railway from Hanoï to Langson.

### Yen-Linh Mines.

The deposits of Yen-Linh are similar to those of Trang-Da (not far away) and the mine is connected to the Clear River three miles above Tuyen-Kwang by a small railway four miles long. Near to the landing-stage are to be found two calcining kilns with coppers.

### Various Deposits.

A great many other deposits exist in Tonkin some of which might in the future become important. Some it is true appear on the surface to be worked out, but the natural irregularity of the deposits of calamine makes it impossible to condemn them without further exploration. Others have been neglected, either through their having been discovered too late to have permitted their working before the war broke out or because of the present difficulties of bringing down the ore to where it can be utilized.

*Calamine is calcined in order to reduce its weight by expelling its carbonic acid gas.

## Steel File Improvements

CONSIDERING the long period of years during which files have been used by workmen of many trades, it is remarkable how grossly these valuable tools are mishandled and neglected. In use, they are often treated unfairly by the wrong file being selected for a particular job and when idle, they are often kept in a bag or drawer so that they damage each other, as well as other tools. In the matter of selecting files the amateur mechanic is generally at a disadvantage compared with the more experienced workman and, as almost every household has its "handy man," a leading British steel firm has made up a set of files meeting all ordinary requirements. There are ten files in the set, but two of them are special files, bastard-cut on one side and smooth-cut on the other, so that the set is really equivalent to twelve tools. These have been selected, from the thousands of files available, as being the most likely to be of service to the amateur, the private workshop, the model engineer, and the jobbing workman. The files are mounted in a neat wooden rack so that all can be seen and the desired one selected instantly. A booklet of information tells what each file is to be used for, and how it should be handled, and the set is completed by that oft-neglected accessory, a "file card," with which the files should be cleaned after use. The steel used for each file is the most suitable for the purpose, and the teeth are cut accurately to the most efficient form, but these advantages are naturally lost if the file is allowed to become clogged with particles of metal.

## Economy in Cabling

AS a means of stimulating international trade a new practice is being introduced to mercantile houses and manufacturers by a British publisher who has printed special codes respectively for the chemical and the iron and steel trades. The effect is to afford a means by which messages concerning quantities, qualities, prices, sizes, specifications, and shipments can be sent by cable in severely abbreviated form with absolute accuracy. The exchange of ordinary commercial phrases is not affected; for these the firm cabling may use any of the general codes. But an astonishing amount of special trade information can be packed into two or three words by means of these new SELWYN codes, and experience has proved that the monthly cable bills of merchants and manufacturers can be cut in half by this ingenious method of condensation. On the other hand, it is now often worth while to make inquiries by cable, the cost of which would otherwise be prohibitive and thus more business is likely to be done.

# Coal Mining in the Maritime District

*By E. Pak in the New Russia*

## I. Resources

A REGULAR and systematic investigation of the mineral wealth of the maritime district has so far not been carried out. The plan drawn up in 1912 for the systematic exploration of the Russian Far East, and the maritime province in particular, on account of the world war and civil war could not be materialized.

The activities of the scientific investigators were directed mainly to the study of separate deposits of minerals. In the maritime province a detailed study was made of the Souchansky coal mine, of the lignite deposits in the neighborhood of Ugolnaya station, the Nikolaevsk coal mines, the west bank of the Gulf of Amur, the iron ore deposits of the Olginsky district, the silverlead deposits of the Tetukhe, and the gold ore of Askold Island.

The total amount of investigation made in the Amur and maritime provinces is shown by the following figures :—

| | |
|---|---|
| District surveyed more or less fully | 0.80% |
| District partly and occasionally investigated | 48.08% |
| Not investigated | 41.12% |

The main deposits of coal in the South-Ussuriisk district may be divided into four groups, stretching from the southwest to the northeast. The western group is that of the western shore of the Gulf of Amur, and with this is probably connected the Nikolsk-Ussuriisk coal. Further east, on a line with this group, run the coal deposits of the Muraviev-Amur peninsula, the extension of which on the north is the coal of the village of Radchikhi. The third group is that of Petrovsko-Vasilkovo, and the most eastern is that of the Souchan river and its upper reaches. By no means are all the deposits of coal included in these four groups. Especially may be mentioned the coal of the upper reaches of the Suifoon, the Lipovetsky mines, and certain parts of the shore of the Sea of Japan.

In the Ussuriisk district there are altogether 69 deposits of coal. Of these only nine are being worked. The principal place is taken by the Souchansky government mine, after which come the Lindgolma mines, the Marguaisky, those at the station Kiparisov, those in the neighborhood of Nikolsk-Ussuriisk, the Lipovetsky mines, etc.

There is both anthracite and bituminous coal. A variety of the latter is well known in the Souchansky district, and in the upper reaches of the Suifoon river. Not long since excellent coal was found on the western shore of the Gulf of Amur.

The resources are most fully investigated at the Souchansky mine, where they amount to 40,000,000 tons. The other deposits are comparatively little investigated, but their general reserves may be taken conservatively as 30,000,000 tons.

Lignite deposits in the maritime province are known in various places, beginning from Possiet along the western shore of the Gulf of Amur, near the mouths of the Suifoon, on Cape Retchnoy, etc., but the main field is near Ugolnaya station, on the Souchansky railway. Further, they are known near Lake Khanka near the Ussuriisk Gulf, between Tsimukhe and Kangauz, in the upper reaches of the Daubukh and Ulukh, in the coastal strip of the Sea of Japan on the Nizmenny Cape, along the rivers of Tadushu, Amgu, Kulumbe, and in other places.

There are altogether 38 deposits of lignite registered in the South Ussuriisk district. First among these are the Zybunny mine, the Krayeugolno-Slasnky, the Alexeievsky, the Nikolaevsk, etc.

The total reserves of lignite in the Ussuriisk district are unknown. They are calculated only for the Zybunny mines of Skidelsky, the Uglavaya station district, and the Nikolaevsk mines on the western shore of the Gulf of Amur. The reserves of the Zybunny mines are calculated at approximately 32,000,000 tons, the Nikolaevsk mines at 12,500,000 tons, and the Uglavaya station district at 32,000 tons.

The total reserves of lignite in the maritime district may be roughly estimated at 80,000 tons.

## II. Development

Coal mining is the most important of the different mining industries in the maritime district of Far Eastern Russia.

The Souchansky or Souchan coal mines, containing the best and richest deposits, are in the hands of the government, and working under its control.

The mountain range containing the Souchan mining district covers an area of 820 square miles. Of this area the best and richest coal-beds occupy about 90 sq. miles, of which some 13 sq. miles are actually under exploitation.

As to the chemical composition and physical properties of the coal found in the Souchan region, there are several grades, ranging from anthracite, with low ash content, to the long-flaming coke-oven soft coal. At present, mostly soft coal is being mined.

The activities of these enterprises are shown by the following table :—

| *Year* | *Coal mined, in tons* |
|---|---|
| 1913 | 163,865 |
| 1914 | 205,920 |
| 1915 | 204,864 |
| 1916 | 270,302 |
| 1917 | 294,135 |
| 1918 | 205,945 |
| 1919 | 118,247 |
| 1920 | 119,148 |
| 1921 | 118,755 |
| 1922 | 138,460 |

In comparison with the year 1921, the production of coal during 1922 increased more than 16 per cent. The same year some 80,000 tons of coal and 319 tons of coke were disposed of to consumers, as may be seen from the following table of Souchan coal consumed :—

| | |
|---|---|
| Ussuriisk Railway | 20,125 tons |
| Government institutions | 17,526 ,, |
| Private consumers | 7,098 ,, |
| Exported to Manchuria | 20,072 ,, |
| Exported overseas | 15,139 ,, |
| Total | 79,960 tons |

The possibility of big exports of Souchan coal to foreign countries undoubtedly exists.

In the year under discussion (1922) consumption of coal for operative uses in the mines, plus the usual mining losses, amounted to 40,274 tons, i.e., 36.3 per cent. of the total production, which is very high. The consumers of Souchan coal during 1922 were supplied chiefly with common varieties of soft coal, at the price of G.Rs.15.80 per ton f.o.b. point of destination.

Souchan coal mines during the last year have produced coal and by-products to a value of 1,287,750 gold roubles. The staff employed during the same year consisted of :—

| | |
|---|---|
| Technicians and clerks | 180, or 9 per cent. ; |
| Laborers | 1820, or 91 per cent. ; |

of which latter 1540, or 77 per cent., were Russian, and 460, or 23 per cent., Chinese.

With the exception of the Souchan district, all the coal and lignite mines situated in the maritime district are in the hands of private firms and individuals. These mines are centered mainly in the South Ussuri district, along the Ussuri Railway, on the shores of the Gulf of Amur, and near the cities of Vladivostok and Nikolsk-Ussuriisk.

Part of these privately operated mines are situated near the station Ugolnaya, on the Ussuri Railway. Other mines are to be found near Nikolsk-Ussuriisk, on the western shores of the Gulf of Amur, and near the town of Possiet. In the districts mentioned there are only four coal mines, but twenty lignite.

In the maritime district there are 202 coal and lignite mining sections, of a total area of 61,474 acres. Only 32 of these were actually worked during 1922.

According to information gained from different surveys and from mine operators and technicians, there exist profitable coal-beds over an area of 19,068 acres, representing 31.1 per cent. of the total coal-bearing area of 61,474 acres. These figures are by no means final, and are probably below the actual areas.

The coal-bearing area now under actual exploitation amounts to about 1,530 acres, or 2.4 per cent. of the total. This area of 1,530.41 acres can be subdivided as follows :—

| | |
|---|---|
| Veins worked .. .. .. | 502.01 acres, or 32.80% |
| Opened, and prepared for work | 115.73 acres, or 7.56% |
| Being opened .. .. .. | 595.88 acres, or 38.94% |
| Covered by buildings, etc. .. | 316.79 acres, or 20.70% |

The total mass of coal veins worked by all concerns amounts to 330.19 cubic feet ; the greatest and the least thicknesses for different veins are respectively :—

| | |
|---|---|
| Coal, maximum .. .. .. .. | 7 sq. feet |
| Lignite, maximum .. .. .. | 13.3 „ „ |
| Coal minimum .. .. .. | 3.15 „ „ |
| Lignite, minimum .. .. | 3.85 „ „ |

On account of this variation in thickness of the veins, the production in different mines ranges all the way from 3.27 tons of coal (Mongugai mines) up to 19.65 tons of lignite (Kraye-Ugolno Spasovsky mine) per cubic sazhene.* Lignite mined in this region weighs 9 to 12 ton, and the same bulk of coal 9.80 to 13 tons.

Information concerning the actual working field of the shafts was received from 12 enterprises of the 23 at work, and gave the total field worked as 344.1 acres, with total resources (in 19 mines) of 35,835,170 tons. The total amount of coal uncovered and ready for immediate mining totals 688,087 tons.

As shown above, the area of all mining claims totals 61,474 acres. The coal supply stored underneath this area can be reckoned as follows :—

| | |
|---|---|
| (a) Certain .. .. .. | 13,955,760 tons |
| (b) Probable .. .. .. | 40,753,440 „ |
| (c) Possible .. .. .. | 113,349,600 „ |

In the fiscal year 1922, mining operations were carried on by 23 enterprises out of 32. Five of the remaining mines were shut down altogether, in two investigations and surveys were being made and of two there was no information.

Besides the Danilovsky mine (Borodin's Sons & Co.), shut down the previous year, and the Mogugai mine (Britter & Co.), mining operations were discontinued in Lassman's " Discovery " mine, in place of which, however, work was started in the " Second Discovery " mine.

From January 1 to December 31, 1922, all privately owned and operated coal mines produced :—

| | |
|---|---|
| (a) Coal .. .. .. | 79,245.79 tons |
| (b) Lignite .. .. .. | 341,052.55 „ |
| Total .. .. | 420,298.34 „ |

The production of these mines last year increased 88,746.08 tons over that of 1921.

The amount of coal and lignite produced by privately operated mines during the last eleven years is shown in the following table (in tons) :—

| Year | Coal | Lignite | Total |
|---|---|---|---|
| 1912 .. .. | 82,524.30 | 77,219.33 | 159,743.63 |
| 1913 .. .. | 69,253.67 | 104,800.61 | 174,054.28 |
| 1914 .. .. | 106,072.82 | 126,842.58 | 232,915.40 |
| 1915 .. .. | 66,348.30 | 186,313.91 | 252,662.21 |
| 1916 .. .. | 99,083.02 | 224,583.98 | 323,667.00 |
| 1917 .. .. | 100,023.09 | 216,192.56 | 316,215.65 |
| 1918 .. .. | 61,107.76 | 261,751,33 | 322,859.09 |
| 1919 .. .. | 81,456.39 | 281,206.09 | 362,662.48 |
| 1920 .. .. | 40,466.62 | 289,438.78 | 329,905.40 |
| 1921 .. .. | 40,346.62 | 290,094.92 | 330,441.54 |
| 1922 .. .. | 79,237.79 | 341,052.54 | 420,290.33 |

The above table shows the steady growth of lignite production as compared with coal. At the same time, increased production of coal is noted. The quantity mined during 1922 almost reaches the level of 1919, but amounts to only 12.21 per cent. of the total production of coal and lignite.

The coal mined amounted to about double the production for 1921, and 18.8 per cent. of the total production of 1922, while the quantity of lignite also markedly increased, being 50,957.64 tons more than the previous year.

* 1 Cubic sazhene = 343 cubic feet.

According to data at hand, all the privately owned and operated coal mining enterprises in the maritime district disposed of during 1922-1923 :—

| | |
|---|---|
| (a) Coal .. .. .. | 55,254.18 tons, or 15.38% |
| (b) Lignite .. .. .. | 303,927.57 tons, or 84.62% |
| Total .. .. | 359,181.75 tons — 100% |

or 85.40 per cent. of the total produced.

For their own needs (boilers, heating of buildings, etc.) the mines consumed :—

| | |
|---|---|
| (a) Coal mines .. .. | 10,367,75 tons — 29.92% |
| (b) Lignite mines .. .. | 24,290.57 tons — 70.08% |
| Total .. .. | 34,558.32 tons — 100% |

or 8.24 per cent. of the total production.

At the time this data was compiled the actual reserves of different grades at the mines were :—

| | | |
|---|---|---|
| (a) Coal reserves .. .. | 17,064.97 tons | 84.16% |
| (b) Lignite .. .. | 3,198.76 „ | 15.84% |
| Total .. .. | 20,263.73 tons — | 100% |

The large amount of coal stores is accounted for by quantities of small broken coal and coal-dirt, accumulated for several years past. Stores of this kind are reckoned at 14,609.22 tons.

During the last marketing campaign mostly large and medium-size coal was sold, there being little demand for small nut grades. The prices for the first two grades fluctuated from G. Rs. 5.50 to G. Rs. 16.20 per ton, and for nut coal from G. Rs. 2.70 to G. Rs. 6.20 per ton, all prices f.o.b. car at mine. There were considerable price fluctuations in coal marketed, due chiefly to local conditions.

To sum up, it may be said that with regard to the actual resources of this region, its mining industry possesses all the factors conducive to future development along broad lines. The total quantity of coal in prospect is reckoned at 7,640,800 tons, but this figure is far below the probable quantities hidden underground in this region.

Less inspiring are the immediate prospects for the marketing of coal produced. The local demand is now fully covered, and there are probabilities of a growing demand being created through increase of local consumption. There are also possibilities for export to foreign countries of high-grade coal, particularly from the Souchan mines, but before this can be carried out on a big scale it is necessary to connect this region with Discovery Bay by rail.

# A New Type of Electric Furnace

RECENT advances in the metallurgy and heat treatment of steel have made it more than ever important to employ a clean source of heat, free from fumes and ash and under very accurate control. These requirements are fulfilled completely by the electrically heated muffle furnace. Heat is generated by the resistance offered to the flow of electric current through wires or rods of special composition and, as there is no combustion, there is no waste of heat or material and no possibility of contamination. Also, the degree of heating can be regulated instantly by varying the strength of the current. Generally, the heating wires or rods are placed outside the refractory tube or chamber which forms the furnace, but a British firm of engineers, who have specialised in furnace construction for many years, have perfected a method of heating the furnace internally. The furnace chamber is built to any desired shape and size by the use of a new type of refractory brick. Grooves in the bricks form continuous channels for the reception of the heating wires or rods. The latter are quite free to expand but they cannot fall out of the channels and, although the channels are open on the inner side of the furnace, the heating elements cannot come into contact with the work in the furnace. This construction amounts to making the inner surface of the furnace the source of heat and it is, of course, uniformly hot all over. Apart from the advantages in point of thermal efficiency, there are mechanical features which make the new furnace exceptionally durable. By building the heating chamber from standardised components it can be made of any size from 2 cu. ft. (0.05 cu. metre) up to 3,000 cu. ft. (85 cu. metres) or even larger. The applications of these furnaces cover an equally wide range ; for example, the baking of pottery, the annealing of sheet metal and wire, and the heat treatment of locomotive cranks, coupling rods and billets.

# An Orgy of Mismanagement

*(Continued from page 585).*

OFFICE OF THE GOVERNOR-GENERAL OF THE PHILIPPINE ISLANDS

Manila, April 29, 1922.

My dear Mr. Wilson:

With reference to the general policy for the bank as outlined by the board of control, I want to impress upon you that the board is desirous not to embarrass the national bank in any way in carrying out its true policy, the policy which is in accord with the general policy expressed by the secretary of war, namely, of getting the government out of business as rapidly as practicable.

It is desired by the board of control:

(1) That the bank proceed with all possible vigor consistent with good business methods to liquidate its assets in order that it may repay its obligations to the insular government.

(2) That no new business enterprises be entered into either directly or indirectly, and that the bank avoid, as a matter of general policy, activities which will result in the national bank, operating largely with government funds and practically without reserves, entering in competition with private institutions operating with private capital.

(3) That offices of the bank be closed at places where they are not making an actual profit and at places where commercial banks offer reasonable banking facilities.

(4) That all banking operations be conducted on the most conservative and careful lines.

(5) That the bank cash checks drawn on it as received by the government.

(6) That it restore the sum of P.11,964,000 on old deposits in monthly installments as contemplated in the budget.

(7) That it replaces approximately P.800,000 insular revenues used by the bank in January and February.

(8) That only the amount of money be advanced to the sugar centrals necessary to enable their economical operation.

(9) That in view of the approved policy of converting the national bank into a bank whose principal activities will be those of a modern constructive agricultural bank, the policy of the bank should be to this end.

(10) That no further advances be made to the oil mills except to handle the copra and oil now on hand with a view to carrying out contracts already made, and that no new contracts be entered into untlr the detailed general statement of the situation, to be presented in youi report of April 30, has been presented to the board of control and received its formal approval.

As it is no longer to the true interests of the government to continue to furnish assistance to the oil mills except under the conditions above prescribed, a program should be submitted looking to their liquidation and salvage as quickly as practicable. The present needs of the government for actual cash to maintain the necessary services are so pressing that it is highly inadvisable to continue to furnish assistance on oil propositions, as the return of the advances made is at best problematical.

The board of control appreciates the efforts being made, but on the other hand it appreciates the gravity of the situation.

In this connection, your attention is invited to letters of April 5 to the general manager of the national bank and to the chairman on the board of directors, also to copy of letter of April 5 addressed to the chairman of the committee appointed under Executive Order No. 54, both of which have received the formal approval of the board of control. Attention is also invited to copy of letter of February 7 addressed to Mr. Unson, chairman of the board of directors of the Philippine National Bank, transmitting, for the information of the board of directors and the general manager of the bank, copy of the report submitted by the committee appointed under Executive Order No. 54. Your attention is likewise invited to the fact that this report was approved by the board of control; also to copy of letter of March 13 and other correspondence which clearly indicates the general policy which the board desires the bank to pursue.

Sincerely yours,

(Sgd.) LEONARD WOOD,
Governor-General.

Mr. E. W. Wilson,
General Manager, Philippine National Bank,
Manila.

The Second Letter.

OFFICE OF THE GOVERNOR-GENERAL OF THE PHILIPPINE ISLANDS.

Manila, February 1, 1923.

Sir:

Your attention is invited to the following letter setting forth the policy of the board of control with reference to the bank:

(Letter, Board of Control of April 29, 1922).

The above letter clearly expresses the policy laid down by the board of control. This policy continues in force, and no steps whatever will be taken which in any way tend to further involve the government in business or to extend the business interests or enterprises which it already has, and no new ones will be undertaken. The purpose of the federal government and the insular government is to get this government out of business as rapidly as we can do so with due regard to the interests of all concerned.

Very respectfully,

(Sgd.) LEONARD WOOD,
Governor-General.

Mr. Wenceslao Trinidad,
President, Philippine National Bank,
Manila.

I commend to your very careful consideration the reports of Haskins & Sells and Messrs. Wright and Martin. The Philippine National Bank was established by act of the Philippine legislature at a time when many governments were forced into business by the necessities of war. The same causes which operated to bring about the almost universal failure of such activities,--inexperience, mismanagement, and in many cases criminal carelessness, brought about the failure of the national bank.

You have before you the pertinent facts as to the condition of the bank and the condition in which the government has been placed by its activities. It is incumbent upon us to arrive at a solution which will protect all interests, especially those of agriculture which is the basis of our prosperity, and which will be in harmony with the policy of the home government which is to leave the field of commercial business open and free to private capital upon terms which will encourage the rapid development of our great but latent material resources for the benefit of the people as a whole. I trust the legislature will take no steps which will hinder the efforts of the board of control along the lines above indicated. In the meantime careful study is being made of the best methods of providing for agricultural relief and co-ordinating the operations of rural credit associations.

LEONARD WOOD,
Governor-General.

The Wright-Martin report, which embodies all the main features of the Coates report, as appended, follows:—

"It is the purpose of this report to bring together in brief form the factors which are essential to the formulation of a definite future policy for the Philippine National Bank.

"The first authentic knowledge as to the condition of the bank is found in the voluminous report of Francis Coates, Jr. As a result of certain disquieting rumors reaching Washington in the summer of 1919, the secretary of war authorized an examination of the bank to be made by Mr. Coates, who was at the time clearing house examiner for Cleveland, Ohio, and an examiner of national reputation. Mr. Coates began his examination on November 30, 1919, and was forced on account of sickness to conclude it rather abruptly on April 11, 1920, before having fully accomplished his purposes. Owing to sickness his report on the examination did not reach Washington until September, 1920. On March 3, 1921, Mr. Coates submitted a supplemental report covering the operations of the currency reserve funds of the insular government in connection with the operations of the bank.

"As a direct result of this examination the bank was placed under new management in the person of Mr. E. W. Wilson, an experienced banker of San Francisco, and the writer was selected to make further and more detailed examination of the bank, as recommended by Mr. Coates; both arriving in Manila the first week in January, 1921.

"It is rather difficult to summarize the voluminous report of Mr. Coates. For present purposes, however, his findings may be grouped under the following heads:—

## Report of Francis Coates, Jr.

"A. BANK'S CONDITION AS TO SOLVENCY. (Mr. Coates' findings are quoted in full below:)

"'A review of the examiner's digest and summary of values of folio 13 will indicate that, on the basis of his estimates, the surplus and profits of the bank, aggregating P.6,196,428, are entirely wiped out, by estimated losses aggregating P.10,697,166, thereby impairing the capital stock by P.4,500,738. The paid and subscribed capital of the bank is P.12,980,000, leaving a margin of capital, unimpaired, of P.8,479,262 against which is scheduled: slow, non-liquid and questionable values, P.8,550,107, slow, non-liquid and problematical values P.6,926,530, and undetermined values of P.8,728,353, a total of P.24,204,990.

"'In addition to this, we have to consider that class of assets that is scheduled as "slow and non-liquid but ultimately solvent values," aggregating P.25,311,119, and also non-liquidity represented by the depletion of (and the necessary future restoration of) the cash reserve fund amounting to P.30,000,000 and the certificate reserve fund (of the insular treasurer) amounting to P.80,000,000.

"'All this must be considered, and carefully weighed, in order to determine whether or not the capital is impaired or whether it is entirely wiped out, and, accordingly whether dividends must be suspended.

(It should be stated here that Mr. Coates' examination did not cover the assets of agencies and branches amounting to some P.26,585,000.)

"'As bearing upon this question of the degree of solvency, it is important that we have also a definite knowledge of the earning power of the bank, and whether or not the integrity of the earnings, and of the earnsing accounts of surplus and reserves and undivided profits is assured?'

## Analysis of Coates' Report

"The analysis of Mr. Coates showed that there had been placed in these accounts the sum of P.730,630 which had not been collected: that uncollectible interest in the sum of P.359,210 had been similarly entered, and that the additional amount of P.364,020 interest on doubtful loans had been added to assets already undesirable. In regard to this Mr. Coates says,—

"'The increasing of the assets by charging into them accounts that are known to be worthless, or accounts that are known to be non-liquid, for the

purpose of creating 'paper earnings' out of which dividends may be paid and reserves set up is more than a fallacy, and a continuance of these practices can spell but only one result—disaster.'

"Nowhere in his report does Mr. Coates come to any definite conclusion as to the solvency or insolvency of the bank. The actual results of his examinations, however, indicate the necessity of a complete examination, verification and valuation being made without delay, in order to determine the true degree of solvency or insolvency.'

"Nevertheless, the fact that the bank was in a very critical position is revealed upon nearly every page of his report which sets forth a most amazing record of inefficiency, carelessness, ad mismanagement. Herein lies the main value of his report.

## Findings as to Management

"B. FINDINGS AS TO MANAGEMENT: In regard to the bank as a whole he states that the head office in Manila exercised practically no control over the agencies and branches with the result that a satisfactory combined statement of the business of the bank as a whole had never been made. Accounts with agencies and branches remained unreconciled for months and in one case no report at all was ever received from one agency. The Manila office apparently knew and cared little about the affairs of the agencies and branches.

"Not only was this true but a decided lack of co-ordination in the Manila office was plainly evident. There was no record showing the combined liability of borrowers. Credit was extended in one department in entire ignorance of what other departments were doing. Loans were made by branches, the proceeds of which were used for paying loans due at the head office. In other words there was woefully lacking any comprehensive scheme of administration whereby there could be maintained a proper knowledge and control of the operations not only of the head office but of the bank as a whole.

"However competent and conscientious the management might be, under these circumstances, the bank was evidently headed directly toward disaster. What, then, is to be said when the evidence plainly showed that the management was neither competent nor conscientious ?

## Currency Reserve Funds

"DEALINGS OF THE BANK WITH CURRENCY RESERVE FUNDS: Possibly no other page in the history of the bank was fraught with such harmful consequences to the government as that relating to its dealings with the currency reserve funds. An almost blind stupidity characterises the history of these transactions.

"For twelve years the carefully devised currency system had worked successfully. The trust funds supporting it had, in spite of certain ill-advised investments, been faithfully maintained. The bank had hardly opened its doors, however, when a systematic raid was made on these funds in New York amounting to some $40,000,000 gold. In violation of the fundamental and plain principles of the currency law, the law as to depositories of government funds in New York was so construed as to place these trust funds in the hands of the bank which proceeded to transfer them to Manila and invest them in long time, non-liquid, and doubtful loans. This, be it said, to the shame of the American officials who were responsible for allowing the bank to obtain possession of the funds. The stupidity of the transaction is almost unequalled in the annals of finance. As a result, the currency system later on broke down completely and the government, in a vain attempt to supply gold in New York against which exchange might be sold, diverted other trust funds from their legal usage and besides borrowed large sums from the United States treasury. Herein lies largely the explanation for the necessity of increasing the indebtedness of the islands by some $45,-000,000 as provided in recent financial legislation.

## Competency of Officials

"COMPETENCY AND TRAINING OF OFFICIALS: After setting forth the high ideals which were impressed upon the bank in the beginning and after noting the fact that the business organizations was designed by a man of rare ability, the examiner proceeds to show how the bank, with its hundreds of millions of assets, came to be officered and manned by men with no training or experience whatever in banking.

"President Concepcion was characterized as an astute politician with only slight tolerance for American or things American, a strong partisan, and not a banker either by training or inclination. During his three years' administration every American but one (a subordinate) was eliminated with the result that there was—'not a trained banker or a man trained in bank detail among them, and these to handle and invest P.300,000,000 of values.' It is beyond comprehension to understand how such a condition could have been allowed to exist. As a result, during the strenuous war and post-war period which brought on unprecedented business and exchange conditions, 'the bank was officered by a president, inexperienced in banking and in the financial world of the white man—unsupported by a single officer or director who had the necessary experience and contact, and manned with a crew of natives—neophytes in the details of the game of banking. It was veritably a 'one man' bank, and that one man was the President, V. Concepcion.'

## Unfamiliar with Credits

"Quite naturally, Mr. Coates found the officers unfamiliar with credit considerations as a basis for granting loans. He found that loans were freely granted, in disregard of all credit considerations, as prompted by 'political' or 'national' considerations with the inevitable result that the bank's assets were tied up solidly in non-liquid, capital, and doubtful loans. Not only this, but Mr. Coates found 'extreme procrastination' and carelessness in looking after and protecting the value of assets after they were acquired by the bank. Gross carelessness, to say the least, was evident from the fact that the examiner found loans in the sum of P.8,278,353 with regard to which the bank's records contained no information from which he could judge as to their solvency.

"Referring to the bank's dealings in hemp, after they had been laid before him in detail, Governor-General Harrison said 'It is the most pitiful story I ever heard.' Mr. Coates himself classed it as 'a history of the wildest kind of 'Wild-cat' banking.'

"Contrary to the law, the liabilities of directors of the bank amounted to some P.10,000,000 upon which the examiner estimater losses of about P.3,800,000.

"On the whole, Mr. Coates said there was 'a runaway desire toward inflation and exploitation at the expense of sound banking.' This opinion he reinforced by quoting a cablegram of Acting-Governor Yeater to the secretary of war as follows:—

## Governor Yeater's Cable

In my judgment, the National Bank may be summarized as drifting with an indisciplined crew, without rudder, compass, or captain. The last American leaves this month. The bank needs a manager and heads of departments with banking experience and financial instincts. Stock has declined to 40. Believe bank solvent but merely on faith, without seeing or knowing.

Such was the condition in which Mr. Coates found the bank, and which was made known to the authorities in Washington in the fall of 1920. As above stated this resulted in the bank being placed under new management in the following January.

"Before the new management was installed, however, the republican party had been returned to power in the United States and it was evident that a new administration would be installed in the Philippines. The Wood-Forbes mission was appointed, and one phase of their investigations covered an examination of the Philippine National Bank by the well-known firm of Haskins & Sells. This examination was continued over nearly a year and the final report was received in Manila about June 15, 1922.

## Report of Haskins and Sells

"A. PRELIMINARY REPORT: In order to supply information as a working basis for the mission Haskins & Sells rendered a preliminary report under date of June 11, 1921. The results of this preliminary survey revealed the fact that in their judgment the losses of the bank would reach the sum of P.47,000,000. Quoting from their report:—

It is obvious, therefore, that the investment made by the Philippine government in the capital stock of the Philippine National Bank has been completely lost, while most of the deposits made therein must remain fixed indefinitely. As a result of the condition disclosed reserve (20 per cent. of each) required by law for the protection of the circulation and the demand deposits amount to approximately P.3,000,000, whereas the legal requirement is about P.23,000,000.

Our examination thus far reveals the fact that the bank has operated during almost the entire period of its existence, prior to the appointment of Mr. Wilson as manager, in violation of every principle which prudence, intelligence or even honesty could dictate."

"B. FINAL REPORT:

"1. Losses.—The final report of the examiners summarized the principal losses as follows:

| | |
|---|---|
| "Loans and Discounts ... ... ... | P.60,889,000 |
| "Exchange operations—Shanghai ... ... | 13,000,000 |
| "Losses on United States liberty bonds ... | 1,200,000 |
| "Total ... ... ... ... | P.75,089,000 |

## Loans to Directors

"2. Loans to Directors.—After citing the law relating to loans to directors there are listed loans made to interests owned or controlled entirely or in part by directors in the sum of P.7,219,207, of which the sum of P.2,987,-789 is estimated as losses.

"3. Sugar Centrals.—With reference to the seven sugar centrals financed by the bank the examiners estimate that they owe the bank something over P.40,000,000, 'of which it is very doubtful whether P.25,000,000 will be recovered. The planters who own these cane lands (mortgaged to the bank), as well as the majority of the shares of the centrals, owe the bank well over P.10,000,000 individually, secured by sugar shipments, lands and personal properties. Advances by the bank from May 19, 1921, up to February, 1922, aggregate about P.3,500,000 for new equipment, off-season expenses, payments to outside creditors, etc.'

"4. Loans to Cocoanut Oil Companies.—Loans outstanding to oil companies at February, 1922, amounted to about P.23,700,000. In addition many loans were made on shares of stock of different oil companies, a number of which are now insolvent. Particular attention is called to the affairs of the Philippine Vegetable Oil as indicating gross incompetence if not almost criminal carelessness. This company, with assets appraised by Haskins & Sells at about P.5,000,000, had borrowed from the bank P.17,251,000, and had incurred additional liabilities to others in the sum of P.13,750,000; total liabilities of P 31,001,000 supported by only P 5,000,000 assets.

## Aggregate Liabilities

"The aggregate liabilities of these oil companies amounted to P.51,-810,000 as against assets estimated as P.21,000,000, an excess of liabilities of P.30,810,000 over assets. 'The manufacturing costs submitted for the year, 1920, indicate that, at the present price for oil and copra, most of these companies cannot earn sufficient to pay the interest on the bank loans amounting to about P.1,900,000 per annum at 8 per cent., unless radical improvements are effected.'

"This prediction has been fulfilled for, after investing considerable additional funds in the business, the bank, at the present writing, is foreclosing its interests in all oil companies.

"5. SHANGHAI LOSSES.—The exchange losses of the Shanghai branch were incurred prior to 1921. These losses were the result of entirely unnecessary and purely speculative operations in exchange by the manager, Mr. J. W. Miller, a man with no banking experience who, very ill-advisedly, was placed in charge of the branch in Shanghai where other foreign banks place their most experienced exchange bankers.

"The settlement of these operations involved a loss of about P.13,-000,000 of which the sum P.3,353,308 had been paid June 30, 1922.

"Details of these transactions were placed in the hands of the United States district attorney for appropriate action but no prosecution resulted because of the inability to get Mr. Miller within the jurisdiction of the court.

"6. GENERAL COMMENTS.—'The foreign department, which operated under the supervision of the Vice-President (M. S. Concepcion), was found to be conducted very inefficiently and dishonestly, necessitating criminal action against the heads of the department. The collection department records were also in bad shape. Many overdue bills had accumulated and as a result of the laxity in the department considerable losses have accrued to the bank. The accounting of the bank generally has been extremely bad. Even where proper records had been devised they were generally carelessly and inaccurately kept. There was no record to show the total liability of any customer, it being necessary to search through the different departments and consolidate the various items. . . . Loans were frequently made by Manila and also by one or more branches to the same customer, making it very difficult to determine the total obligation of any customer.'

## Summary of Two Reports

"Solvency—Coates Report:—No definite conclusion is drawn by Mr. Coates as to the solvency of insolvency of the bank as of November 30, 1919. Actually determined losses were sufficient to wipe out the entire surplus and to reduce capital (at that time P.12,980,000) to P.8,479,262. As against this amount of unimpaired capital he places P.24,204,990 doubtful loans, and there evidently was a serious question in his mind as to whether sufficient losses would not develop from these doubtful loans to wipe out the entire capital.

"Solvency—Haskins & Sells Report:—A year and half later, May 19, 1921, Haskins & Sells show aggragate losses of P.75,089,000, while their consolidated balance sheet shows that the bank's liabilities exceed its solvent assets by P.65,903,167. It is evident, therefore, that as the result of five years' operations of the National Bank the entire capital stock of the bank, P.35,300,000 (of which the government owns P.32,000,000), had been lost as well as some P.30,600,000 of its P.60,016,345 (insular) deposits.

"When the additional facts are taken into consideration, (*a*) That the assets of the bank, over and above its losses, must remain indefinitely tied up in frozen loans, (*b*) that the bank's outstanding circulation amounted to P.41,019,701, and (*c*) that the required legal reserves for the protection of this circulation and some P.81,000,000 deposits were deficient by the sum of P.21,985,479, it is clearly evident that the bank is hopelessly insolvent.

## Causes Leading to Failure

"In the terse opinion of Haskins & Sells the causes leading to failure were that the bank, during almost the entire period of its existence, was operated 'in violation of every principle which prudence, intelligence, or even honesty could dictate.'

"The opinion of Mr. Coates, while no less emphatic, was based upon an elaborate analysis. Starting under very favorable circumstances, the trained personnel of the bank was rapidly eliminated and the institution soon come to be officered and manned by men without experience or training in banking or in the tecflinical details of procedure. Bad as this was, it was made worse by a lamentable lack of responsibility, by political interference in matters of policy and administration, and by a woeful failure of proper supervision. In fact, the influence leading to failure were those which characterize, in general, the failure, under a democratic regimé, of government banking as well as of other ventures in the field of business where success is dependent upon individual initiative, efficiency, and responsibility. The economic fallacy underlying the failure of the Philippine National Bank is that government funds were lavishly used in feverish speculation in the marketing of products rather than in assisting in their production. Private capital was abundantly able to care for the former but not for the latter.

## Revaluation of Assets

"The condition of hopeless insolvency revealed by the Haskins & Sells report indicates the necessity for immediate action. The present situation is fraught with serious danger to the government, especially in view of the bank's large outstanding circulation which it is unable to redeem in lawful money as required by law.

"However, in view of the startling nature of the Haskins & Sells report and in order that we might proceed with a greater degree of assurance, it has been deemed advisable to check their estimate of losses by a reappraisement of the bank's assets. I have, therefore, during the last three months, largely with the assistance of Mr. Leon H. Martin, a trained banker as well as an experienced National Bank examiner, made such a revaluation and the results are given below.

"The revaluation of the assets of the Philippine National Bank was made as of June 30, 1922, or a little over thirteen months after the examination of Haskins & Sells (May 19, 1921).

"The nominal condition of the bank as of June 30, 1922, is reflected in the following consolidated report of the bank which has been condensed from the more detailed official statement of the insular auditor's representative in the bank, Mr. H. S. House:—

CONSOLIDATED STATEMENT OF CONDITION OF THE PHILIPPINE NATIONAL BANK AS OF JUNE 30, 1922.

ASSETS.

| | | |
|---|---|---|
| Loans, discounts, overdrafts and Accounts Receivable | | ...P141,964,793.06 |
| Bonds and other Investments ... ... ... ... ... | | 2,875,993.46 |
| Real Estate, Furniture and Fixtures ... ... ... ... | | 1,145,116.75 |
| Reserve Cash ... ... ... ... ... ... ... | | 632,152.12 |
| Checks and other Cash Items ... ... ... ... ... | | 546,639.95 |
| Due from Banks ... ... ... ... ... ... ... | | 1,858,993.45 |
| Due from sugar shipments ... ... ... ... ... | | 3,710,000.00 |
| Miscellaneous Assets ... ... ... ... ... ... | | 442,583.86 |
| Profit and Loss (Unrecoverable assets) ... ... ... | | 14,280,377.03 |
| Total ... ... ... ... | | ...P167,456,649.68 |

LIABILITIES.

| | | |
|---|---|---|
| Capital Stock Paid up ... ... ... ... ... | | ...P 35,300,000.00 |
| Deposits: Insular Government ... | ...P 47.543,913.47 | |
| Prov. and Munc. Govts. ... | ... 15,281,820.09 | |
| Individual ... ... | ... 10,591,120.23 | |
| Time Deposits ... ... | ... 8,208,422.92 | |
| | | 81,625,276.70 |
| Circulation outstanding ... ... ... ... ... | | 30,758,230.50 |
| Reserves for taxes, etc. ... ... ... ... ... | | 399,354.52 |
| Cash Letters of Credit outstanding ... ... ... ... | | 4,283,535.17 |
| Acceptances outstanding ... ... ... ... ... | | 4,230,828.62 |
| Due to Banks ... ... ... ... ... ... ... | | 704,269.77 |
| Due to Branches and Head Office ... ... ... ... | | 3,941.662.04 |
| Notes Payable ... ... ... ... ... ... ... | | 9,646,692.48 |
| Accounts Payable ... ... ... ... ... ... | | 630,943.53 |
| Miscellaneous liabilities ... ... ... ... ... ... | | 135,856.35 |
| Total ... ... ... ... | | ...P167,456,649.68 |

CONTINGENT LIABILITIES.

| | |
|---|---|
| Accepted time drafts outstanding ... ... ... ... | 350,000.00 |
| Customer's Letters of Credit, outstanding ... ... ... | 4,656,935.03 |
| Exchange contracts ... ... ... ... ... ... | 2,511,391.20 |
| Items for collection ... ... ... ... ... ... | 2,005,252.97 |
| Total ... ... ... ... | ... P 9,523,579.20 |

"Sommed up briefly the results of the revaluation of the bank's assets show the following condition:—

| | |
|---|---|
| Acknowledged losses in Profit and Loss Account ... | ... P14,280,377.03 |
| Losses on loans to Sugar Centrals ... ... ... | ... 14,974,346.49 |
| Losses on loans to Cocoanut Oil Mills ... ... ... | ... 14,727,536.46 |
| Losses on Miscellaneous loans ... ... ... ... | ... 16,001,239.66 |
| Losses at various Branches, estimated ... ... ... | ... 2,000,000.00 |
| Losses on Miscellaneous Assets ... ... ... ... | ... 1,108,138.82 |
| Total losses ... ... ... | ... P63,091,638.46 |
| Very slow loans ... ... ... ... ... ... ... | ... 11,659,016.38 |
| Doubtful loans ... ... ... ... ... ... ... | ... 4,683,562.07 |
| Long time loans ... ... ... ... ... ... ... | ... 6,141,759.10 |
| Loans on which no interest is charged P22,155,000 ... | ... |
| Assets unquestioned at present time ... ... ... | ... 81,880,673.67 |
| Total Books Assets ... ... | ...P167,456,649.68 |

## Entire Investment Lost

"In order to make the above estimate of losses (P63,091,638) comparable with the estimate of Haskins & Sells there must be added the losses written off by the bank between May 19,1921 and June 30, 1922 from reserves carried on the bank's books as of the former date. This makes a total of estimated and actual losses of P63,091,638 plus P11,600,000 or P74,091,000 as of June 30, 1922, as compared with P75,089,000 losses estimated by Haskins and Sells as of May 19,1921.

"In other words the government has lost its entire investment in the capital stock of the bank as well as about 60 per cent. of its deposits remaining in the bank.

"Considering the remainder of the assets, after losses are deducted, it will be noted that P11,659,016.38 are closed as particularly slow and difficult of working out, P4,683,562.07 are closed as of doubtful value, upon which considerable losses will no doubt accrue, while P6,141,759.10 are classed as long time loans. This latter amount represents loans secured by real estate, probably of sufficient value to liquidate the loans if purchasers could be found, which is, of course, very improbably. If these loans could be amortized over a period of 20 to 30 years and carefully watched it is probable that the larger part could be realized upon.

"The fixed character of the bank's loans is further emphasized by the fact that there are loans in the amount of P22,155,000 upon which the bank is charging no interest. This of itself represents, at 8 per cent., an annual loss of P1,772,000.

## Legal Reserves Gone

"As a further indication of the non-liquid condition of the bank, it is to be noted that on June 30, 1922, the bank should have held legal reserves of P12,229,719 against its P30,758,230 circulating notes and P81,625,276 deposits. In actual fact it held a lawful reserve of only P182,022, or a deficiency of P12,047,696.

"Under the conditions as above revealed there is only one conclusion to be drawn, viz., that the Philippine National Bank is hopelessly insolvent.

"In making the above reappraisement of the bank's assets, the examiners have been very conservative, and have based their judgment upon all the information available. In this connection it should be stated that experience in examining the other Manila banks has thrown much light upon the condition of the loans of the National Bank which has never before been available. They do not claim that their judgment is infallible. However, the fact that the results of the reappraisement of the bank's assets are practically confirmed by the estimate made by Haskins & Sells as the result of nearly a year's investgation on their part, leads to the belief that we have arrived at conclusion upon which it is safe to proceed.

## Recent Operations of Bank

"The Coates report was not conclusive as to insolvency, but upon the facts revealed the bank was placed under the management of an experienced American banker with an advisory corps of four Americans trained in banking practice. The new regime entered upon its duties believing that it was possible to rehabilitate the bank. The administration has been reorganized, undesirable personnel has been eliminated and several persons convicted of criminal offenses. The bank's securities have been put in better shape and new securities taken where possible. These efforts have undoubtedly resulted in saving the government considerable money.

Early the process, February, 1921, the government attempted to strengthen the position of the bank by increasing its capital to P35,300,000, but as the capital account was increased by a book entry transferring government deposits (P23,082,860) to capital, no actual relief was thus obtained save in the interest which the bank would otherwise have paid on the deposits so transferred.

"In order to meet the demands of the government for the return of its deposits and in order that the bank might advance large sums to the sugar centrals, sugar planters and oil interests, the liquid loans of the bank have been collected, its United States bonds largely sold, its cash holdings, reduced to an unsafe minimum, balances due from other banks called in, and its circulation increased. As far as these funds were returned to the government this use was justified. The use of such funds, however, in an attempt to improve the condition of seriously involved debtors, has, I am convinced, not been justified and I do not believe the bank's position on the whole has been strengthened by thus "throwing good money after bad."

## Bled Dry of Assets

"The net result of the policy pursued is that, between the urgent demands of the government for the return of its deposits and the demands of the sugar, oil and other interests, the bank has been bled dry of its liquid assets, practically no reserves are held in support of its P32,000,000 circulation and its P81,500,000 deposits, while the assets remaining to be liquidated are tied up solidly—frozen. It is very questionable whether the bank, in the future, will be able to meet the requirement of the government for a sufficient sum annually to compensate the government for the interest and sinking funds on the bonds it has recently been forced to issue because of the former mismanagement of the bank. However, should it be so fortunate as to be able to do this, it would be so depleted of funds that it could transact no business with the general public.

"Government necessity, and the policy of the management in reinvesting proceeds of liquidation in the hope of 'working out' its frozen assets, together with its tremendous losses, have brought about a condition under which the bank is now operating at a loss in doing practically nothing but financing the affairs of debtors who are themselves in various stages of insolvency. This in spite of the fact that the bank has been operating with the financial advantage of having to maintain no reserve (required about P.12,000,000), an advantage of about P.720,000 per annum.

## Interest of Debtors

"In spite of the painstaking effort which have been made to remedy its affairs in the last two years the position of the bank has thus become day by day more hopeless. It has been impossible to overcome the damage wrought by former management, and the bank to-day is laboring under the false pretense of doing business with the public, whereas its business is almost entirely confined to the interests of its debtors who persistently ask that they be indefinitely financed by government funds while the government is forced to curtail its legitimate and vital necessities because of the lack of funds thus used. The ever present and inevitable protest and outcry of the debtors class against a policy of daflation (liquidation) has materially retarded the process. These debtors have persistently urged, and are largely responsible for such feeling as exists, that the bank must be kept indefinitely in business. Obviously, as a class, they are demonstrated 'failures' in the field of business. It was only through sheer ignorance of banking principles that they were set up in business in the first place with government funds and it is little less than criminal to continue them in business with government funds when the health and sanitation of the people of the islands is seriously suffering because of such use of funds.

"It is very apparent, therefore, that nothing is to be gained by keeping up the false pretense of doing a banking business with the public, and this at a loss. As a matter of fact the bank, at the present time, is not functioning as a bank but rather as an organization devoted almost exclusively to handling the affairs of a large number of more or less insolvent business concerns and individuals. There is thus nothing which cannot be gained by closing it to the public and converting it into a special corporation for the gradual liquidation of its frozen assets. The government would, in this manner, not be put in the false and vicious position of maintaining one standard of business law and ethics for its own institution while at the same time forcing another higher and more rigid standard upon private business. Not only is the present position of the government unjust in this respect but I am also convinced that the courts would hold it to be illegal. The present attitude of tle government toward the bank is now being made use of to discourage the coming of much needed capital to the islands. I know of no argument more potent in this respect.

## The Problem of the Bank

"The bank has been legally and morally dead for at least two years though it has been necessary to inject into its palsied body a semblance of life on account of its and the government's inability to repay the immense loan from the people in the form of its outstanding circulation (now about P.32,000,000) as well as to restore individual deposits in the approximate sum of P.15,800,000, and provincial and municipal deposits in the sum of P.18,281,000.

"Summarized briefly, as of June 30, 1922, the government is confronted with a National bank, of whose stock it owns approximately 92 per cent., in the following conditions :—

(*a*) Its capital of P.35,300,000 entirely wiped out by losses and with assets insufficient to meet its remaining liabilities by P.27,791,638.

(*b*) An outstanding circulation of some P.32,000,000, representing a loan from the people, protected by practically no legal or other cash reserves, and which can only be redeemed by the slow liquidation of frozen assets.

(*c*) Deposits due to the insular government in the sum of P.47,543,000 due to provinces and municipalities in the sum of P.18,281,000, and due to individuals in the sum of P.15,800,000 ; a total of P.81,625,000, protected by practically no legal or other cash reserves, and which can only be repaid by slow liquidation of frozen assets.

(*Note.*—The above distribution of deposits is based upon more recent reports than those of June 30, 1922).

(*d*) A bank which, by its inability to be of service, has been deserted by practically all customers, whose business is worth while, and consequently

(*e*) A bank serving practically none but those whose business is seriously involved or verging upon or actually bankrupt.

(*f*) A bank whose liquid assets have been collected, and whose remaining assets are invested in long time, non-liquid, and capital loans which must remain so fixed for an indefinite period.

(*g*) A bank, practically owned by the government, operating at an actual loss in accordance with the auditor's report for September 30, 1922, and in open flagrant violation of the law which it forces privately capitalized banks to observe.

(*h*) A bank whose reputation, as far as the outside world is concerned, is irretrievably lost.

(*i*) A bank whose entire history, from the day of its opening down to the present time, has been a conclusive demonstration of the fallacy of the government entering a business which is abundantly financed by private capital and efficiently conducted.

## Receivership Justified

"Obviously a private bank in such a condition would have been placed in the hands of a receiver for immediate liquidation as soon as the fact were known. As a matter of fact the government has had ample evidence for taking such action since July, 1921. This evidence was made conclusive by the final report of Haskins & Sells in June, 1922, and still further confirmed by a careful reappraisement of assets made as of June 30, 1922.

"Unpleasant and as unfortunate as it may be, it is well to squarely face the demonstrated fact that a government owned and operated bank has been a complete failure for which both Americans and Filipinos have been responsible. I have no hesitancy, therefore, in recommending that the bank be closed to the public as soon as proper provision can be made for the repayment of individual, provincial and municipal deposits, for the protection of its outstanding circulation, for the proper administration of relief to agriculture, and that the bank be transformed into a special corporation whose operations shall be confined to handling the affairs of all debtor corporations, firms, and individuals in such manner as will result in the greatest returns to the government and the least disturbance to business conditions. This would enable its affairs to be liquidated as a going concern, remove the many present elements of danger, and place the government square with the world.

"In confirmation of this position I desire to quote the very pertinent opinion of Mr. Robert L. Herrick who, at your request, was sent out here to make a careful investigation of government finances. Mr. Herrick, as you are aware, is one of the most eminent financial and banking authorities in the great eastern financial centre of the United States ; a man with long and successful experience in rehabilitating the affairs of some of the largest American corporation. He gives his opinion as follows :

## Herrick's Opinion

"This bank, I think, should be liquidated. If it is made strong again by putting government money in it, it will become weak again, as a result of injudicious loans. I do not believe it possible to run it under government management, and run it well and safely as a bank. This is not because I particularly distrust Philippine management for I assume exactly the same thing would take place here (United States) if we started a government bank. Unavoidably, with government management and more or less political influence, or indifference or lack of competence on the part of managers appointed by the government, such a bank would absorb all of the dead loans of the surrounding country, and the other banks would do their best to help such absorption by leading their unsatisfactory customers right over to the doot of the new bank. Such a thing would happen here and all over the world, and surely it must happen in the Philippines.

"With regard to restricting its functions and then keeping it alive, I believe the answer is that all the good it could do with restricted functions can be accomplished in some other awy, and that it would be difficult to keep it on a restricted basis, and it is much safer to get rid of it finally winding it up."

## Closing the Bank

"I am well aware of the justifiable feeling of the Filipino people that they should have a bank distinctly their own. Other nationalities have banks catering to their particular needs. There is no valid reason why Filipinos likewise should not have a bank of their own. But, in view of the unfortunate and inevitable failure of the National bank, it should, like the banks of other nationalities, be a private bank. If the Filipino people are ever to achieve financial success they must cease to lean upon a paternalistic government, and clearly recognize the almost universally demonstrated fact that the people, through the agency of government, cannot accomplish collectively, in the affairs of business, that which they cannot accomplish individually through their own initiative and ability.

"I have great confidence in the latent ability of the Filipino people to transact an increasingly larger part of their own business. But progress must necessarily be slow in view of the fact that, in entering the new world of business, they must match their wits against the keenest minded men of a business world of age long training. This subject will be referred to later.

"The closing of the bank requires the careful consideration of many important factors.

## Limitation of Banking Facilities

"It is the general opinion among bankers and business men, and borne out by statistics, that the banking facilities of the islands, aside from the National bank, are far in excess of needs. In fact it hardly seems possible that there is sufficient business to make possible the successful operation of the present banks. The closing of the National bank would, therefore, deprive no one of ample banking facilities.

"In fact, in the light of experience, the islands would have been infinitely better off without such facilities as have been supplied by the National bank. Further, the bank in its present condition is unable to finance any but those heavily indefied to it and even these on a very limited scale. Nearly every customer whose business is worth while has been forced to transfer his business to other banks, and the bank has been left with a very undesirable residuum.

## Provision for Paying Depositors

"There are at the present writing (October 20, 1922), approximately P.11,722,000 of individual dep0sits, and arrangements must be made for their payment in full before the bank can be closed.

"In addition the bank holds deposits of provinces and municipalities in the approximate sum of P.19,192,000. These deposits represent the working balances of these organizations. Should the bank be transformed into a special corporation as above recommended, such corporation could be allowed to continue to handle the funds of provinces and municipalities until such time as the proceeds of liquidation would enable it to repay these deposits in full.

"There remains to be considered the provision for paying individual depositors. The most feasable method of raising funds for this purpose would be the sale of the bank's interests in the sugar centrals and various oil companies.

"First, as to the Sugar Centrals.—On June 30, 1922, the centrals owed the bank approximately P.43,500,000. Without going into the details of costs of production, overhead expenses, volume of product, etc. (for which see former reports), it is plainly evident that the centrals, under government management and control, and on the probable average price of sugar, will not be able to do more than meet their current expenses including upkeep, depreciation and interest. Indeed they will be exceedingly fortunate to be able to do even this much. It is a well known fact that, under private ownership with a much lower capitalization, with the most skillful management individual initiative can provide, sugar centrals can, with difficulty, keep their capital investment intact and earn an average yearly net return of say 6 per cent. How, then, under the universally recognized handicap of government ownership, with a capitalization at least 40 per cent. greater than normal, can the centrals be expected to do more than, or even as much as, privately owned centrals?

## Unheard of Feat

"If the sugar centrals, then, will be fortunate in being able to provide for up-keep and to meet annual interest charges, what hope is there that they will in addition be able to repay the bank their entire capitalization. Such a feat is practically unknown in the annals of private finance, to say nothing of government operated enterprises.

"Even if the Centrals could accomplish the unheard of feat, say in twenty-five years, it would be infinitely better to sell them on a fifty per cent. basis for cash, for the amount realized would be worth much more to the government now than the full amount in twenty-five years; to say nothing of the vicissitudes and uncertainties of the government being involved in the sugar business all this time.

"Neither can it be expected that the sugar planters will be able, out of their profits, to purchase the centrals. At least they cannot do this until they have first paidtheir present heavy obligations to the bank, estimated at approximately P.15,000,000. Judging from past experience this latter will be an exceedingly slow process.

"Under these conditions the obvious thing to do is to sell the centrals to private interests. I am convinced that this can be done, and under conditions much more favorable to the planters themselves. Under present arrangements the planters must pay the bank the entire amount owed the bank by the centrals P.43,500,000, and until it were paid their farms would be under mortgages to the bank. Under a proposed sale to private interests the planters would be freed at once from their mortgages and would be able to repurchase the centrals, if they so desired, at the price paid for them by private interests, say P.22,000,000, plus the necessary capital additions made in the meantime, or say P.25,000,000, as compared with the P.43,500,000 they will have to pay under present arrangements.

"Second, as to the Oil Interests.—These were, on June 30, 1922, indebted to the bank in the sum of P.24,727,536 as compared with P.23,710,000 of May 19, 1921. The increase represents an ineffectual effort to "work-out the oil indebtedness. The bank's entire interests in oil should be sold for what they will bring for ac§ual cash. Under no conditions should the government be put in the position of assuming the ultimate risk by permitting any one to supply the working capital in an attempt "work-out" the proposition by which the experimentors would come to own the properties if successful while the government would gain become the owner if the process were unsuccessful.

"I believe the bank would be fortunate to receive P.10,000,000 in cash for its present interest of approximately P.24,000,000.

"If a sale of the sugar and oil interests as above indicated could be affected, the net returns, some P.32,000,000, would enable individual, provincial, and municipal depositors to be paid in full.

## Provision for Circulation

"Again the bank cannot be closed without some satisfactory provision for its P.32,000,000 circulation. This could be effected by the legislature guaranteeing the ultimate redemption of the notes. If they circulate freely now with the bank in its present condition they would circulate equally as freely with the added guaranty of the government behind them. The notes should be redeemed as rapidly as possible from the proceeds of liquidation as, unsupported by reserves, they are a constant menace to business stability and the operation of our currency system. For instance:

"If the government should be forced to sell say, $12,000,000 exchange before the balance of trade turned in our favor, the treasury certificates in circulation would be reduced to such a point that the banks would find it impossible to keep their resources in such certificates. The result would be that reserves would have to be kept in bank notes, which, being unredeemable in money of intrinsic value, would be merely a paper reserve, and our entire business structure would thus come to rest upon a fixtitious paper reserve, than which nothing could be more dangerous.

## Danger to Business Conditions

"The winding up of the affairs of an institution of such wide ramifications must inevitably work a hardship upon some people. However, if the bank were converted into a special corporation, as recommended, no greater hardship would be worked upon anybody than if the bank continued the same process. The severity of liquidation could be gaged, as at present, in such a manner as to prevent any undue disturbance to business conditions in general.

"The payment of depositors in full and the guaranteeing of the redemption of the bank's circulation would prevent any ill-effects upon their banks.

"With the present banks competing eagerly for business, it is evident that every business man, regardless of his nationality, can obtain at the present time banking facilities for a sound bankable proposition. Other banks should not be criticized for turning down such propositions as were formerly acceptable to the Philippine National Bank and which brought about its downfall. However, if Filipino business men feel that they should have their own banking institution there is no valid reason against it. But, as before stated, it should be a purely private institution. It would not require a large capital. I believe a capital of P.1,000,000 would be ample for some years to come, and that this, with such deposits as it would obtain, would be ample to finance Filipino business men. They, as well as others, have leaned upon a 'broken reed' in the past. It is time for them to throw away crutches and stand on their own feet if they ever expect to handle any large share of their own business.

## Provision for Agricultural Relief

"The closing of the bank will make necessary the establishing of an institution to promote agriculture. In fact the urgent needs of agriculture demand the establishment of such an institution at the earliest possible date regardless of the ultimate disposition of the Philippine National Bank. The continuance of the National Bank for this purpose is out of the question.

"First, because agricultural relief is dependent upon securing large sums of long time money through the sale of farm loan bonds, and it would be absolutely impossible to float bonds in the United States over the name of the National Bank whose reputation is irretrievably lost.

"Second, though no further argument is necessary, I am fully convinced from the results of careful examination of branches of the bank in favored localities that the bank's efforts to assist agriculture have, as a whole, been more of a detriment than a benefit to the real interests of the farming community, and that it has created obstacles in the way of well considered scientific relief to agriculture which it cannot overcome itself and which will seriously handicap legitimate relief for some time to come. The whole atmosphere of the bank since its foundation has been one of the exceeding laxness, indifference, and carelessness in granting loans to farmers, in watching to see that the funds were not used for illegitimate purposes, and in inculcating a sense of responsibility for the prompt meeting of obligations. The personnel of the bank is so permeated with such false ideals that it would not only be useless but also dangerous in administrating scientific relief to agriculture. The new institution should be entirely free from these dangers as well as from any connection with the unpleasant details inevitably connected with the liquidation of many ill-considered agricultural loans.

## Agricultural Bank

"I have, therefore, prepared, with the valuable assistance of the secretary of agriculture and natural resources and already submitted to you, a bill for the establishment of such an institution embodying the best features of similar successful institutions in other countries, adjusted to meet local customs and conventions.

"It is very probable it may be urged in opposition that this is another government venture in the field of business. It must be remembered, however, that this is a field which is not covered by private capital. Early in 1904, I assisted in the preparation of a bill for an agricultural bank in the Philippine Islands which was based upon the idea of encouraging private capital to undertake this function by guaranteeing a minimum net return to such capital. The attempt resulted in failure. Nearly every other progressive country has found the establishment of a government institution for this purpose necessary. Even the United States, where government ventures in business have been particularly unfortunate, has found it necessary to assist agriculture through the establishment of a federal farm loan system.

"I trust this bill will meet with your favorable consideration and that it may be transmitted to the present legislature with your recommendation for its prompt enactment into law.

## When Shall the Bank be Closed

"As before stated it cannot be closed until provision is made for the payment of individual depositors in full. The sale of the sugar centrals and oil interests would provide the funds for this purpose, but though tentative negotiations are now under way it will take considerable time to arrive at and effect a satisfactory sale.

"In the meantime it will be necessary for the bank to continue in business on a restricted basis. In my judgment, however, it would be a very serious mistake to continue it in business for a longer time than is necessary to determine whether the sugar centrals and oil interests can be sold. At that time, if the central and oil interests have not been or cannot be sold, the special gold reserve which the government holds for emergencies should be used to repay depositors, the bank definitely closed to the public as a going concern, and converted into a special corporation as above recommended.

"In presenting the above analysis of the situation I have had in mind solely what I consider to be the best and permanent interests of the Filipino people. My conclusions have been reached without reference to considerations of personalities or national pride. Under all conditions, it is best to know the truth and to be guided by its application.

"Respectfully submitted,

"(Sgd.) BEN F. WRIGHT,

"Special Bank Examiner.

"Manila, November 20, 1922."

# 30,000,000 Cigarettes Daily

## The Nanyang Brothers Tobacco Company

AN example of what Chinese industry and enterprise can achieve is furnished by the success of the Nanyang Brothers Tobacco Company, which last year paid dividends amounting to fourteen per cent. on nominal shares of $20.

Less than eighteen years ago, says the *Hongkong Telegraph*, the Company was started in a small way in the colony. To-day it has assumed the position of China's biggest native purveyors of tobacco products, with funds and property swollen to well near $20,000,000. The dividend it paid out to shareholders last year was $3.20, and there are expectations of an even greater return this year, increased costs of production and labor notwithstanding.

This remarkable development of what has become one of the colony's chief industries is viewed as a phenomenon by those who recall the circumstances which saw the starting of the Company eighteen years ago. The difficulties usually besetting the path of the pioneer enterprise included in the case of Nanyang Brothers competition against companies which had already established a firm market for their products in China. The history of Nanyang Tobacco Co. in this connection is like those of other pioneer undertakings. It had its ups and downs, but, once established on a sound business foundation which came with experience, success was assured.

When in 1908 the small concern that operated a factory on the Wanchai Praya failed for the second time as a limited company, the shareholders then already drawn for the second time into an expenditure of $100,000 on the industry and receiving none of the promised profits, resolved on a complete winding-up, and in due course the machinery and property was put up for public auction. It was then that the Nanyang Brothers did a remarkable thing. They bought the machinery for what it was worth—which was very little in that period of depression—and proceeded to give another instance of that optimism which was to carry them through to the gaol desired.

Uncle Kan Ning-shek, who was blessed with ample wealth, allowed himself to be infected with the optimism of his nephews (Kan Chiu-nan and Kan Yuk-lee) to the extent that he cheerfully put up the new capital required to place the concern on a sound business footing. Investigating the causes of the previous failures, it was discovered that what was really behind it all was the standard of the products manufactured. These were in quality far behind those put on the market by competitors. It was towards remedying this defect that the two brothers now concentrated their efforts. Native tobacco, such as grown in North China where the raw material was principally secured, lacked the flavor demanded by consumers. It was necessary to improve the flavor by blending with other growths, and an agreeable mixture was achieved by the introduction of a small percentage of Virginia leaf. A system of buying, and distribution of sales was organized; and, backed by an increased output made possible with new and improved machinery, the Nanyang Brothers Tobacco Company, really originating with the old Canton Nanyang Brothers Tobacco Company, slowly but surely pushed forward its business, gaining, with the improved quality of its products, the favor of the Chinese smoker, and thus a firm place amongst the four hundred millions of China's population.

For the Kan family, the business had now become a sound investment, and the co-operation of a third brother had to be secured. He came from Saigon in 1916 and joined the family directorate which had by this time been reinforced by a fourth member, Kam Hong-chin, a son of that benevolent uncle who had so kindly come to the rescue when the fortunes of the brothers were at low ebb. The partners had to be content at first with small profits on a limited output, and the real progress from a dividend point of view can be said to commence from the reorganization of the Company from a private family concern into a public limited liability company.

The plant in 1919 had produced a daily output of four million cigarettes and was on the way to producing more when the brothers found themselves up against a proposition. The effects of the anti-Japanese boycott were felt by almost every Chinese merchant of any good standing. In the case of the Nanyang Brothers these had taken the form of a mischievous rumor that the controlling interest in the Company was in the hands of Japanese. How this damaging assertion could originate only those who took the trouble to examine closely into the psychological side of the movement could give an explanation. At any rate, dependant as the Nanyang Brothers were on the goodwill of their large army of Chinese customers for the promotion of their business, such a report could not be ignored. So in due course the Chinese public were invited to look into the articles of association and subscribe, according to their means, to the new public limited liability company of Nanyang Brothers.

Since 1920, the Company has prospered exceedingly under its new status. With the growth of business the necessity was felt of having a factory established also in Shanghai, and though this branch started out very late in the day, its output is already double that turned out by the factories at Wanchai. The combined output per day amounted to 30,000,000 cigarettes. This is a good figure, and, considering that all the plants are being kept working at full pressure, it must be realized that the demand for Nanyang Brothers' products is growing.

The Wing Fat Printing Company a couple of years back was started as a subsidiary company for the printing and making up of packages for the dozen or so different brands of smokes manufactured by the Nanyang Company. In line with this progressive tendency was the establishment of a factory at Causeway Bay for the manufacture of tins. This now turns out 10,000 pieces a day and, incidentally, gives employment to nearly a thousand hands. The Company had also acquired some 50,000 square feet of land situated at the Bowrington Canal for an extension of their present plant. Work at putting together the new buildings will commence shortly and when these are completed the tin factory will be removed to this new location. Property values since the boom commenced have increased the assets of the Company and it is now estimated that the Company holds property and funds amounting in value to $20,000,000. In line with the progress of the concern, the amount of dividends paid out at each end of the financial year has steadily increased. At one time the value of Nanyang Tobacco shares rose to as much as $45, on a par value of $20.

# The Testing of Railway Couplings

MESSRS. W. & T. Avery, Ltd., at their Birmingham works have just completed a large impact testing machine for the purpose of testing railway screw couplings, three link wagon couplings and draw bars, by impact. The machine, which has been specially constructed for The Alipore Test House, Calcutta, follows largely on similar lines to the machine installed at the National Physical Laboratory, Teddington, Middlesex, for a like purpose, although several improvements in the details of the machine have been made where thought desirable.

Figure 1 shows the general arrangement of the machine, while Figure 2 gives a view down the centre of the machine, showing the coupling in position ready for the test. The friction brake described later is also shown, also the striking buffers on the pendulum hammer.

It will be seen from the illustrations that the machine consists of a pendulum hammer and a suspended anvil, both of which are carried upon ball-bearings mounted upon one common shaft, the whole being supported within a large double sided frame built up of rolled steel sections.

The pendulum hammer weighs 2 tons and is raised to a maximum height of 2½-ft. The full maximum capacity of the machine is thus equal to 5-ft.-tons. The raising of the pendulum from its vertical position is effected through the medium of a motor-driven winch. The suspended anvil weighs 4½ tons and is a "U" shaped casting through which the pendulum hammer can swing quite freely. The coupling under test is connected at one end to a central screw upon the anvil and at the other it is attached to a steel crossbridge which is provided with two hardened steel buffers. This crossbridge is carried upon the anvil by means of a hinged bracket which is provided with two straining screws by which an initial load of 1 ton is applied to the coupling prior to the test.

A special feature of the machine is the friction brake which is connected to the anvil. This brake consists of two flat steel reins which pass between strips of "Ferodo" material. By the side adjustment of a series of steel coil springs the friction of the brake can be so adjusted that it will give the maximum frictional resistance of 12 tons. The pendulum hammer is provided with two steel buffer faces, which, on the downward spring of the pendulum, strike against the buffers of the above-mentioned crossbridge, thus applying an impact-tensile test to the coupling. The energy of the blow is partly absorbed by the friction brake and the suspended anvil respectively, the remainder being taken up by the coupling itself.

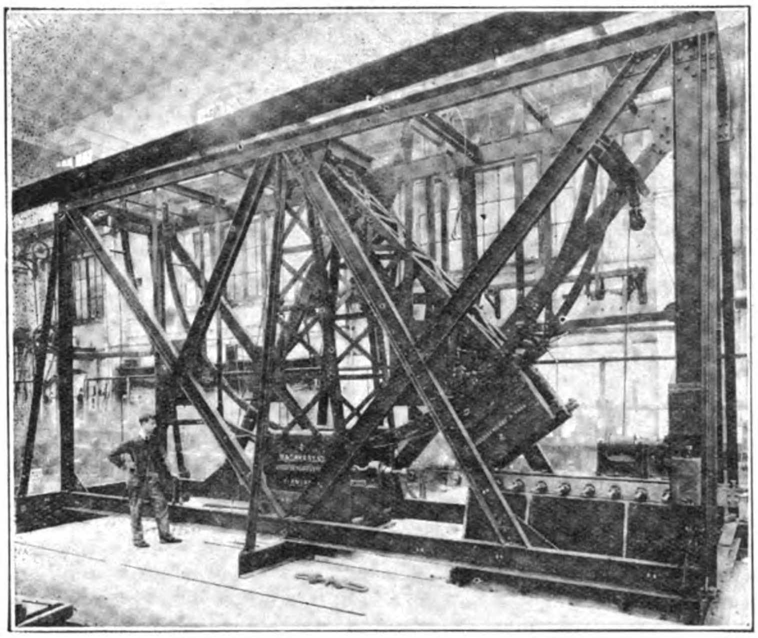


Fig. 1

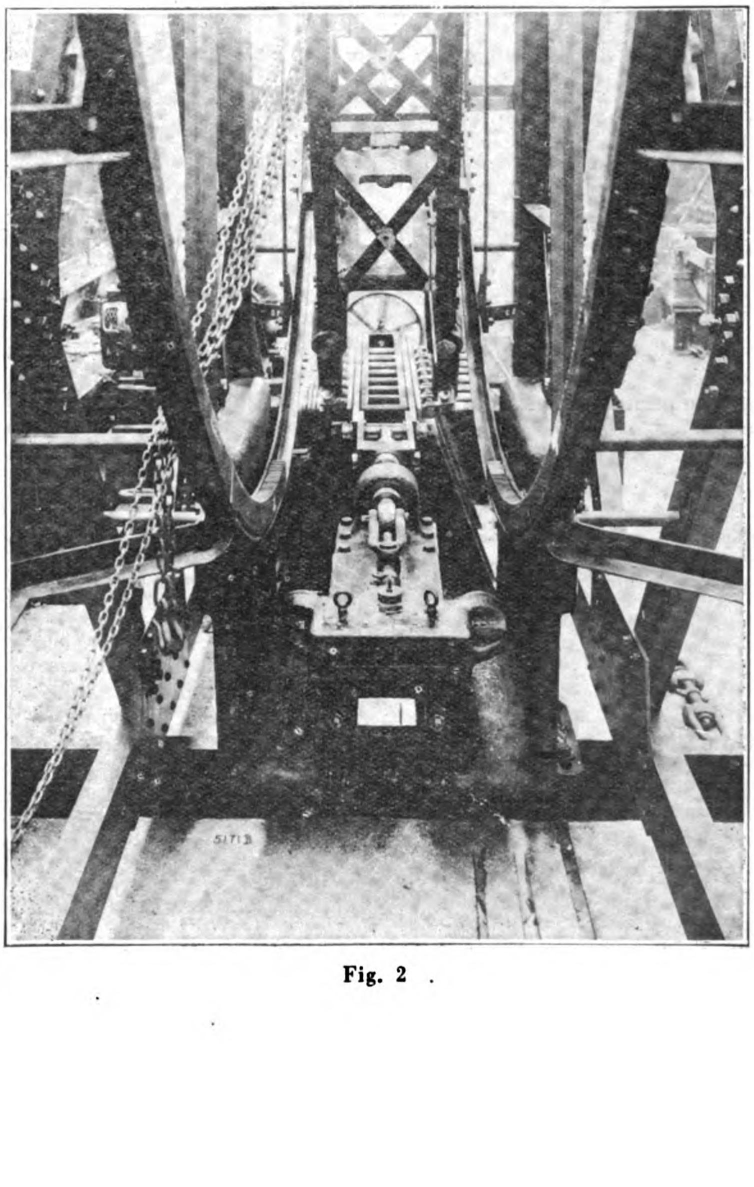


Fig. 2

In the event of the coupling breaking under the blow the pendulum hammer will swing past the vertical and will travel up two circular tracks which are fitted with teeth. Two spring pawls upon the hammer fall into these teeth when the pendulum comes to rest and so prevents its return.

The machine complies with the conditions laid down by The India Office for the testing of couplings, in which, particular consideration is given to the fact that the coupling must withstand without fracture, three blows of 5-ft.-tons, and must not exceed certain limits laid down as regards extension and deformation. On the completion of the machine careful calibration tests were carried out at Messrs. Avery's works and a number of couplings subjected to test.

# Rails and Sleepers Laid Over 1 Mile a Day

THE extension work on the Taonan line beyond Chengchiatun has progressed about 53 miles. For the preparation of the road-bed, about 3,500 coolies are employed. This rapid progress is principally due to the use of a rail-laying machine, the first of its kind imported from America, which is worked by a gang of about 500 coolies for laying sleepers and rails. This new machine may be employed with advantage in an expanse of level plain, such as lies on the Taonan Railway route. By this means, a track of 1 mile or 1⅓ miles a day may be laid. It is the first machine of this type ever brought to play in railway construction, in which the Japanese have been concerned.

The officials of the S.M.R. Co. and the East Asia Enterprise Company, who are connected with the construction work, live inside some thirty goods-cars, moving forward as the work advances. The construction of the 141 mile section from Chengchiatun to Taonan is expected to be finished in October, and the same section will be opened to train operation by the end of that month. As regards the new station buildings along the section (the number of the stations being 14 or so), they will take the remainder of the current year to complete.

# Forests in the Basin of the Ussuri River

*By Ivan Booshkoff*

THE basin of the river Ussuri, within the Russian territory, extends from the western slopes of the Sikhot-Alin range in the east and the plains of the Hanka lake district in the south to the borders of China (Manchuria) in the west and the Amur river in the north. The total area is 14 to 15 millions dessiatines. The river Ussuri is formed from the confluence of the rivers Ulakhe and Daubikhe, the sources of which take their origin in the eastern branches of the southern corner of Sikhot-Alin. The length of the Ussuri from the confluence of the two rivers is about 500 versts. The tributaries of the Ussuri river from the west are the rivers Sungachi, coming from the lake Hanka, then follow Iman, Bikin, Podkhorenok, Hor, Kia, and a few other rivers. Iman is about 350 versts long, Bikin about 400 and Hor about 350 versts.

The basin of the Ussuri river is in a mountainous country. In the northern part of the basin, from the Amur to the confluence of the rivers Ulakhe and Daubikhe representing to total area of 8 to 9 millions dessiatines, about 68 per cent. of the area is mountainous country and 32 per cent. are plains. The basins of the rivers Ulakhe and Daubikhe is still more mountainous and there the proportion is 82 per cent. of mountainous country to 18 per cent. of plains, principally river basins. The total area of this part is about 3.5 millions dessiatines. The southern part of the basin with an area of 2 millions dessiatines is a plain, the mountainous part being only 20 per cent. of the area.

A considerable part of the Ussuri basin is covered with forests. An exception is found in the basin of lake Hanka which resembles Russian steppes. The rest of the area is of a mountainous nature 45 to 50 per cent. of which is covered with forests. The nature of forests in that country entirely depends on the soil which, owing to the mountainous nature of the Ussuri basin, offers a large variety of species. It is seldom that one meets large areas covered with one specie only, in most instances the specie follow one another as the soil changes. Abietic species are predominating, though in the southern part leafy species are common. This is especially noticeable in densely populated districts or where forest fires have occurred, there abietic species are substituted by such leafy species as birch, aspen, poplar, etc. The abietic species in the basin of the rivers Ulakhe and Daubikhe are cedar, fir, then spruce and a small proportion of larch-tree. The leafy species are oak, white birch, elm, black poplar, aspen, ash, maple, and then velvet oak, walnut, acacia, etc.

In the northern part, fir predominates. Cedar comes next in quantity followed by larch-tree. Leafy species are scarce and only oak, and black and white alder are occasionally met with. Cedar undoubtedly yields the best building material, then follows fir and spruce. Larch-tree is excellent for railways sleepers, props, piles, etc.

The construction of the Ussuri Railway resulted in the destruction of a large portion of forests mainly along the railway line and in the vicinity of villages and towns.

According to surveys made during the period from 1912 to 1917 the following areas of state-owned forests existed in the basin of the Ussuri :—

| District. | Surveyed Forests | Total Area |
|---|---|---|
| Lower-Ussuri | ... 314,000 dessiatines | 314,000 dessiatines |
| Iman ... | ... 855,000 ,, | 4,500,000 ,, |
| Habarovsk | ... 375,000 ,, | 2,280,000 ,, |
| Total ... | ...1,544,000 ,, | 7,094,000 ,, |

These figures should not be considered as final since in both instances they include such areas where the forests had been destroyed by fire, or covered with young growths, or forests of low commercial value. On the other hand, only those forests were surveyed which are situated near rivers and easily accessible. On the whole one must take the commercial value of these forests to be lower than given in the above table.

Timber for local requirements is either cut on lots assigned to peasants' communities, or *by special permission* from state-owned lots. Export timber is cut in special concessions leased by auction. The greater part of these concessions is situated on the rivers Iman, Bikin, Hor, and their tributaries. In these parts, one meets with stretches in which cedar predominates. The forests in that part of the Ussuri basin may be divided into the following groups :—

(1) Lots covered exclusively with cedar with trees 130-150-200 years old with excellent timber yielding at least 60 cub. sazhen,* 80 per cent. of which is first-class building materials.

(2) Growths of cedar 130 to 170 years old with a certain proportion of fir 100 to 150 years old. This proportion varies from 3 to 5 per cent. per dessiatine. About 70 per cent. of this *timber is suitable for* building purposes. The reserves are up to 50 cub. sazhen per dessiatine.

(3) This group includes so-called double-deck growths of cedar: A forest with cedars from 150 to 200 years old has an undergrowth of cedars 50 to 80 years old. At least 80 per cent. of such timber is first class building material. A dessiatine would yield about 60 cub. sazhen. If conditions for the growth of cedar are favorable the trunks are quite straight and often a single tree would yield two logs 21 feet long each (standard Russian length), the thinner log being at least 14 to 18 inches in diameter at the upper end.

Growths of fir, covering sometimes considerable areas are found in valleys of rivers. The average age of this specie is between 100 and 150 years and the reserve about 50 cub. sazhen per dessiatine. Larch-tree is found in considerable quantities in the Bikin and Hor river valleys including their tributaries. The average age of the trees is from 100 to 150 years and the reserve about 50 cub. sazhen per dessiatine. The trunks are straight and some trees reach the height of 120 feet with a diameter of 35 inches at the height of 4 feet from the ground.

Among leafy species attention should be called to ash which is met with in growths of mature age—100 to 150 years. Some trees reach the height of 105 feet. The reserves are up to 70 cub. sazhen per dessiatine. Or sometimes ash is met with in connection with aspen and birch. Ash is met with in the valleys of the rivers Ussuri, Iman, and Bikin and of their tributaries. White birch grows in separate lots along valleys of rivers. The average age of birch is 80 to 100 years, with an average reserve of 40 cubic sazhen to the dessiatine. The height of birch in these parts is satisfactory and the trunks are clean and straight. The second type of growths of birch is in small patches with a reserve of up to 70 cub. sazhen per dessiatine. Aspen is met with everywhere in large quantities, though the best growths are along the Svianginsky branch line of the Ussuri Railway and along the rivers Daubikhe and Ulakhe. Trees 120 feet tall are often met with. The average age of aspen there is about 80 to 100 years with a reserve of up to 60 cub. sazhen per dessiatine. Other leafy species are oak, maple, walnut, acacia, and velvet oak.

Cedar is undisputably the most valuable specie, yielding excellent material for building purposes, either sawn or in logs. Fir is suitable for building purposes, however, it had but little application since cedar is invariably used instead. Larch-tree is indispensable for railway sleepers, props and piles, owing to its special resistance to moisture. Leafy species are suitable for the manufacture of veneer and 3-ply wood, the demand for which increases every year. They also offer excellent material for cabinet making, while aspen supplies material for match factories.

Strange as it may seem, the whole production of saw-mills situated along the line of the Ussuri Railway before 1917 did not exceed 5 million cub. feet a year. The main consumers were the Ussuri Railway, the Vladivostok Fortress, and also the town and adjacent summer resorts. The best equipped saw-mills in that part of the country where Sinkevicz Bros.' saw-mill at the station Hor, then L. S. Skidelsky successors' saw-mills at the stations Bikin and Iman, Streletzky's and Kuzin's mills at the station Iman, and Borodin's saw-mill at the station Ussuri. Apart from these there was L. S. Skidelsky successors' 3-ply wood factory, which was the only one of its kind in the maritime province. All these mills used to cut an average of 75,000 to 100,000 cedar logs a year 21 feet in length and with an average diameter of 17-in. at the upper end. This made up about 3 to 4 million cub. feet of sawn timber, while about 1 million cub. feet were used in the manufacture of 3-ply wood.

The trees were usually cut by gangs of Chinese or Russian lumbermen, who sometimes used to make up trains of 100 and more horses. At the beginning of winter they would go to the forest, cut trees and transport them down to the rivers. Before the revolution of 1917 there were no long-term leases granted on con-

*A cubic sazhen is 343 cubic feet.

cessions. The forest administration would cut the area available into separate lots and lease them by auction for a period of two years. This was quite sufficient time, since labor was then plentiful.

During the period from 1914 to 1917 a cedar log 21 feet long and 17 inches in diameter at the upper end would cost at the mill 5.50 to 6.00 gold roubles, including stump tax, sawing, transportation, etc. Such a log usually yielded 25 cub. feet of sawn timber, making 22 to 24 gold kopecks per cubic foot of sawn timber. Freight from saw-mills to Vladivostok at that time did not exceed 5 to 6 kopecks per cub. foot, thus a cub. foot of timber cost not more than 30 to 33 gold kopecks delivered in Vladivostok, while the market price was 40 to 45 kopecks. This gave a net profit of 10 kopecks per cub. foot. Nobody thought of exporting timber since the Vladivosok Fortress and the Ussuri Railway, as well as the population usually bought up the entire production and only in a few instances were small parcels of timber shipped to Japan and other countries.

The revolution of 1917-21, the civil war, the Japanese military occupation of the whole Ussuri line in 1920-21, the destruction of bridges by partizans and the pilfering of the saw-mills caused great losses to concessionaires, who were compelled to discontinue work and even leave cut logs in rivers. In 1922 all saw-mills were stopped. In addition the exhorbitant railway tariff introduced in 1921 (30 kopecks per cub. foot from Iman to Vladivostok) made the cost of transportation prohibitive.

Such, in general, is the forest position along the zone of the Ussuri Railway. In spite of the enormous reserves only a small part has been exploited. At the same time a fully developed timber industry in the zone of the Ussuri Railway has a great future in store. It is but natural that the timber industry in the Ussuri country will not remain in the same state of stagnation as it is at present. It must and will develop, however, this development follow a carefully worked out plan and the rapacious methods of working hitherto employed definitely abandoned. As is evidenced from the foregoing, the cost of one cubic foot of sawn timber delivered at Vladivostok was about 35 gold kopecks. But this price could have been much lower if the mills were better equipped, the methods of production more scientific and the transport from the forest to the saw-mills and from there to the town more satisfactory.

In order to develope the timber industry in the Ussuri country, it would be necessary to construct about 150 to 200 versts of side lines at the stations Ussuri, Iman, Bikin, and Hor. Then the rivers should be cleaned in order to enable the floating of timber in spring. It would be further necessary to erect well equipped saw-mills and 3-ply wood factories in places best suited for the purpose. Great advantages are offered by the village Rakitnee situated on the river Vak. It would be necessary to construct a line about 50 versts long connecting that village with the station Iman. The line would cross a plain and no tunnels and bridges would be required. Another place is the confluence of the rivers Daubikhe and Ulakhe which could be reached by extending the Sviagin line some 30 versts. It would also be advisable to construct two lines of an aggregate length of 100 versts from Bikin and Hor reaching right into the heart of the forests.

Simultaneously with saw-mills there should also be constructed various plants for the extraction by products from timber, paper mills, wood-pulp mills, and others. Well equipped mills with railways, rafting rivers, and low tariff will appreciably lower the price of timber and it would find a ready sale on foreign markets. It is only necessary to adapt the production to the requirements of those markets. The enormous reserves of high-grade timber, the close proximity of consuming markets, requiring timber in large quantities creates especially favorable conditions for a development of that industry and facilitates competition with Oregon pine, which is more expensive than cedar.

Apart from markets adjoining the maritime province, Ussuri timber could enjoy a great and steady demand in more distant countries of the Pacific, as in the instance of Australia, which requires about 10 million cubic feet of timber for cases, this figure showing a tendency to grow. Here also Ussuri timber has the possibility of competing with Oregon pine.

Naturally the organization of the timber industry in the Ussuri country will only be made possible with the assistance of foreign capital since the Russians have none. There is but little doubt that foreign firms interested in that industry will be able to take advantage of the situation and begin the exploitation of the enormous reserves of timber, provided, naturally, that conditions are created guaranteeing a possibility of private enterprise and of a sound organization of the enterprise.

# CHINESE GOVERNMENT RAILWAYS

## Approximate Financial Returns for the Year 1922

The following figures are only the approximate returns of the various lines, and are subject to revision when the complete annual for the year is published:—

| Name of Line | Operating Revenues | Operating Expenses | Net Operating Revenues | Income Debits | Income Credits | Net Debits | Surplus for the Year |
|---|---|---|---|---|---|---|---|
| Peking-Hankow .. .. | $25,500,000 | $12,500,000 | $13,000,000 | $4,000,000 | $650,000 | $3,350,000 | $9,650,000 |
| Peking-Mukden .. .. | 20,451,791 | 13,873,151 | 6,578,640 | 1,141,372 | 423,494 | 717,878 | 5,860,762 |
| Tientsin-Pukow .. .. | 16,000,000 | 9,750,000 | 6,250,000 | 4,920,000 | 322,000 | 4,598,000 | 1,652,000 |
| Peking-Suiyuan .. .. | 7,581,644 | 4,219,406 | 3,362,238 | 3,127,636 | 117,737 | 3,009,899 | 352,339 |
| Shanghai-Nanking .. .. | 7,572,529 | 4,525,891 | 3,046,638 | 1,604,113 | 41,143 | 1,562,970 | 1,483,668 |
| S'hai-Hangchow-Ningpo .. | 3,663,009 | 3,183,613 | 479,396 | 1,258,714 | 165,357 | 1,093,357 | *Def* 613,961 |
| Cheng Tai .. .. .. | 3,590,118 | 1,597,419 | 1,992,699 | 290,262 | 62,520 | 228,742 | 1,764,951 |
| Canton-Kowloon .. .. | 1,540,000 | 1,030,000 | 510,000 | 760,000 | 190,000 | 590,000 | *Def* 60,000 |
| Kirin-Changchun .. .. | 2,783,250 | 1,810,220 | 973,030 | 416,460 | 28,910 | 387,550 | 585,480 |
| Taokow-Chinghua .. | 1,375,000 | 622,000 | 753,000 | 507,000 | 2,000 | 505,000 | 248,000 |
| Lung-Hai .. .. .. | 3,150,000 | 1,400,000 | 1,750,000 | — | — | — | 1,750,000 |
| Kaifeng-Honan .. .. | 2,436,000 | 1,036,000 | 1,400,000 | 382,000 | 62,520 | 227,742 | 1,764,957 |
| Hupeh-Hunan .. .. | 1,890,788 | 1,629,859 | 260,929 | 2,319,059 | 174,735 | 2,144,324 | *Def* 1,883,395 |
| Chuchow-Pinghsiang .. | 519,851 | 632,000 | *Def* 112,149 | 1,500 | 2,500 | *Credit* 1,000 | *Def* 111,149 |
| Changchow-Amoy .. | 76,826 | 85,738 | *Def* 8,912 | 127,025 | 1,189 | 125,836 | *Def* 134,748 |
| | | | *Not arrived.* | | | | |
| Ssu-Tao, Chinese 1922 | 98,130,806 | 57,895,297 | 40,235,509 | 20,855,141 | 2,245,785 | 18,609,356 | 21,626,153 |
| Government Railways 1921 | 95,218,000 | 52,503,000 | 42,715,000 | 21,539,000 | 2,536,000 | 19,003,000 | 23,712,000 |
| Increase | 2,912,806 | 5,392,297 | | | | | |
| Decrease | — | — | 2,479,491 | 683,859 | 290,215 | 393,644 | 2,085,847 |

(1) There is no report for the yearly Income Account, as the Lunghai Railway is still under construction.
(2) The approximate return of 1922 for the Ssu-Tao Railway is not reported.
(3) The approximate return of Lunghai for 1921 is not included.

*Government Bureau of Economic Information.*

# Canton Reclamation Project

ONE of the projects now under serious consideration by the municipality, says the *Canton Times*, is the reclamation of that whole stretch of territory starting from the front of the Hospital Doumer and extending westward as far as the Canton Hospital, thus connecting the Dutch Folly which will form part of the new bund. Mayor Sun Fo has had this undertaking in his mind for the last two years and but for the lamentable *coup d'etat* of Chen Chiung-ming, he might have carried it to completion by this time. The area thus reclaimed is estimated to measure 1,843 *cheng* of land suitable for building lots.

The cost for the reclamation including the construction of a new bund, excavation works, and deepening of the river-bed, etc., is estimated at a total of $1,368,000. The old materials recovered from the demolition of the Haichu buildings and the old bund, etc., will easily fetch $77,000. This reduces the net cost of the reclamation to $1,291,000 or about $700 per *cheng* of reclaimed land.

Taking the present values of land in this locality that is land between Hospital Doumer and Canton Hospital, which range from $2,000 to $4,000 or an average of $3,000 per *cheng*, it can be readily seen that a profit of $2,300 per *cheng* can be realized without any trouble, thereby bringing the total profit to $4,238,900.

From a financial standpoint, the project is certainly a paying proposition. The problem before the municipality, however, is how to finance the project. Conceivably a loan for the amount can be made. Perhaps there may be some difficulties to be encountered at this time but if the loan proposition is not feasible, the lots may be sold in advance. There is no question that the latter scheme is quite feasible in the event of failure to raise a loan. The only objection is the possibility of reduced profits for the municipality by almost one-half. This is a consummation hardly to be wished for it means depriving the city of that much money for improvements.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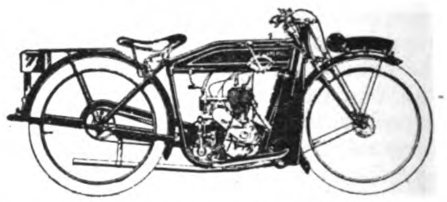

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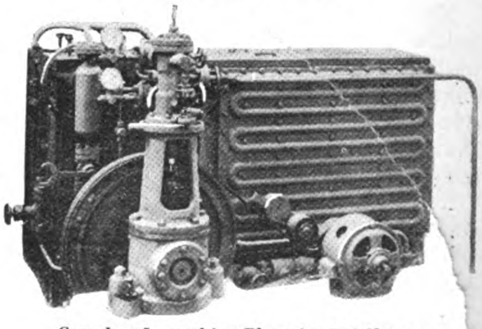

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遠東時報

## THE DAWN OF A NEW ERA

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## A PICTORIAL ACCOUNT OF THE JAPAN EARTHQUAKE

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## MINES OF INDO-CHINA

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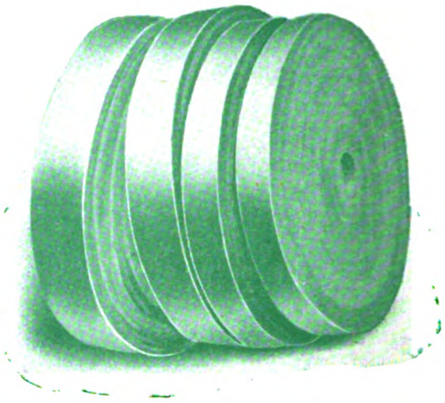

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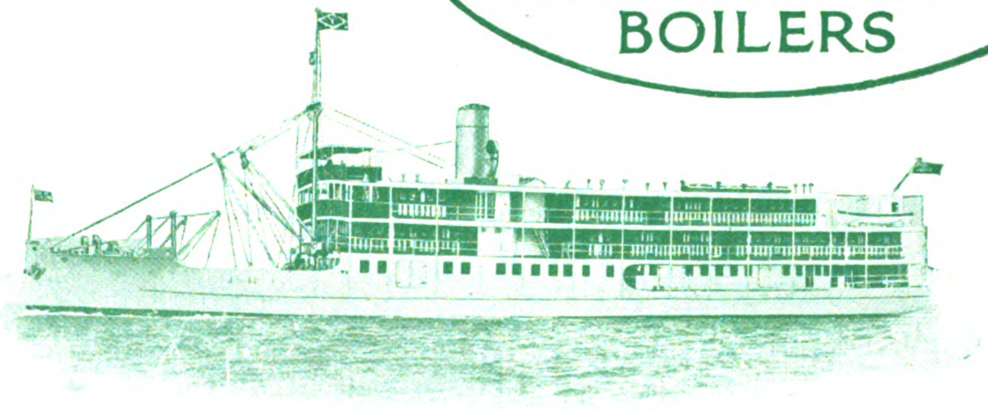


# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, OCTOBER, 1923 No. 10

# THE DAWN OF A NEW ERA

## A Calamity Turned into a Blessing

*By Geo. Bronson Rea*

"OUT of the great calamity will come a greater blessing." This sentiment springs from the hope that the day is not far distant when the relations between Japan and America will be so firmly cemented with bonds of sympathy, understanding and business that never again will talk of war in the Pacific be tolerated by the press of either country. Once again, Japan has been called upon to pay the price of peace and good-will. After surrendering every advantage in China and Siberia, conforming to the principles of the consortium and the Washington treaties, restoring Shantung and accepting the limitation of armaments and in many other ways demonstrating her willingness to march in harmony with America; after subjection to a grilling propaganda and disastrous boycott for refusing to relinquish her one remaining strategic position in Manchuria, Japan has been crushed by a calamity which overshadows the losses of the Russo-Japanese war and surpasses any destruction which might have been inflicted upon her by an overwhelming invading army. Whatever may have been the political mistakes of former Japanese cabinets; whatever grudge may have been held by other nations against Japan for her advance in industry and power, the score has been settled in full. Japan lies helpless, shaken to its very foundation by the most appalling catastrophe in the history of the world and in her hour of trial and need turns her eyes eastward over the broad Pacific towards the great nation whose people more than any other has misunderstood and misinterpreted her policics and aspirations, and silently asks for its friendship, trust and co-operation. And before even the need was realized or the hope framed, the response was on its way.

**A Little Mother of Old Japan who Lost all, Father, Mother, Husband, Child, facing anew the Struggle for Life from her Refuge in an Old Temple Graveyard**

Nothing, not even the wholesome clarifying of the atmosphere and frank exchange of views at the Washington conference has so moved and convinced the people and the government of Japan of American sincerity, friendliness and good-will as the spontaneous and immediate measures which sent a score of deep-laden relief ships hurrying from China, from Manila and the Pacific coast to succor the victims of the great calamity. In a vague, remote way, the people of Japan had heard about American relief work in France, in Russia and the Near East; they had more accurate information about the millions poured into China to succor the famine and flood sufferers, but never in their wildest imagination could they conceive that those whom they had been taught for years to look upon as the imaginary enemies of their country and race, would respond in the same generous spirit to any urgent need for relief where they were personally concerned.

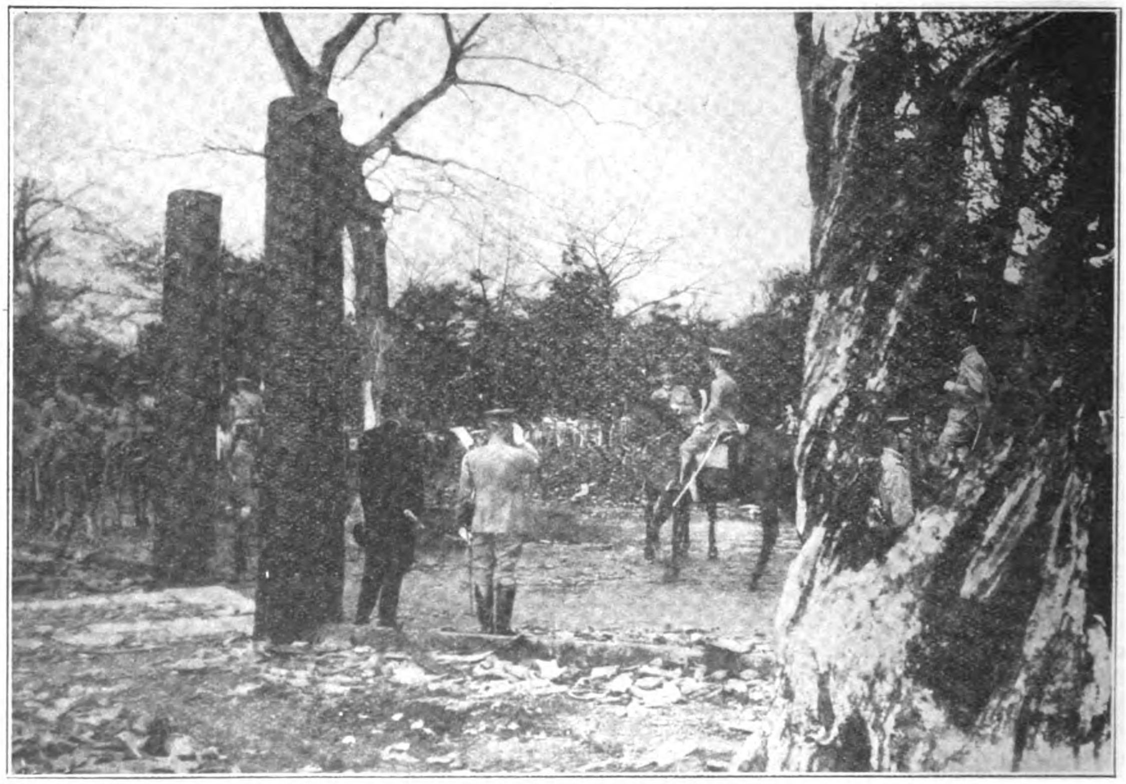
And when the earth heaved and rocked, dancing to the tune of death played by the mighty subterranen forces and their flimsy structures came tumbling down like houses of cardboard, burying thousands in the ruins, and the fire demon licked clean the *débris*, wiping out the whole of Yokohama and over half of Tokyo, piling up the dead by heaps and rows in the streets and by thousands in the open places when they had taken refuge; when over two million people suddenly found themselves homeless, destitute, hungry and heart-broken with sorrow and despair; the first foreign ships to come rushing in with food, clothing, tents, medicines, nurses and doctors, flew the flag of the United States of America.

Shell-shocked, dazed and dumb with the horror of the first three days, the survivors of the quake at Yokohama saw on the evening of the third of September a streak of fire flaming towards the harbor from the south. Speeding in at a thirty knot clip, with her funnels glowing red, the American destroyer *Stewart* slowed up and came to anchor off the ruins of the breakwater, the first foreign relief ship to arrive on the scene, the vanguard of the fleet loading supplies in the various ports of the Far East for the victims of the catastrophe. The American navy was on the job from the minute the first news was received at Dairen. Had war with with Japan been declared it could not have operated with greater dispatch. The opportunity had arrived to show the Japanese people the real friendliness of America and the navy swung into action moved by a common impulse to render immediate aid and

The Prince Regent of Japan receives the Report of the Disaster from Baron Goto in Uyeno Park

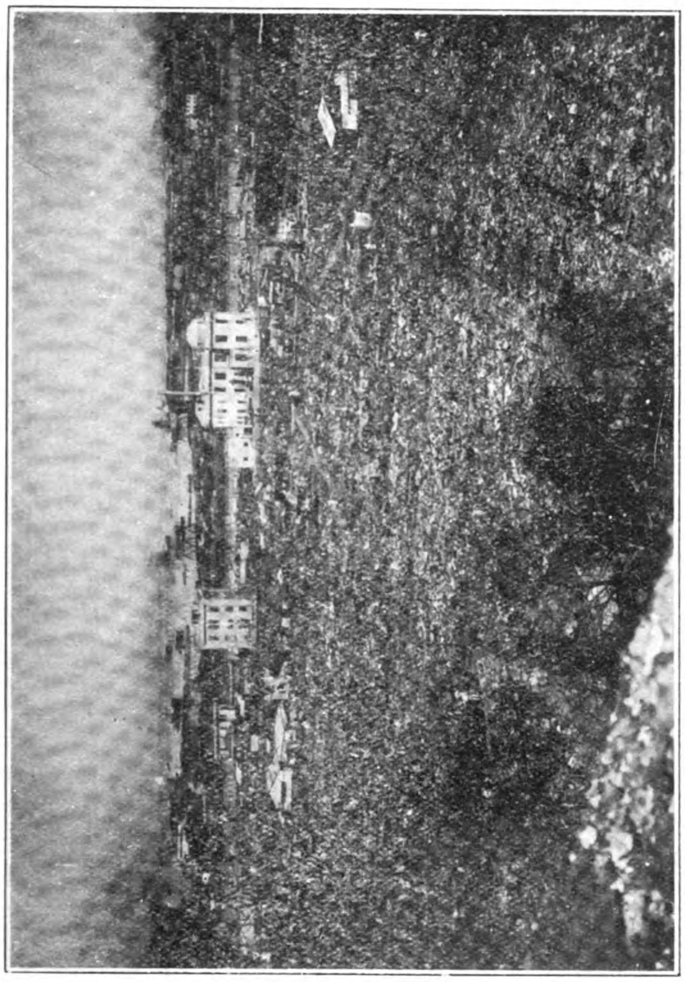
comfort. At ten o'clock Sunday morning, the news of the disaster reached Dairen. The *Huron*, flagship of the American Asiatic fleet, the supply ship *Black Hawk* and the 38th destroyer division were lying in the harbor under command of the chief of staff, Captain Stearns. The admiral was at Chefoo, the summer rendezvous of the fleet, a hundred miles away across the Chihli Gulf. Captain Stearn in company with Consul Ballentyne was starting out to pay an official call on Baron Ijuin, governor-general of Kwantung, when he learned the news. Issuing orders to have steam up and ready for immediate departure, he hastened to meet the governor-general and placed the American Asiatic fleet unconditionally at the service of the Japanese government. By three o'clock the *Stewart* was steaming at full speed towards Yokohama with orders to keep the admiral informed of the extent of the disaster and the nature of such supplies as would be most urgently needed. The fleet picked up the admiral at Chefoo, who ordered the *Black Hawk* to Tsingtao to load supplies and wirelessed every naval supply ship in the Far East to do likewise. The naval purchasing officers at Manila, Shanghai and elsewhere were authorized to purchase everything that could be readily procured on the local markets. The 38th destroyer division followed the *Stewart* within twenty-four hours and the 45th division at Chinwangtao, was ordered to join the flagship already under full steam headed for Yokohama. Admiral Anderson assumed full responsibility. Red tape disappeared. Without awaiting instructions from Washington he compromised the navy department to an expenditure of over two and a half million dollars, and then informed the secretary of the navy what had been done. The answer came congratulating him, approving his action and authorizing him to go the limit. It was not until relief from other sources was on its way and after the first emergency had been adequately met, that this order was revoked. By that time, the other branches of the government and the Red Cross had relieved the navy of the load. On the fifth, the 38th destroyer division steamed into Yokohama, followed by the flagship on the 8th and by the 45th division on the 9th. On the 11th, the *Black Hawk* loaded to the plimsol mark with a full cargo of food and other necessities came in from Tsingtao, followed by the mine-layer *Bittern* with tents, clothing and miscellaneous stores. The *Pecos*, the *Aberenda* and the *Vega* had answered the S.O.S. call of the admiral and followed each other into Yokohama from Manila, from the Yangtze and from far off San Francisco loaded down with urgent supplies. The destroyers were placed at the disposition of the Japanese government. Some were employed in conveying refugees from Yokohama to Shimidzu, others made special trips to Kobe and back for the Japanese and in other ways contributed their full share in establishing communications and succoring the unfortunate victims of the earthquake. The navy established a new record, one that the country may well be proud of.

Following close on the heels of the navy came the army transport *Merritt* hastily loaded at Manila with 800 tons of food, a complete field hospital and 1,200 tons of medical supplies; the navy tender *Pecos* also from Manila, followed three days later with 1,000 tons of food, then the army transport *Meigs* appeared with nearly 4,000 tons and 20,000 cans of food, 3,000 cases of milk, 30,000 suits of clothing, 2,500 tents, 12,000 blankets, 15,000 cots, medical supplies for 150,000 people for two months, 67,000-ft. of lumber, water carts, rolling kitchens, another complete field and evacuation hospital and 23 doctors and nurses. Then came the navy supply ship *Aberenda* with 4,000-lbs. of fish and a full cargo of various foodstuffs. On the 26th, arrived the great army transport *Somme* from San Francisco with another base hospital, 104 in-

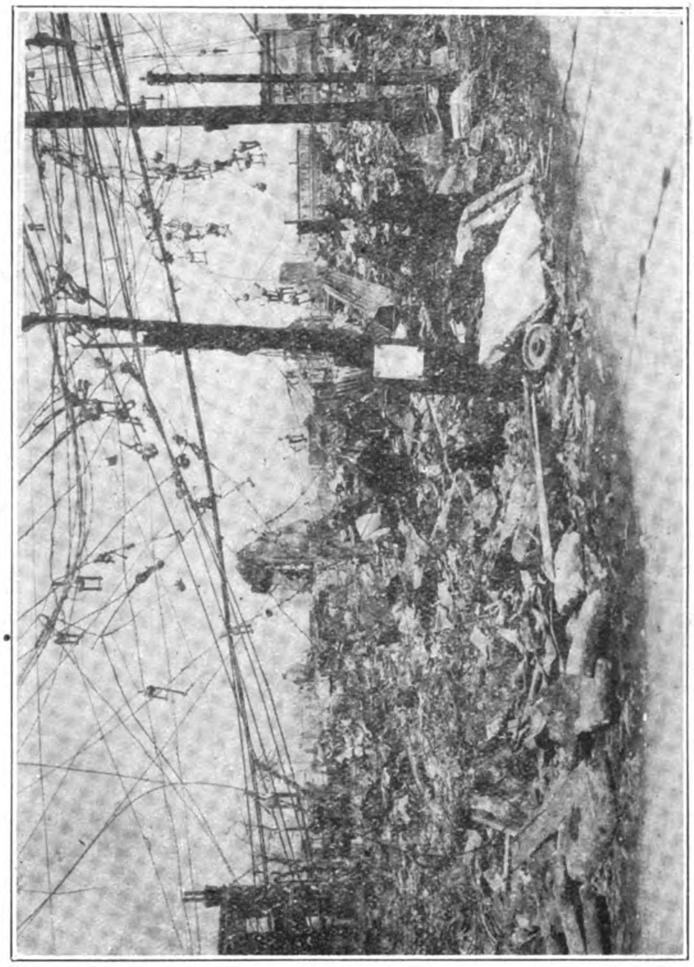


The Prince Regent and his Escort of the Imperial Guards passing through Uyeno Park

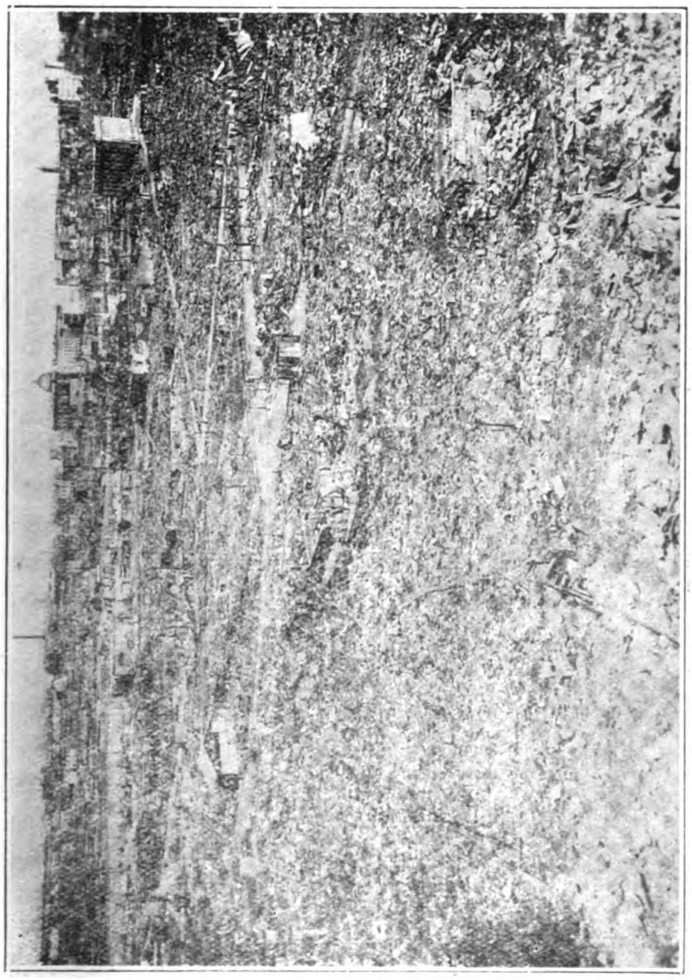
# THE DESOLATION THAT WAS YOKOHAMA



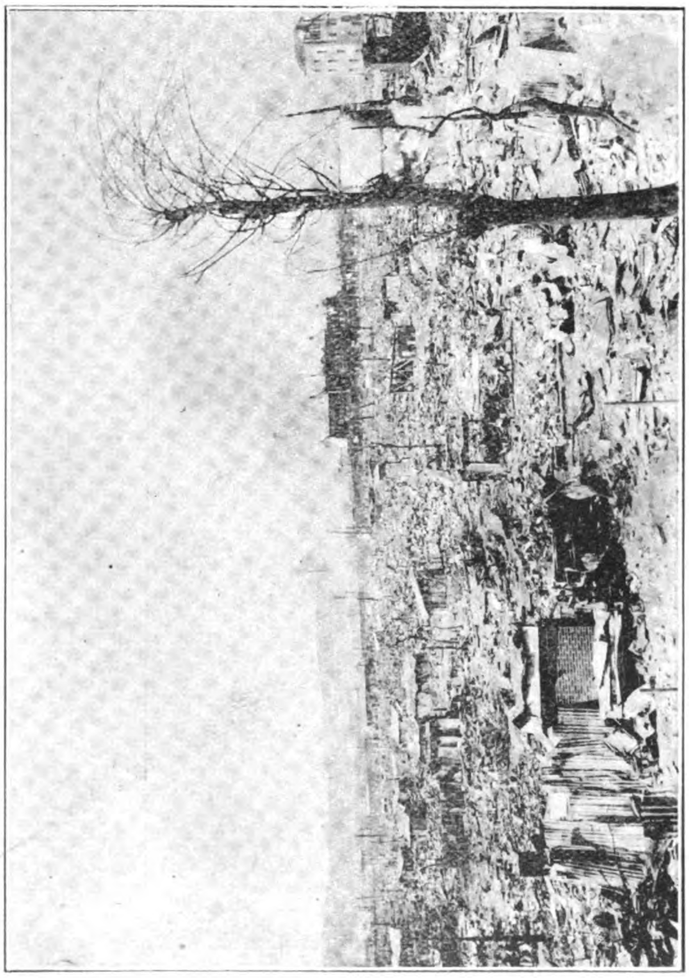
View from Kanagawa: Municipal Social Hall in centre now operated as a hospital by the South Manchuria Railway Company



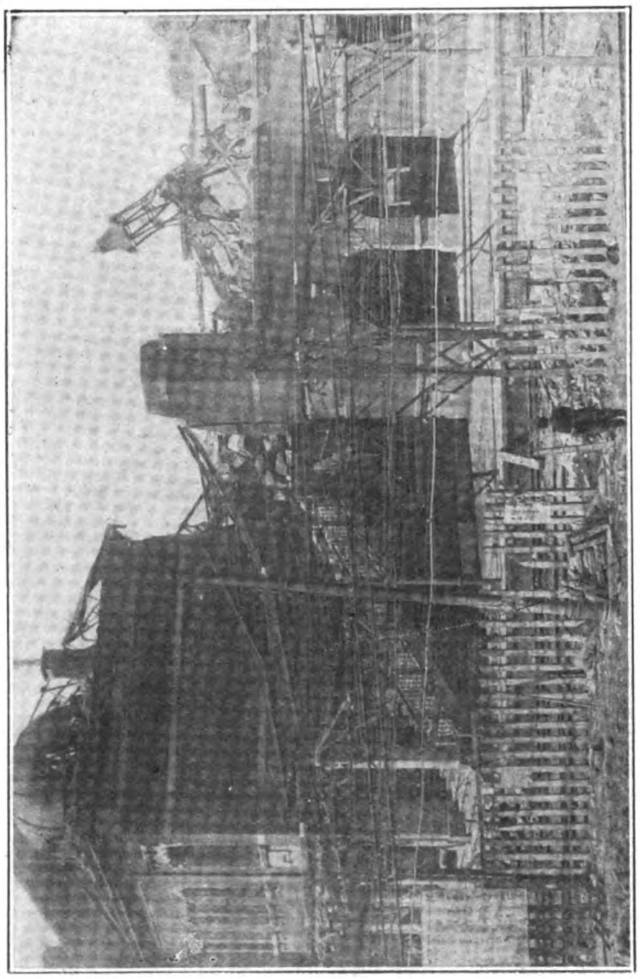
Another view of the wreckage that was once the proud commercial port of Japan



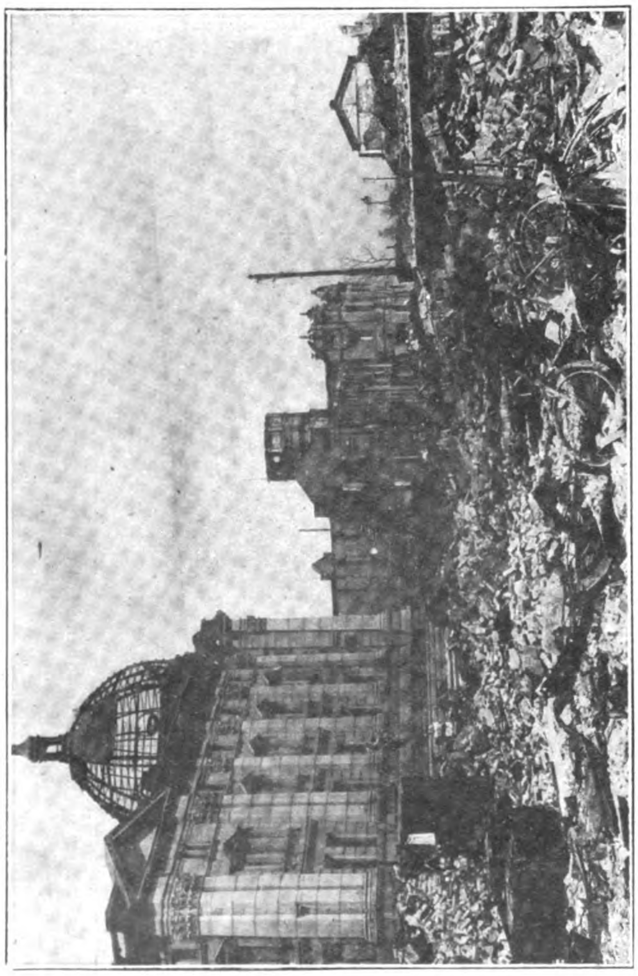
Looking toward the centre of Yokohama from the north-west



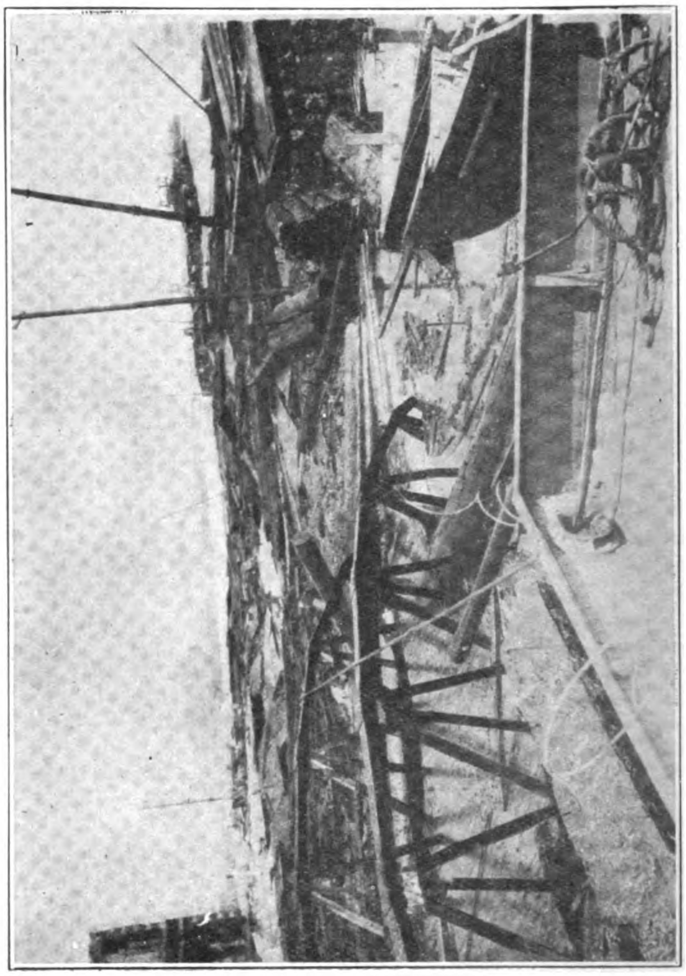
A Bird's-eye View of Yokohama: two days after the disaster. Shacks and shelters appear on the still smoking ruins



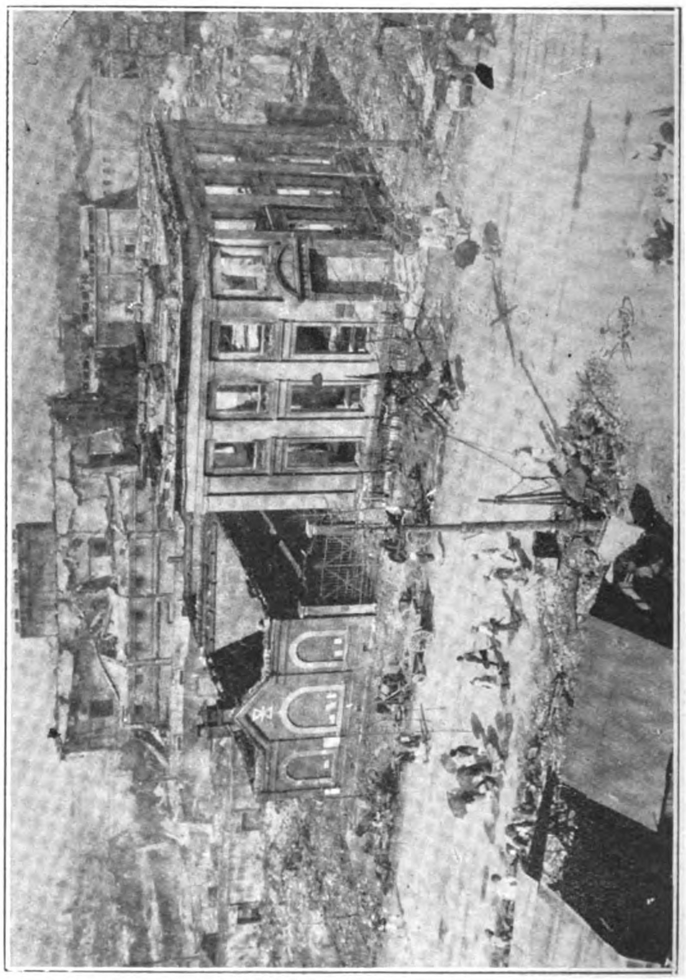
The Imperial Japanese Government Railway Station at Yokohama gutted by fire



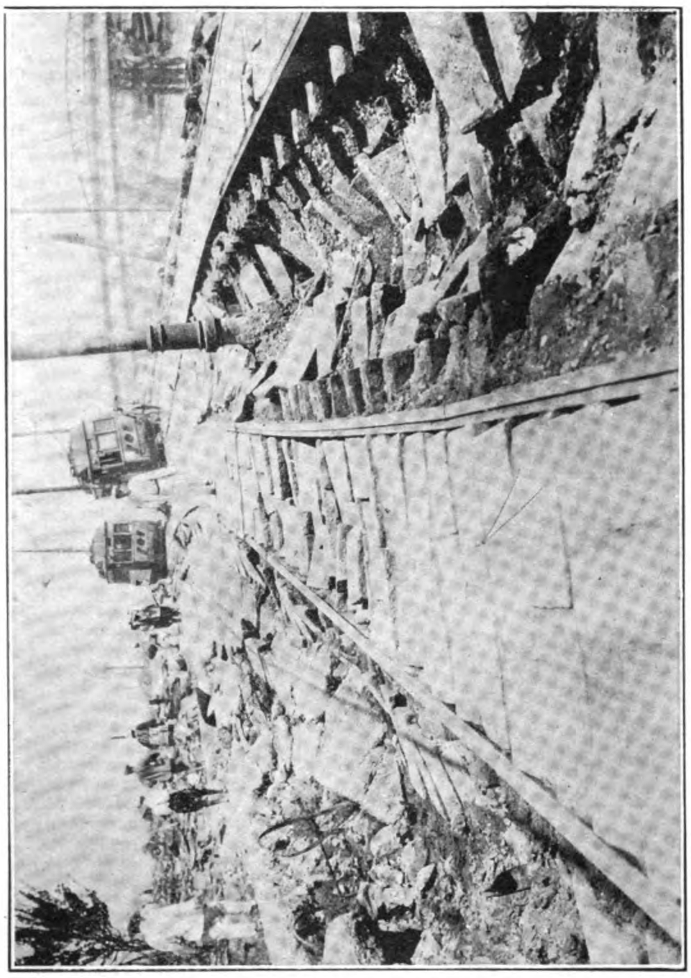
Ruins of the Yokohama Specie Bank at Yokohama. Over two hundred people, who flocked to this edifice for safety, were burned to death when the flames enveloped and gutted this splendid structure. Heaps of dead were banked against its outside doors where they were appealing for entrance inside. The saddest spectacle in Yokohama



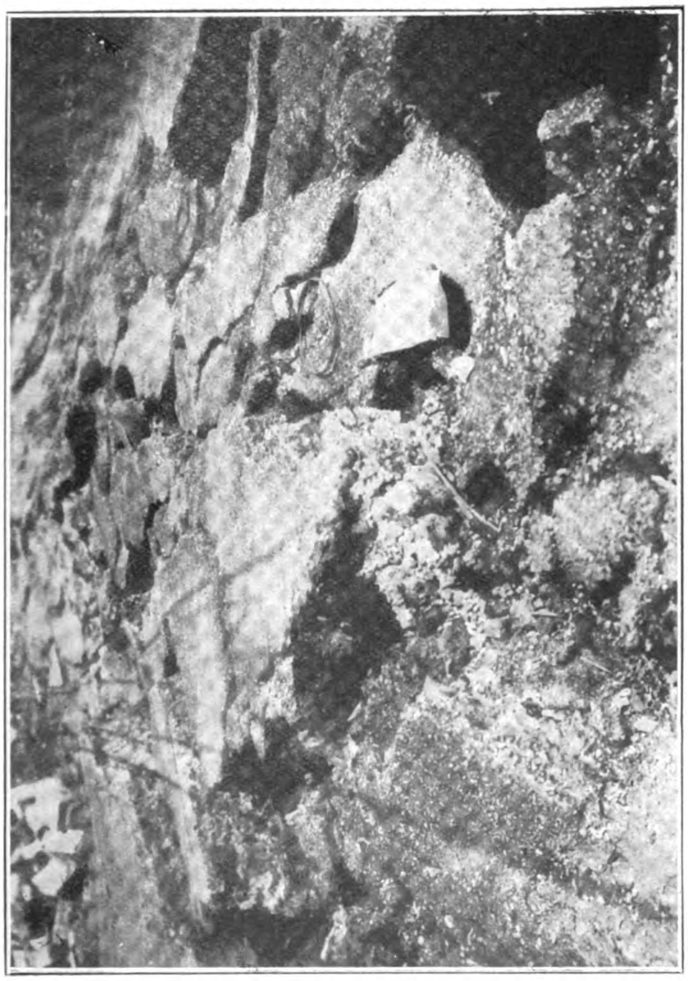
The ruins of the Pier at Yokohama



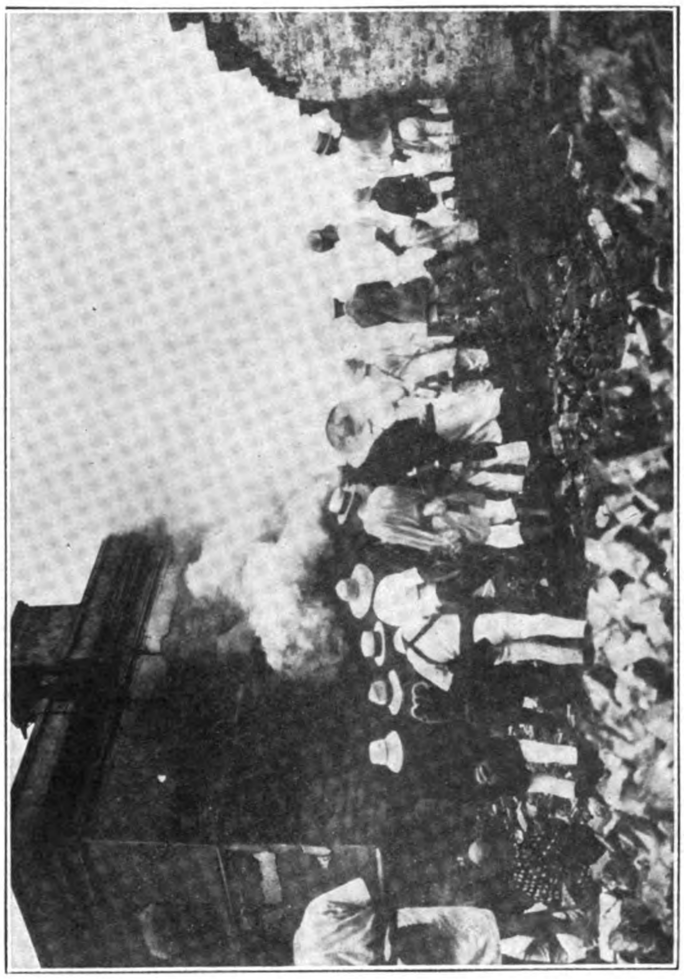
Customs House, Yokohama



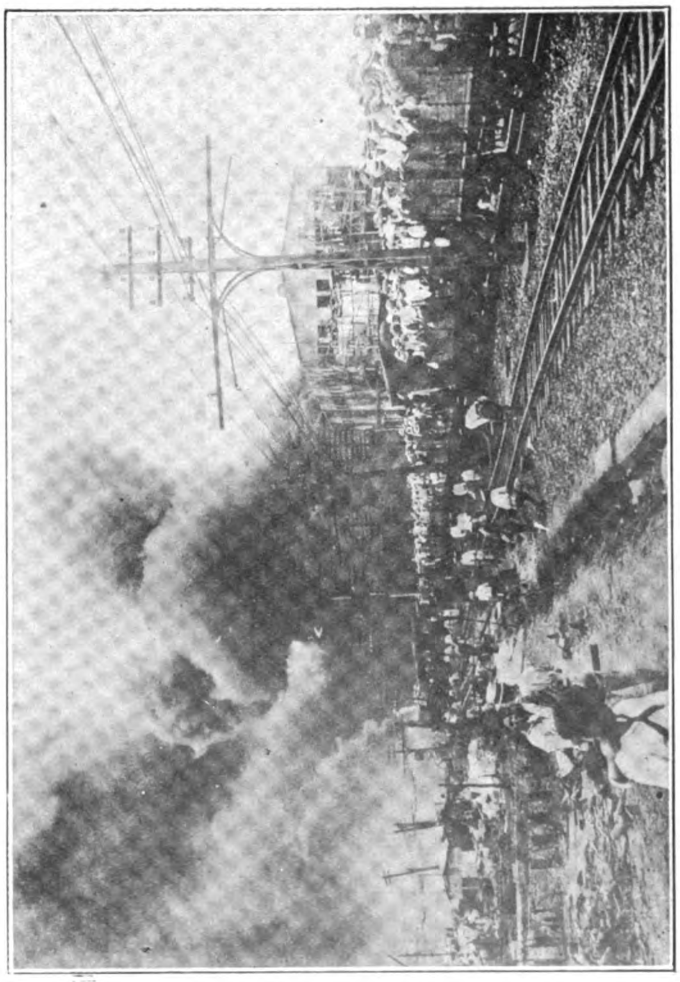
What the quake did to the tramway at Yokohama



Earth cracks at Yokohama

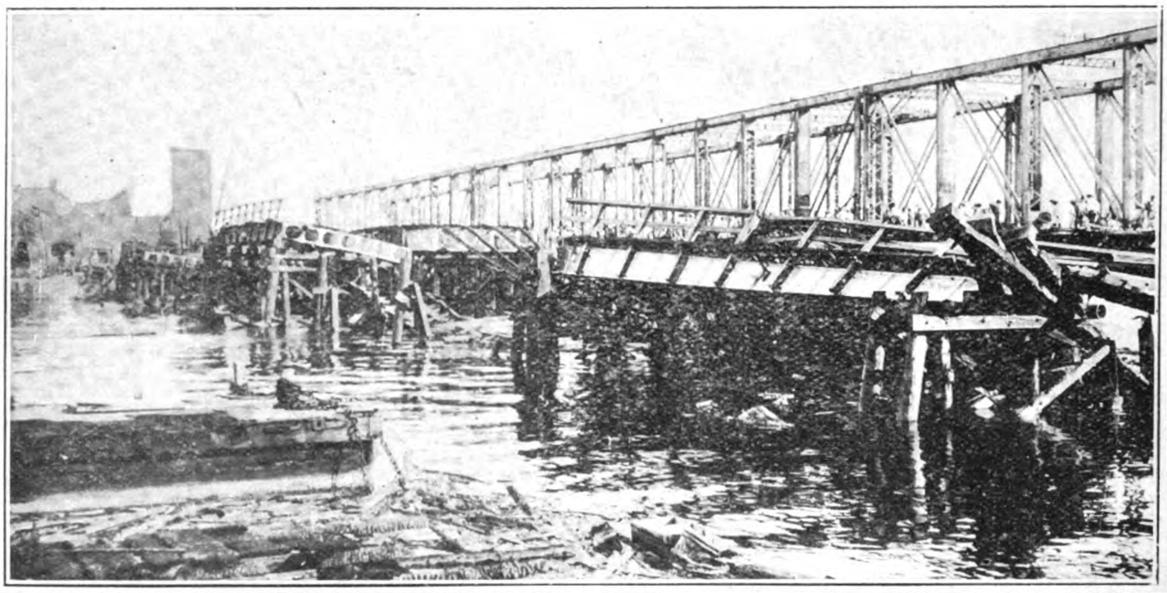


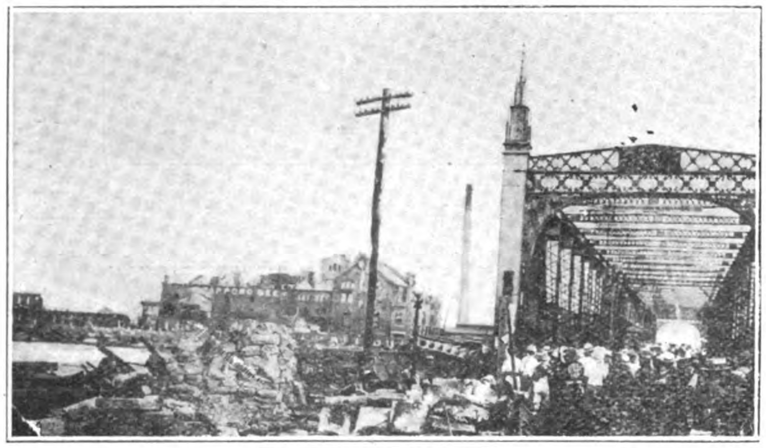
Many of the old Japanese fire-proof storage houses with heavy iron doors and shutters stood the quake and resisted the flames. The photo shows one being opened with clouds of smoke rolling out, the contents having been baked and scorched by the terrific heat

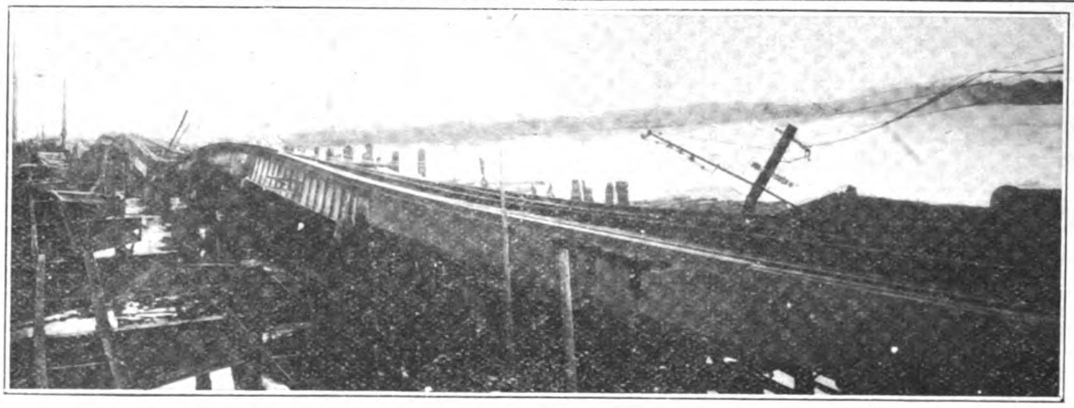


Refugees fleeing from Yokohama

firmaries complete with 3,200 tons of medical stores, about 15,000 tents of all sizes (in addition to the hospital tentage) 6,000 extra cots and at least 2,000 tons of food. Behind this vanguard plowing their way across the Pacific from Seattle are following the Blue Funnel freighter *Tyn Dareos* with 500 cases of salmon, 1,000 cases of milk, 200 tons of flour, 6 tons of hard tack and five tons of drugs; the *Congosan Maru* with 25 tons of rice, 300 tons salt fish, clothing, blankets and 28 tons of galvanized iron roofing; the *Toyama Maru* *Henshaw* with 54,500,000-ft. of lumber and 5,000,000 shingles; from Portland comes the *Dewey* with 4,500,000-ft. of lumber; from San Francisco, the navy supply ship *Vega* with 5,000 tons of rice, 1,000 tons of salmon, 100 tons of evaporated cream, 1,000 tons of flour, 200,000 drawers and 150,000 undershirts, 100,000 blankets and 100 tons of roofing; the *President Taft* had 300 tons of rice; the *Fusan Maru* from Seattle had 60 tons of rice, 375 tons of meat and fish, 20 tons of milk, 600 tons of flour, 50 tons







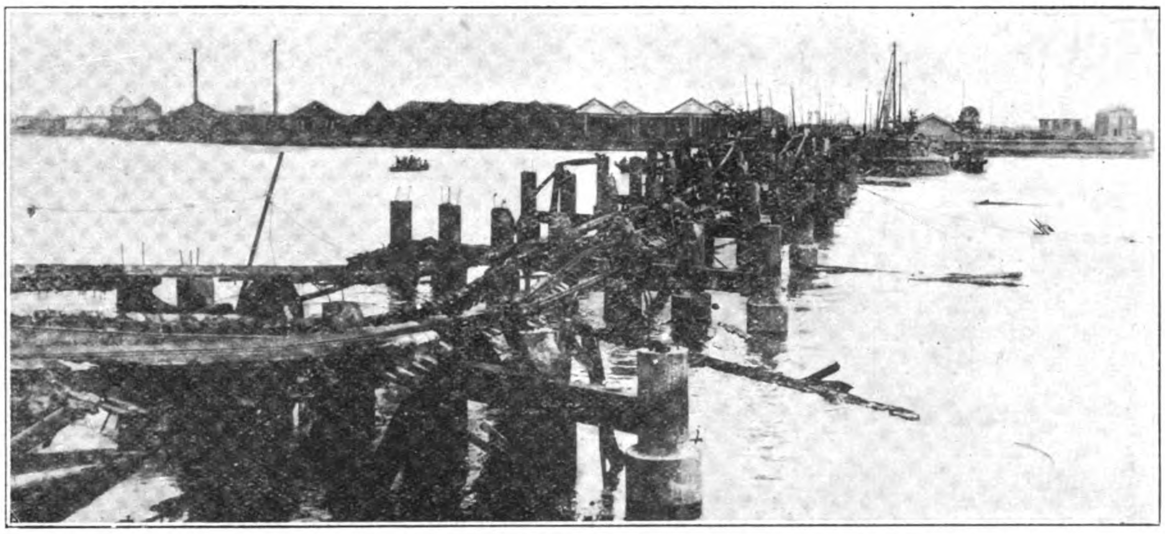
**THE AZUMA-BASHI (BRIDGE) OVER THE SUMIDA RIVER,**

Connecting the Asakusa and Honjo districts of Tokyo. The large building on the left in Honjo is the Sapporo Beer Brewery, gutted by fire.

The main steel structure stood the quake, but the old bridge on pile foundations carrying the railway and water pipes was shaken into an unrecognizable mass of ruins.

with 50 tons rice, 10,000 cases of salmon, 500 cases of milk, 500 tons of flour, 20 tons of hard tack and 100 tarpaulins; the *President Jackson* with 3,000 cases of evaporated cream, 100 tons of flour; the *Yomei Maru* with 200 tons of galvanized iron roofing; the *Tempaisen Maru* with 150 tons of roofing; the *Iyo Maru* with 100 tons of fish, 150 tons of evaporated cream, 50 tons of flour; the *President Jefferson* with 150 tons of roofing and the *West* of hardtack, 6 tons of tentage. This was only the beginning, the stores readily obtainable in the local markets. Manila depleted its supplies to the minimum margin of safety; Seattle was drawn upon to its limit and now from the East are coming the main Red Cross shipments. All this was spontaneous, the immediate reaction of America to the needs of the situation without consultation with the Japanese authorities. At the same time the American Red

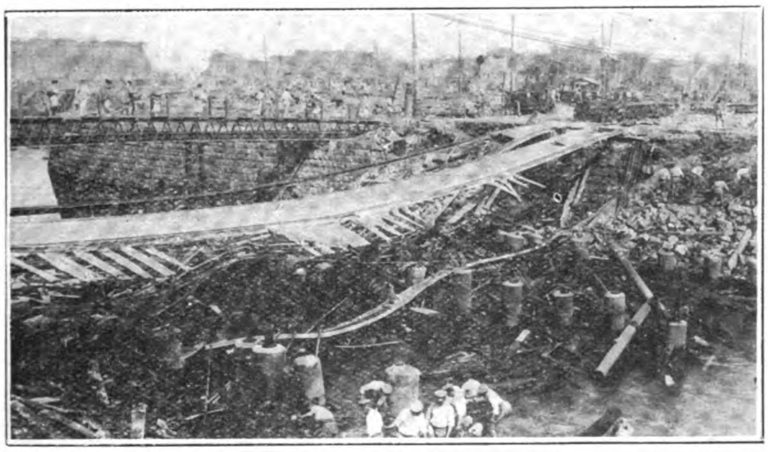
Cross Society issued its call for relief funds and within a few days over $8,000,000 was contributed from all parts of the United States. (The latest report states that the American Red Cross contributions have reached a total of $19,000,000). The navy had spent nearly $3,000,000, another $1,000,000 was cabled by the government to General Wood at Manila, the Philippine authorities set aside a special fund for relief, the American Red Cross chapters in China rushed over a complete hospital unit, while the army transports and naval supply ships freighted cargoes without charge. To such an extent did food supplies come rushing in that the Japanese authorities early requested that they be discontinued, and clothing, blankets, tents and building material sent in order to prepare against the severe winter weather. It took some time to ascertain the full extent of the calamity, the number of dead and wounded, the missing, the homeless and destitute and draw up an intelligent requisition for necessary relief supplies. The following graphic dispatch sent by Ambassador Woods to the secretary of state for the information of the Red Cross Society tells its own story: "The Japanese earthquake relief bureau officially reports four provinces so devastated that over two million people are homeless and destitute, dependent solely upon government support or outside assistance for shelter, clothing and subsistence during the approaching



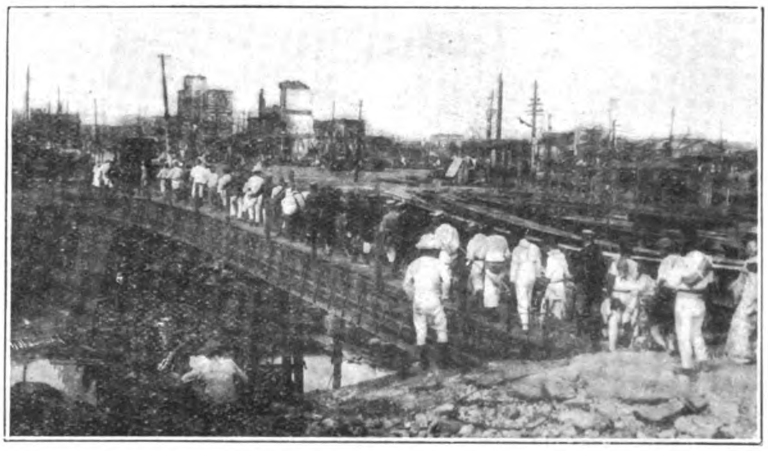
**Ruins of the wooden bridge connecting Fukagawa ward of Tokyo with the Tsukishima Island; nothing left but the reinforced concrete piles and twisted rails and pipes**

**The Eitaibashi bridge over the Sumida River, connecting the Eitaibashi district with Fukagawa. The wooden floor of the new structure was licked up by the flames which devored the old wooden pile bridge in the foreground**

**The Ryogokubashi bridge over the Sumida**



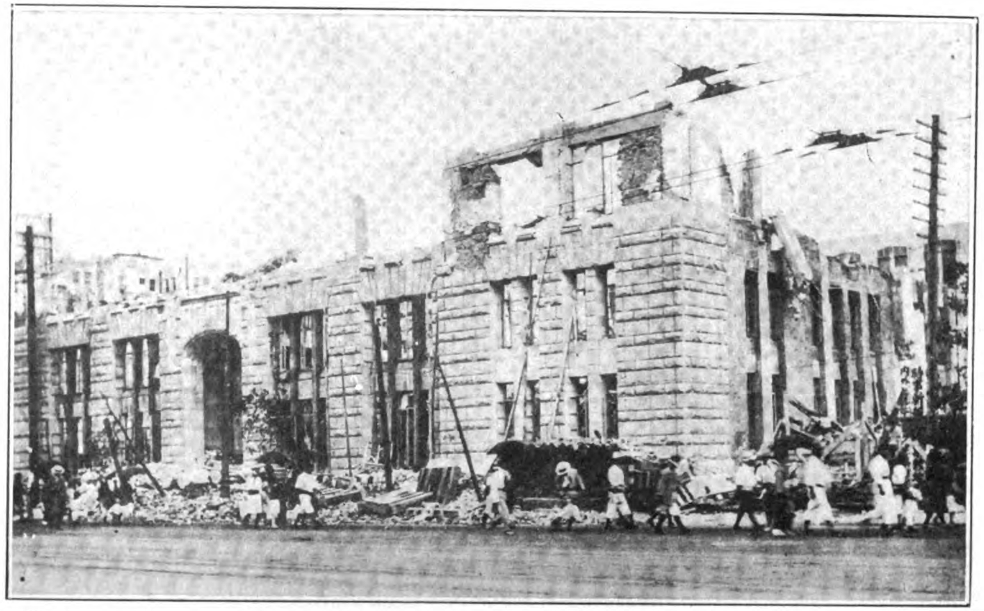
**Ruins of the Kanda Bashi bridge**



**Pedestrians crossing the Kanda Canal on the water pipe**

How the magnificent new Nippon Yusen Kaisha Head Office in Tokyo stood the quake. This is one of the three modern steel frame edifices erected by the Fuller Construction Company. The damage was superficial, confined largely to splitting and shaking loose the hollow terra cotta tile facing in imitation of granite. The facing on the lower stories suffered most, which at each corner the brick and hollow tiles were shaken out.

**Ruins of the 12-storey Pagoda in Akasaka Park.**

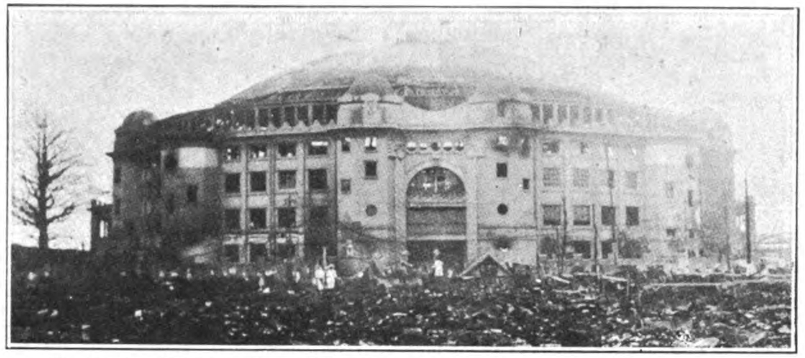


**Ruins of the Nagai Office Building on Babasaki, near the new N.Y K. Building.**

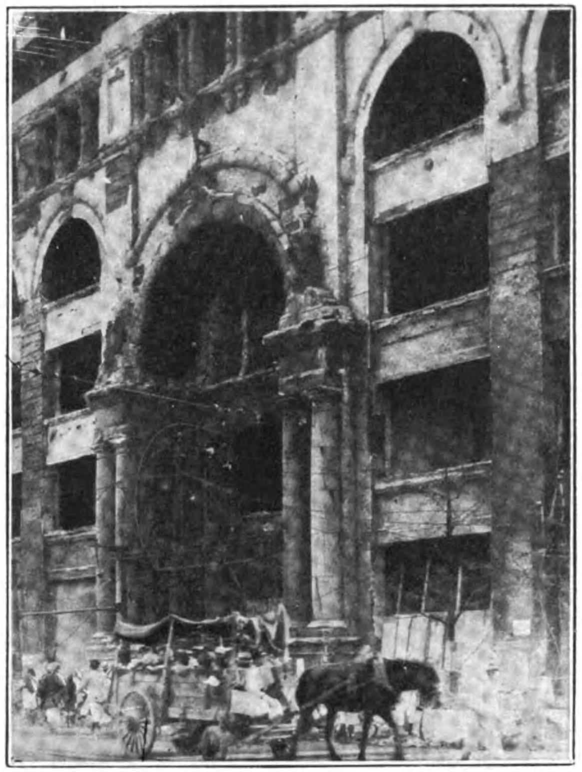
This is new six-storey reinforced concrete building under construction at the time of the quake with gave way and caved in from all sides towards the centre. Pillars, beams and floors of reinforced concrete were broken up, burying over thirty workmen under the mass of *débris* which fills the interior up to the second storey.

**Entrance to the Metropolitan Police Headquarters at Babasakimon. The building stood the quake but was gutted clean by the fire.**

The beautiful new Tokyo Kaikan, or Palace Hotel, had the entire second tier of bricks shaken out, throwing all the weight of the quivering building on to the steel columns of the frame work, bending them to an angle of at least five degrees. The building will have to be demolished.



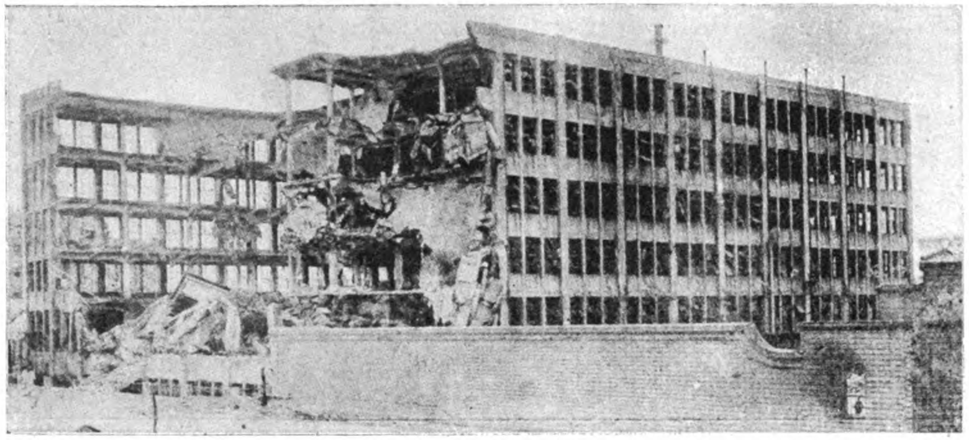
The Kokugikan, or Great Wrestling Hall in Honjo. A magnificent steel concrete and stone structure surviving the quake to be gutted by flames.



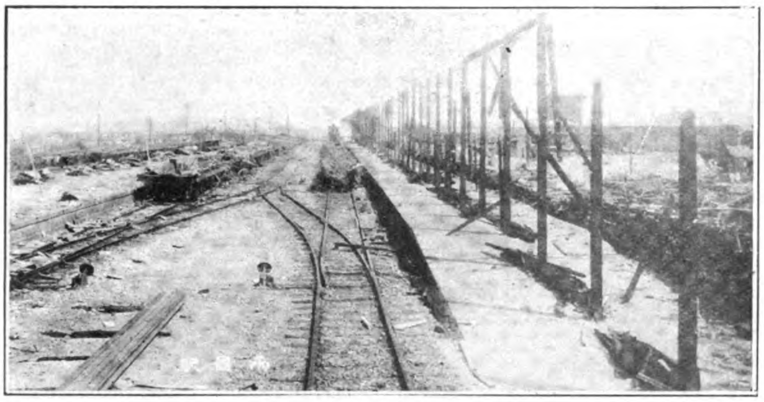
The facade of the great Mitsukoshi Department Store operated by the Mitsui interests. The flames swept clean the interior with its huge accumulation of merchandise, the heat cracking and peeling the granite and limestone facings like paper.

The Mitsukoshi Department Store seared by the intense heat of the conflagration

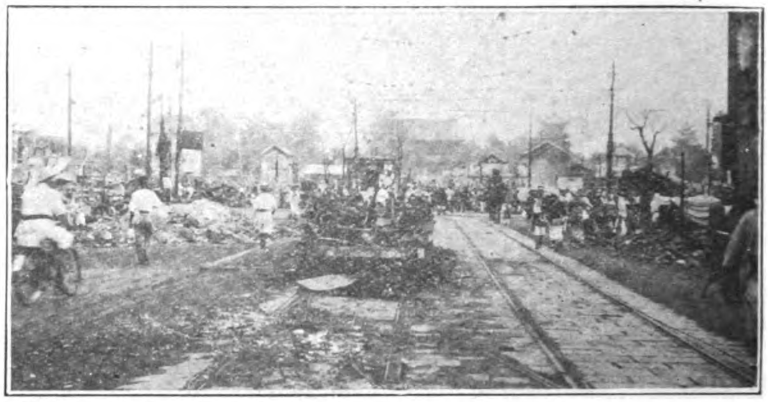
The collapsed Maruzen Building on the Ginza, A brick structure with iron beams and pillars which collapsed with the quake and licked clean by the fire.



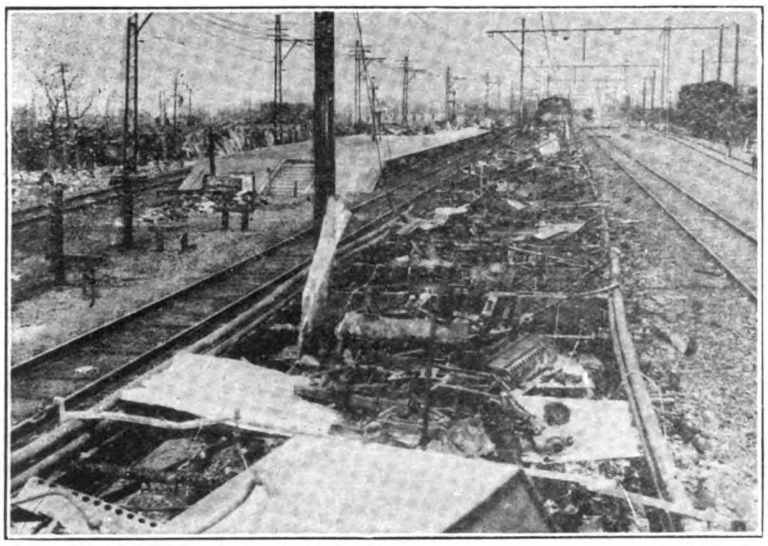
The reinforced concrete warehouse of the Mitsukoshi Department Strre, collapsing in part on the first shake of the quake, and gutted by the fire.



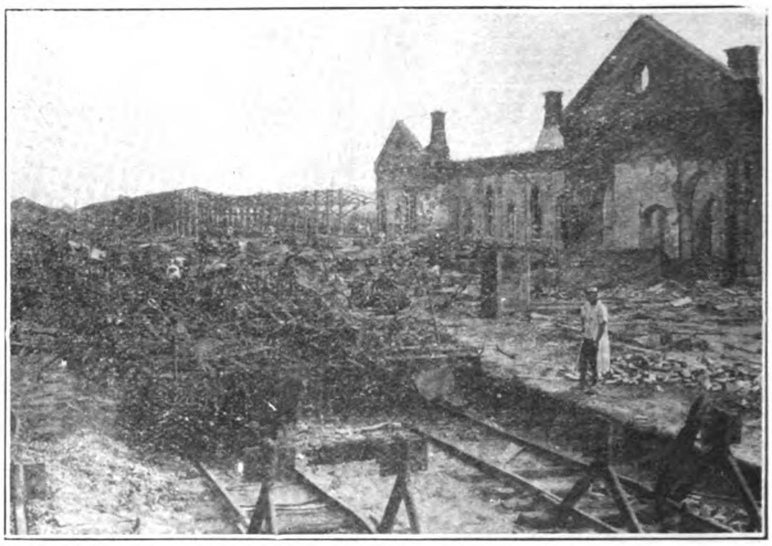
The Ryogoku Station of the Imperial Railway in Honjo



Tram Cars burnt near Asakasa Park



Hamamatsu Station on the Tokyo-Yokohama Electric Line



The Uyeno Station of the Imperial Government Railways

Outside of Car Barn in Yurakucho

Looking towards Shinobazu Pond from Uyeno Park

HOW THE RAILWAYS AND TRAMWAYS FARED DURING THE FIRE

winter. Devastated areas are now under martial law in order to facilitate relief and expedite shelter construction before cold weather begins in January. If supplies from America are shipped promptly much can be done during the next two months to alleviate suffering and forestall winter hardships. Over 600,000 houses entirely destroyed and at least 1,500,000 people will have to be provided with immediate shelter. The Japanese authorities are displaying great courage, energy and determination. The present non-party administration is admirably selected to face the crisis and is doing everything possible. In addition to generous contributions from the imperial family and government the Japanese people have already raised $15,000,000 by voluntary contributions. After careful study of urgent requirements the following list of supplies was submitted as the official request of the Japanese government through the earthquake relief bureau in answer to the generous proffer of assistance by the American Red Cross Society":—

100,000 girl's winter dresses; 100,000 girl's woolen cloaks; 100,000 pairs girl's stockings; 100,000 shawls; 300,000 yards cotton flannel; 150,000 blankets; 3,350,000-lbs. of cotton for making quilts; 1,000 galvanized iron buckets; 100,000 enamelled wash basins; 100,000 enamelled ware cups and bowls; 100,000 enamelled ware kettles; 50,000 men's suits; 50,000 men's winter overcoats; 40,000 pairs of men's shoes; 60,000 pairs of shoes for children; 100,000 neglige shirts; 200,000 soft

collars; 100,000 men's caps; 50,000 cotton overalls; 40,000 sweaters; 30,000 safety razors and blades; roofing materials and nails."

American aid did not end with the Red Cross activities, chambers of commerce and other purely local associations swelled the relief funds with their contributions; the American government through Secretary Hoover offered to furnish the Japanese government with all kinds of supplies at the lowest costs in order to assist the sufferers and facilitate reconstruction. The invitation was gratefully accepted and the initial order has gone forward for 9,000,000 feet of lumber and 120,000 tons of iron and steel, consisting of galvanized iron roofing, sheets and structural material. The Japanese government has decided to order through the American government practically the entire quantity of iron and steel required for the first year of reconstruction, controlling its distribution through the local dealers and supervising prices in order to prevent profiteering.

Secretary Mellen, Secretary Hoover, and Mr. Strong, head of the federal reserve board, assured Mr. Inouye, the new finance minister, of their deep sympathy, solicitude and desire to help Japan financially to any extent, while Ambassador Woods supplemented their offers by declaring that Japan can have a billion dollar loan from America when she wants it. Other prominent bankers have come forward and offered to subscribe to large issues for reconstruction. The same hearty sympathy and proffers of financial assistance came from London. Japan will not lack funds when her reconstruction program is formulated. One of their first steps was to telegraph for Mr. Charles Beard, the American municipal expert (who last year investigated and made a full report on Tokyo for Mayor Baron Goto) to assist with his advice. Although it is too early to make accurate statements as to the manner of their employment, it is the intention of the Japanese government to call in the services of many American and foreign experts to advise them in the reconstruction of the capital and port.

Aside from the larger features of American relief work, no mention of the disaster would be complete without some reference to the splendid initial activities of Ambassador Woods and his staff. The ambassador, but newly arrived in Japan, is a wonder. Tired of the monotony of diplomatic life in Spain he requested a transfer to some more active post. He was sent to Japan. After the first three weeks of official rounds and courtesy calls, he probably felt bored and wondered how he was to get any real action out of life in dreamy old Tokyo. About midday on the first day of September, seated at his desk discussing things in general with Colonel Burnett, the military attaché, the subject of earthquakes came up. The ambassador was remarking that he would like to feel a real eart——. He got no further. The ambassador was thrown out of his chair, wondering what had struck him. The embassy careened, came back and started to fox trot around the compound. "This is a real one," said Burnett, reaching out and pulling him away just in time to save him from being buried under a falling wall. From that minute, the American ambassador has been active. That night the old wooden embassy buildings, relics of a bye-gone age and a monument to congressional parsimony went up in flames. The ambassador's wife and her mother had a miraculous escape. For several days they slept on the floor in a Japanese house in the suburbs, while the ambassador with his sole remaining clothes—those he had on—was organizing searching parties and sending out relief for destitute Americans.

When told, the record of heroic rescues, of heartrending suffering and unbelievable escapes from death, will make a story that will bring tears to the eyes of the readers. It is not our purpose to refer to these in detail. But when the full story is told, the record made by the American embassy staff will stand as one of the bright spots in the great tragedy. Living up to the highest traditions of their country, this small group of men, assisted by other Americans, whose homes, offices and business were ruined; many who had lost their all, even to members of their families, came together by common impulse and under the general leadership of the ambassador and the active command of Colonel Burnett, organized themselves into a relief corps and labored night and day without rest until their countrymen were accounted for. The embassy and relief headquarters was transferred to a wing of the Imperial Hotel the day following the fire. Around the nucleus of the embassy staff came together a group of Americans of all classes, old and young, business men, managers and heads of great concerns, clerks, professional men and others. They all worked, some at driving cars, others hustling baggage, loading trucks, transporting refugees to safety at Yokohama, or aboard the naval vessels or some steamship bound for Kobe or home. No task was too humble for them. Their example was an inspiration to the Japanese who will never forget the sight of these Americans working like laborers in their shirt sleeves on their tasks of mercy.

At the head of the relief organization stood Lt.-Col. Burnett, ably assisted by Major Faymonville who took charge of all refugees. Lt.-Commander Garnett Hulings, assistant naval attaché, came rushing down from Chuzenji on learning of the disaster and assumed charge of the naval end of the relief work, maintaining constant and efficient contact between Burnett and the fleet. The five language officers of the American army studying in Japan fell into line behind their chief and took charge of details; Major Witsell assisted by Lt. Cranford kept the records and information lists; Captain Clear directed the transportation; Captain Martin, the supplies with Major Crane as the *liaison* officer between the embassy and the fleet. Hugh Wilson, councillor of the embassy, J. J. Caldwell, the Japanese secretary and Ferdinand Mayer, 1st secretary of the Peking legation, carried on the routine and official work of the embassy, keeping in touch with Washington and the Japanese authorities. It is difficult to record the individual work of the many Americans who gave their time and labor to make the relief work a success, but the most faithful and hardest worked of them all was David Tait, a newspaperman, who had active charge of transportation. Captain V. C. Wagoner backed him up by keeping the cars in working order. The efficiency of the whole organization depended upon the work of these two volunteers.

Col. "Sam" Reber, representative of the Radio Corporation of America, smoothed out the tangle of getting information through to Washington by radio in addition to being a tower of strength in the initial movement of organizing Americans for relief. The ambassador is the proudest diplomat in the American service. He loses no opportunity in telling the world about the efficiency of his staff and the wonderful work they accomplished in the first few days of the calamity. If he had his way, every officer would have the medal of honor and a promotion in grade. His countrymen and subordinates are equally proud of their chief. The Japanese are loud in their praise for the way he handled the situation. The ambassador came to Japan seeking activity. He found it and made good.

These activities, however, concentrated largely on the immediate relief of American citizens, were only the beginning of the larger measures undertaken by the American government and Red Cross for alleviating suffering amongst the Japanese. On the day of the quake the *President Lincoln* bound south, left Kobe in complete ignorance of the catastrophe. Amongst her passengers, hurrying to join General Wood at Manila, were two of the most capable and distinguished officers of the American army, Brigadier-General Frank S. McCoy, assistant to the governor-general, and Colonel George Langhorne another member of his staff. They learned of the disaster when the *Lincoln* arrived at Shanghai. Without awaiting orders they booked a return passage on the outgoing Pacific Mail Liner *President Pierce* sailing the next day for Japan, cabled the war department and General Wood of their movements and on reaching Kobe received instructions from Washington to proceed at once to Tokyo and take charge of the American army and Red Cross relief work. Washington lost no time in meeting the emergency when the first terrible news of the disaster was flashed from Iwaki. Aboard the *President Pierce*, under urgent cabled orders from the state department, were Consul-General Cunningham, and Vice-Consul Wright from the Shanghai office and Consul-General-at-Large Johnson, commissioned to render all help to the legation and American citizens and reestablish the Yokohama consulate. Cunningham remained at Kobe to assist the overworked staff at that port under Consul Dickover, while Johnson and Wright proceeded in the same steamer to Yokohama. They are there now, living in tents or aboard the station ship, togged out in nondescript khaki costumes with blue flannel shirts without collars, working like common laborers assisting Americans in distress, helping business men to locate their properties, blowing open safes, identifying and burying the dead, handing out provisions and in general making themselves useful in many extraordinary and unofficial ways. It's worth a trip to Yokohama to get a glimpse of Johnson, the quiet, unassuming, genial young diplomat who for the past few years has rounded out physically and officially in the Far Eastern bureau of the state department at Washington.

He is now dropping avordupois by chunks, gloriously happy and contented at the opportunity to do real work. Like the ambassador, Johnson pined for action and is having his ambition gratified. Americans in Yokohama unite in declaring that it is an inspiration to see Johnson at work. They are proud of him. He also has made good.

When General McCoy arrived at Tokyo on the 8th he found that the highly efficient organization under Lt.-Col. Burnett had almost completed the task of relieving American sufferers and the work of assisting the Japanese had assumed paramount importance. At the same time, as assistant to General Wood, he was called upon to ascertain the fate of about 300 Filipino students attending the various medical and dental colleges in Tokyo. Fortunately, at the time of the disaster, this year's graduates and the great majority of the students had gone home to spend their summer vacations and had not returned. However, urgent telegrams were pouring in from Manila from anxious parents asking about their sons. General Wood cabled a special fund for their relief and within a few days most of those residing in Japan, about thirty in all, were located, provided with clothing, food and funds and those who so desired, sent home.

Early on the scene was an American Red Cross unit from Shanghai consisting of three doctors and eleven nurses under the direction of Dr. Miller, professor emeritus of surgery of the University of Pennsylvania, who was visiting China and volunteered for the work. The funds for equipping this unit were hastily raised by Mr. Harold Dollar and the American chamber of commerce of China, the *personnel* selected by Mr. Arthur Basset and Dr. Fearn of the China central committee of the Red Cross Society and placed under charge of Dr. W. W. Peters, secretary of the committee. This unit landed in Kobe on the morning of the 13th and by three in the afternoon had taken over the temporary hospital established on the roof of the Oriental Hotel by the international relief committee of that port. Foreigners and Japanese praise the efficient, unostentatious manner in which the Shanghai unit jumped into the first opening that presented without waiting for instructions from the authorities.

With the arrival of General McCoy and Colonel Langhorne in Tokyo the more important work of handing over the relief supplies contributed by the American army and the Red Cross was carried forward with the utmost dispatch. At the outset, the Japanese authorities very wisely declined to accept the services of foreign *personnel*, feeling that the language barrier, differences in methods of working and in view points would inevitably lead to misunderstandings and possible friction. This, they were determined to forestall at all costs. However, it was pointed out to them that several small hospital units had already embarked from Shanghai, Manila and San Francisco, and if their services were rejected it might lead to the very thing were most anxious to avoid. The Japanese authorities therefore modified their decision to the extent that all foreign relief units who had already started would be permitted to land and function. To facilitate the relief work all supplies were handed over at the ship's sides to a representative of the Japanese government, who assumed all responsibility for their landing, transportation and distribution. This greatly expedited the task of the Americans, relieving them of the expense of erecting storehouses, operating a costly transportation system and employing large gangs of laborers.

At the same time, the Japanese government appointed Mr. T. Sakai as the director-general of the Japanese Red Cross in order to co-operate with General McCoy. In this appointment, the Japanese were most fortunate. Mr. Sakai, a graduate of Harvard, is one of the ablest business executives of Japan. As managing director of the great Mitsui interests he controls a world-wide organization whose efficiency was demonstrated at the time of the quake in the most striking manner. The Tokyo office of Mitsui was talking over the long-distance telephone with the branch at Kobe when the first severe shake interrupted the conversation. The Tokyo manager's last words were: " there is a terrible earthquake." The line was then broken. Repeated unsuccessful efforts to resume conversation convinced the Kobe office that a serious catastrophe had occurred. The same intuition which moved Americans to instant action started the wheels of the great Mitsui organization turning. Wirelessing all the Mitsui ships within the Japanese zone to return to Kobe, that same afternoon supplies were hurried aboard the first available steamer. On Monday morning, the first ship from the outside to report to the Japanese admiral at Yokohama, flew the Mitsui house flag, in from Kobe loaded with rice and provisions, with others trailing along behind her with further supplies for the destitute. The Mitsui head office, bank, mining department, the Mitsukoshi department store, and warehouse, the Shibaura Engineering Works and other edifices owned by the firm, after standing the quake were gutted by fire. Setting aside the pressing need for his services at such a time, the Mitsui family and his immediate chief, Dr. Takuma Dan, gladly gave their most efficient executive to head the relief work for Japan. Surrounding himself with a group of earnest young workers, for the most part educated in America, and having as his right-hand man, Mr. H. Saito, of the foreign office (recently Japanese consul at Seattle), Mr. Sakai pitched into the thick of the work and established headquarters in rooms adjoining the offices of General McCoy in the Imperial Hotel. Through personal contact at all hours of the day and night, Mr. Sakai has created a spirit of co-operation, sympathetic understanding and mutual helpfulness that will stand as one of the cherished memories of the American mission's work in Japan.

This sentiment was strengthened and emphasized when the venerable statesman, Prince Matsukata, the last of the elder statesmen, one of the five men who made modern Japan, placed his palace in Mita at the disposition of General McCoy for use either as a hospital or as the American Red Cross headquarters. This mute acknowledgement of Japanese appreciation and gratitude towards Americans for their prompt and disinterested assistance is only equalled by the similar gracious offer of the prince regent in placing the palace of Prince Takeda, brother of the emperor, at the disposition of the American ambassador until such time as the American embassy is rebuilt. Owing to the urgent necessity of keeping in close and constant touch with the embassy and the Japanese relief bureau, General McCoy was unable to accept the invitation of Prince Matsuktata. Ambassador Woods, however, accepted the other invitation and is now comfortably installed in the imperial palace at Mita, until such time as congress decides to appropriate funds for the rebuilding of a suitable embassy. In the meantime, the American embassy will be confined to a few rooms at the already over-crowded Imperial Hotel.

Each of the army transports brought to Japan complete base hospitals with infirmaries, tentage, medical supplies, beds, cots, blankets, kitchens, and sanitary utensils. The first of these hospitals arriving on the transport *Merritt* was erected on the reclamation ground under the bluff at Yokohama. Another was set up on the site of St. Luke's hospital at Tokyo and the third on the grounds of Prince Takamatsu in Mita ward. At the head of these army medical units is Colonel E. L. Munson, who, next to General Gorgas, is the foremost sanitary expert in the United States. General Wood specially requested the secretary of war to send him to Manila in order to reorganize the insular public health bureau and improve the sanitary conditions of the islands, allowed to deteriorate under the direction of Filipino *personnel*. When the news of the Tokyo catastrophe reached Manila, General Wood at once detached Colonel Munson from his duties and ordered him to assume direction of the hospital units and medical relief work, and if called upon, to place his services as sanitary expert at the disposition of the Japanese government. Under him are Major Martin and Captain Craig of the medical corps, superintending the hospitals at St. Luke's and at Mita. When erected and in operation the hospital at Yokohama and Mita are to be turned over to the Japanese Red Cross, while the one at St. Luke's will be presented to the American board which operated the institution destroyed by the fire.

The extent of these hospitals may be judged from the following figures. At Yokohama, the present capacity is 500 patients with ample tentage for expanding and taking care of 750. This includes administration offices, *personnel*, and full equipment with a water supply piped from the Bluff and chlorinated before delivery. Roads have been built and every preparation taken to cope with any outbreak of an epidemic, which, fortunately to date, has not appeared. At St. Luke's on the water front of Tokyo, the hospital has a capacity of 220 beds, or three times the capacity of the destroyed establishment. The Red Cross hospital on the grounds of Prince Takamatsu is equipped with 500 beds and is taking care of nearly 900 in-patients suffering from fractures or burns, the result of the earthquake cr the fire. There is a maternity ward in a separate building takng care of 125 to 175 cases. It is interesting to note that before the quake the entire hospital facilities in Tokyo was only 4,000 beds, of which about 60 per cent. was destroyed. The American army contribution will total over 4,100 beds with fully equipped and

organized staffs. The transport *Somme*, hastily placed in commission in San Francisco to load relief supplies for Japan, brought the following immense hospital equipment:—One base hospital, complete with 1,000 beds; 12 field hospitals complete with 216 beds (the transport *Meigs* also brought two field hospitals from Manila making 14 in all, the average cost of each unit being $40,000) 52 camp infirmaries or small hospitals; 52 camp infirmaries medical reserve supplies; 30,000 pajamas; 30,000 sheets; 20,000 blankets; 5,000 bed sacks; five medical and surgical chests; 40 supplementary chests; 3,000 mattresses; 63 hospital tents, 16 beds capacity each; 120 tents tropical hospital type with a capacity of 6 beds each; 797 large storage tents suitable for housing large families; 3,300 pyramid tents suitable for one family each; 3,000 metal and 5,000 wooden folding beds in addition to over 2,000 tons of miscellaneous medical supplies, some of them of great value. It is too early to make an exact statement of the value of the army supplies sent to Japan, but a fair estimate will approximate $3,000,000, or about the same amount that was expended by the navy. If the American navy was first on the scene, the American army was not far behind, both branches of the service operating on the spur of a humane impulse to show their friendliness towards a gallant people who only a few years ago were held up to them as the imaginary enemy.

Major-General George Read, commanding the American army in the Philippines, with his chief of staff and other officers, came from Manila on the transport *Merritt* in order to personally convey to the Japanese authorities and especially the Japanese army the assurances of American good-will and sincere desire to help, returning at once to Manila on the same vessel when their mission of courtesy was ended. On the same transport came Captain H. W. Rogers and Mr. Thomas Wolf, official representative and treasurer respectively of the American Red Cross in the Philippines and on the next steamer Mr. Knowlton Mixer, chief of the Red Cross in the Far East arrived, bringing to General McCoy two of the most experienced relief administrators in the Red Cross service. Dr. C. N. Leach, representative in the Philippines of the Rockefeller Foundation, was also sent to lend his valuable services to the mission and at the same time to convey to the scientific staffs of the Tokyo universities the offer of the Foundation to send ten specially selected men with their entire families to Peking to continue their studies at the Rockefeller Institute, the Foundation paying all expenses. This generous offer was gladly accepted and a happy little group of Japanese scientists with their families are now preparing to spend a year in Peking as the guests of the Americans.

It may not be out of place to bring in at this juncture a word about the work of the Japanese army. Brfore the disaster there was considerable talk of reducing the Japanese army, but its splendid record during the days of chaos, has completely altered public opinion as to its efficiency. It is frankly admitted that the army saved the situation. It was on the job immediately. The men worked long hours without grumbling, responding to the emergency magnificently, meeting every situation promptly and efficiently. At the time of the quake the Yokohama court was in session crowded with people. The court house collapsed at the first big shake burying hundreds of people in the ruins. The Yokohama police force was practically wiped out and for the first two or three days organized looting was carried on by bands of desperadoes, who were checked and dispersed only by the arrival of the military. The quake also freed the convicts in the Negeshi prison on the outskirts of Yokohama, who, in the absence of the police, indulged in a carnival of crime until the army appeared on the scene and put them down. In view of the stories circulated by foreign refugees about the killing of Koreans and shooting down people in the streets, the above facts will help to explain something of the situation in Yokohama. The Japanese army justified its existence.

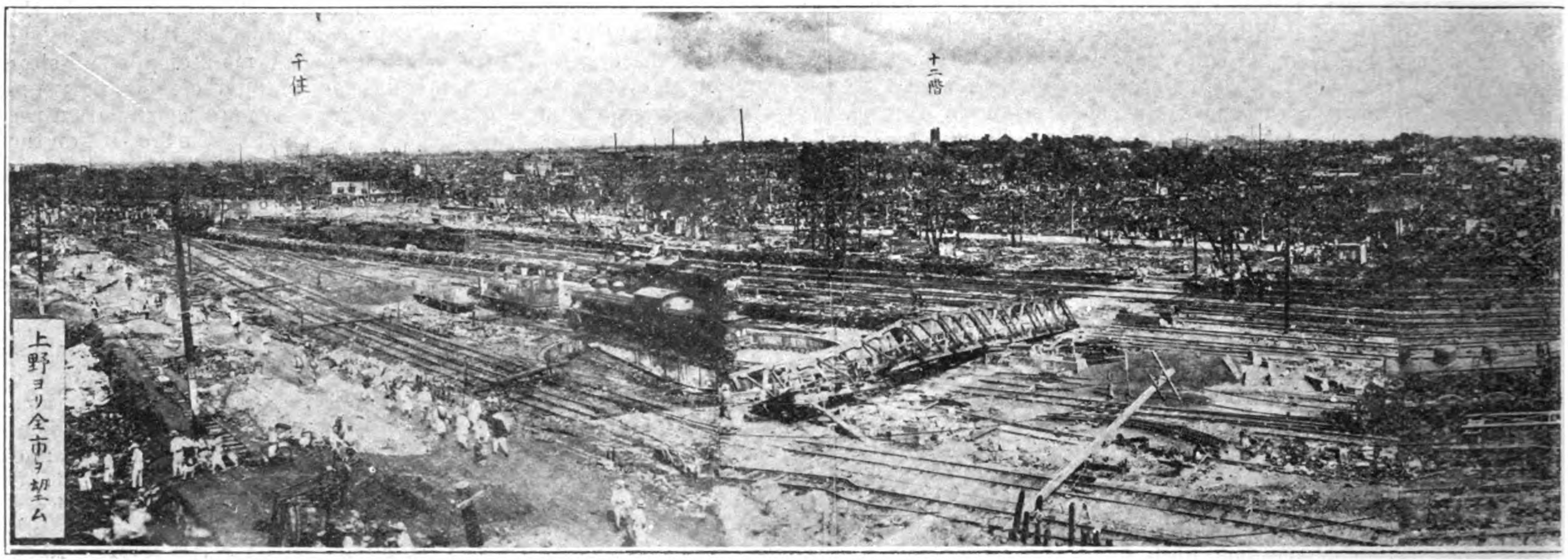
The army simply typifies the splendid spirit of the people who met the unprecedented disaster with their traditional fortitude. History does not record a battle in which so many lives were lost, so many deprived of food, clothing, shelter and the necessities of life as in the twenty-four hours of hell which broke over the fairest part of Japan on the first of September. In war, organized, armed and trained men take their chances with a full knowledge of the game and the penalties of defeat. Here the calamity fell upon a defenseless people, women and children, old and young, without a minute's warning. It came as a bolt from the blue, killing outright over 250,000 and wounding probably more than twice that number. The swift spreading conflagration herded the people in the small open places where they were smothered and cremated by thousands, and drove over two million out of the cities to seek shelter in the country, itself torn and wrecked by continuous earthquakes. The solid earth seemed to turn into a quivering mass of jelly. Before midnight of the first of September, following the first angry upheaval, two hundred and twenty-one shakes were registered on the Tokyo seismograph; 323 came on the 2nd, 181 on the 3rd, 184 on the 4th, and 109 on the 5th, dwindling down from that record to ten a day on the 16th. Up to that date 1,319 shocks were registered, and even as this is written on the 30th, the earth is still trying to find its equilibrium. Many of these subsequent shocks were good sized quakes in themselves violent enough to send the people scurrying in fear and trembling out of their improvised shelters and houses into the streets and open places. The experience was terrible enough to break down the *morale* and paralyze any community of less courageous fiber. The Japanese, however, rose to the occasion. They did not mope or fill the air with lamentations or lay down passively and wait for outside relief to save them. The general orderliness of the people, the universal decency and spirit of mutual helpfulness which characterized their reaction and the prompt mobilization and unobtrusive efficiency of the military and police stands unparalleled in the annals of great disasters.

Out of the chaos of destruction, amongst the twisted ruins and ashes of buildings, began to appear as by magic the humble temporary shelters erected on the still warm and in some places smoking ashes of the Tokyo that was. People came back to the little square of earth they called home and under shelters of galvanized iron sheets salvaged from the *débris* and hammered into shape, faced anew the bitter struggle for existence.

Tokyo and Yokohama will be rebuilt. You can't blot out cities peopled with such spirit. It will take years and the expenditure of billions of yen to reconstruct the capital and chief port of Japan. Many weary, heartbreaking months will pass before anything like a new city will take the place of the one destroyed, but the indomitable courage, legacy of the Samurai, will win out in the struggle against overwhelming odds and Tokyo, the capital of the fair land of Japan, within the decade will resume its place amongst the great cities of the world, bigger, better and more beautiful.

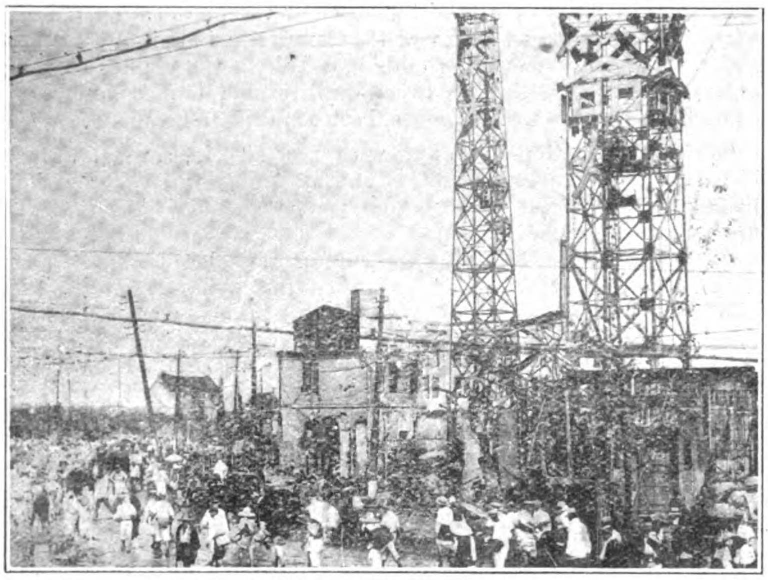
The reconstruction of Tokyo with new streets, sewers, water and park systems, public utilities and buildings will call for the expenditure of at least three billion yen spread over a period of years. Japan can finance some of her own reconstruction from within, but the bulk of the needed capital must be obtained from abroad, from America and Great Britain. Whatever may be Japan's financial requirements, if it is only a billion or a half billion dollars, it is safe to assume that the larger proportion will come from the United States. Once Japanese government bonds are held in large quantities in America, and the American investor is brought into intimate and sympathetic contact with Japan, the way will be opened for the realization of the great dream that has inspired and animated the leaders of Japan for the past several years, the dream that has influenced their government on so many occasions to concede and surrender, special advantages and privileges in order to prove their friendship for America. These men have followed and adhered religiously to a program and policy that would hasten the day when American capital would co-operate with Japanese capital in the creation of industries and commercial enterprises and unite the two peoples in ties of business that would make impossible and inconceivable any future talk of hostilities in the Pacific arising out of Japan's peaceful expansion.

That day has been brought measurably nearer. America has demonstrated in no uncertain manner her cordial friendship and sympathy for Japan, discovering the real sentimental regard that during all talk of war by irresponsible and paid agitators and deluded enthusiasts has remained unshaken in its trust and belief in Japan's integrity and peaceful intentions. The real Japan has also come to the surface. As the facts surrounding the full measure of America's generous and spontaneous relief activities have trickled down to the masses, all former animosity and suspicion of our motives has disappeared. The people of Japan have learned through a terrible cost to themselves what years of propaganda could never have put over; they have learned that Americans are truly their friends. From the regent down through the elder statesmen, the cabinet, the diet, the rank and file of the army, navy and other government departments, through the universities and schools, business men, bankers, and small traders to the man in the street, the revelation has come that a new era is dawning in



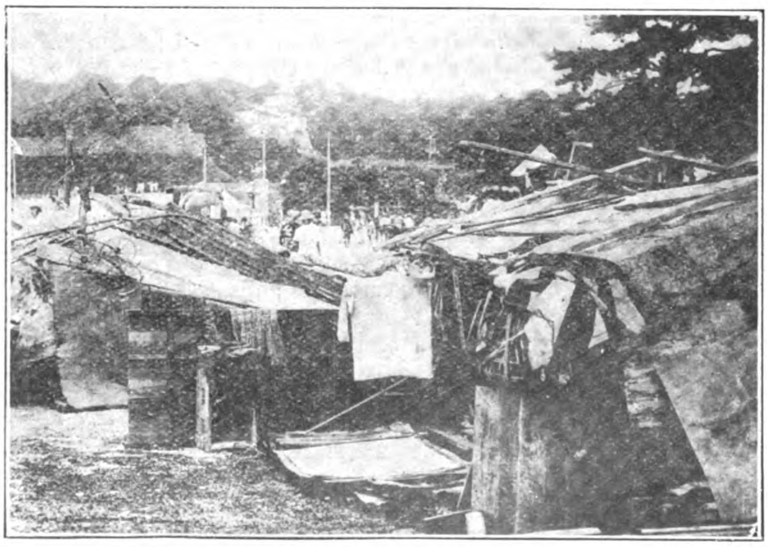

TOKYO LOOKING FROM

the Pacific. The same feeling pervades all intelligent Americans who have had the good fortune to work in close understanding with the Japanese during the period of relief work and penetrate behind the screen of language and traditional reserve into the inner sanctum of their hearts. These men also look far ahead into the future and see the coming together of Japan and America in bonds of sympathetic understanding that will do more toward advancing the cause of civilization and peace than all the treaties, conventions and protocols of the past few years. If this spirit is accepted by Americans of all classes (and it is bound to prevail once the financial ties are drawn tighter) the price that Japan has paid will be repaid many times over. Out of the calamity will come a great blessing. The monetary losses of Japan will be more than saved in the next ten to fifteen years in armaments.



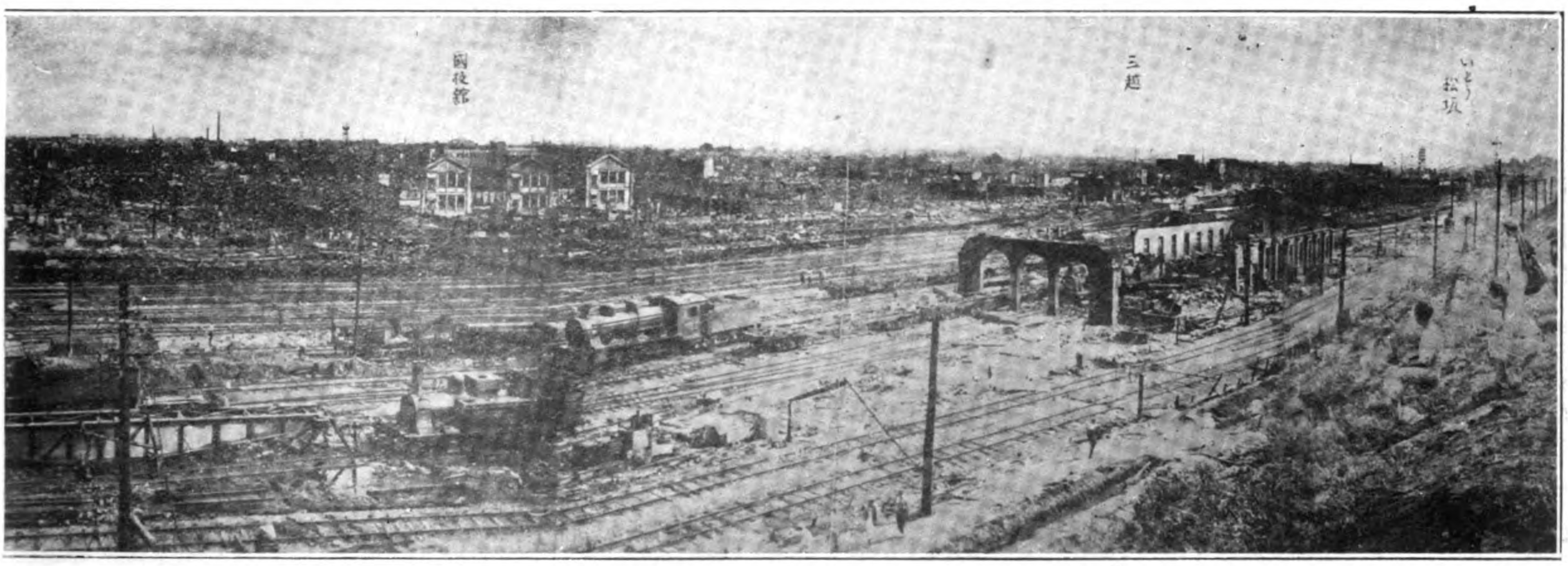
Refugees leaving Tokyo

Telephone poles and street lamps remain standing

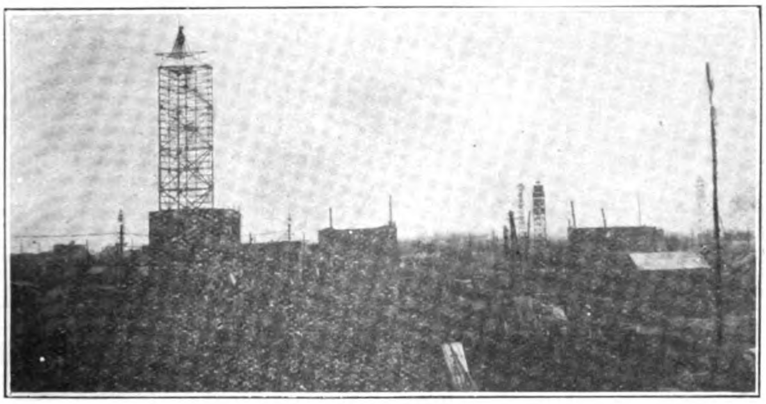


Refugee huts in the Imperial Palace grounds, Tokyo

Dai Ichi Ginko, Tokyo

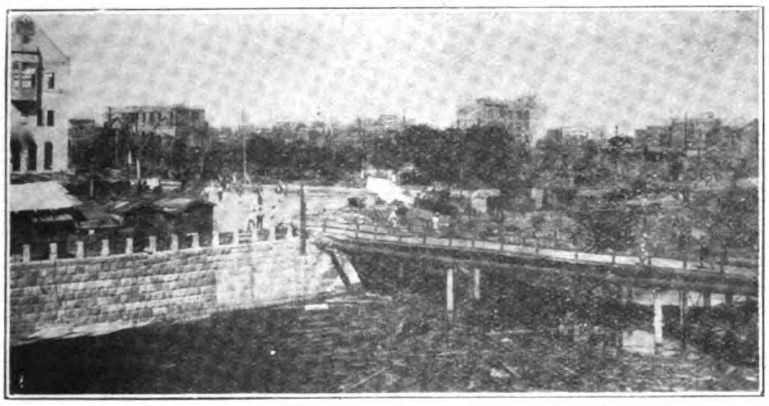


UYENO PARK



Uyeno Distillery

**In front of the Palace grounds**



**Hitotoubasbi in Kanda, showing Imperial Commercial University Club on left**

**Mauseibashi Station**

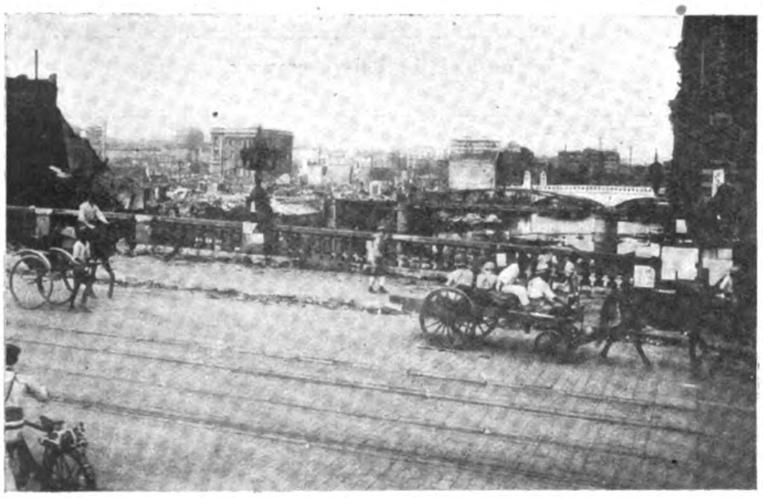
Yokohama Specie Bank in Tokyo

**Mitsukoshi, Tokyo**

Two views of a modern steel structure that was under construction

Metropolitan Police headquarters, Tokyo the first building to bnrn

Looking down the Ginza



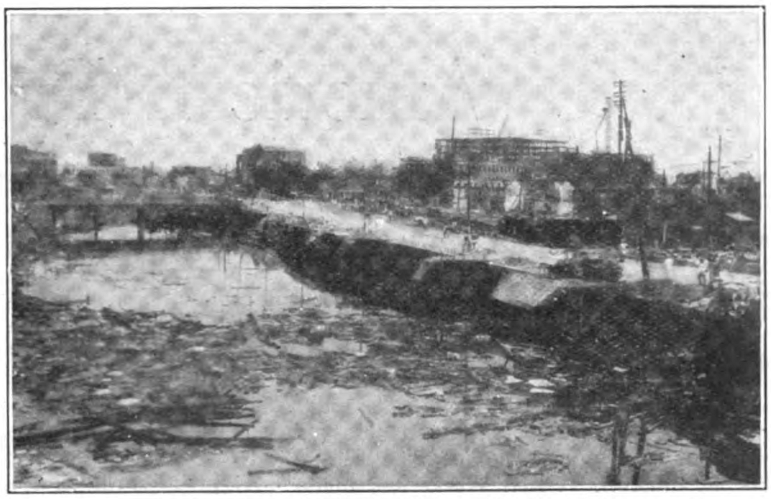
Nihonbashi Bridge

Looking toward the Ginza

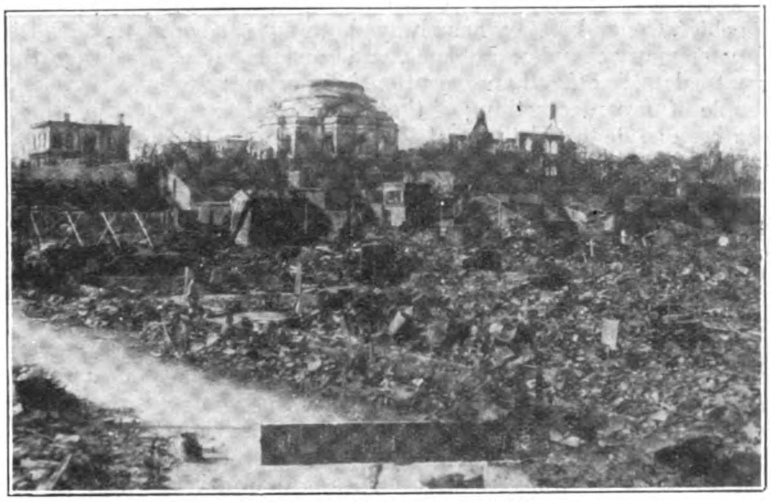
Part of the buildings of the Imperial University

Part of the countless homes shattered by the earthquake

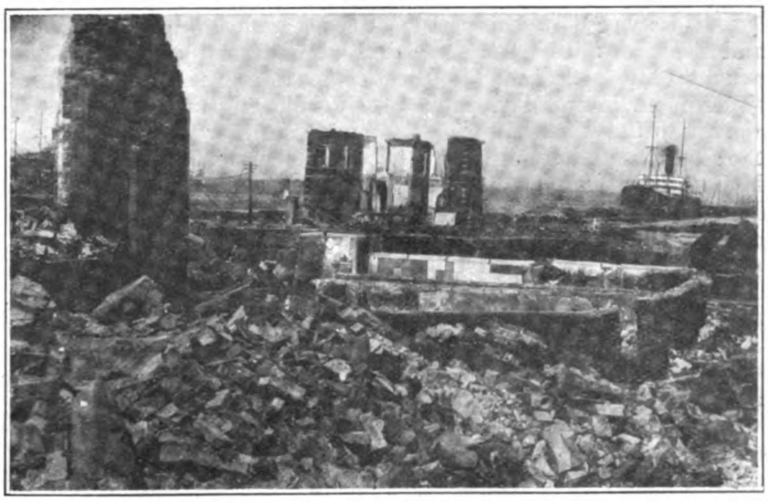
Himagawa Electric Tram Station


Looking towards Kyobashi from Tsukiyabashi

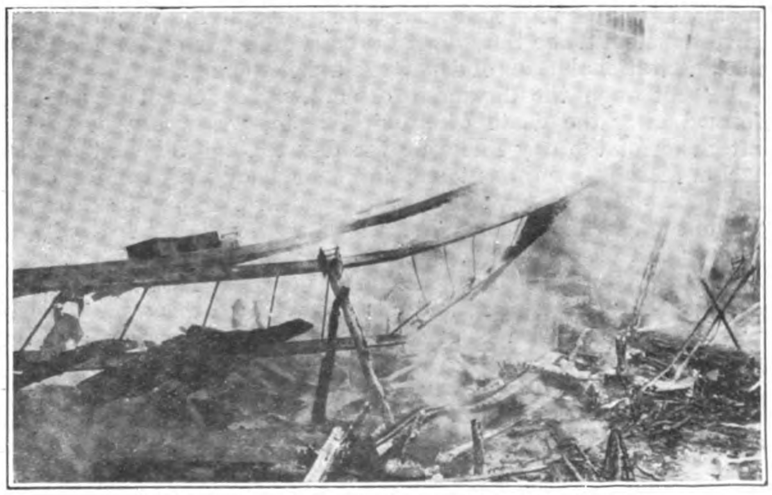
Himbashi Station


Russian Cathedral in Kanda

Japanese Fire Proof Godown


Yokohama Harbor

Wreckage fills the Canals


Smoke such as this caused the suffocation of many

# American Praise for Japan

## Interview with General Frank S. McCoy, Director-General of the American Red Cross in Japan

AMERICANS have been most fortunate in having at the head of their Red Cross and army relief work in Japan, an executive of high ability and broad-mindedness in the person of General Frank S. McCoy, who, during the great war, was assistant chief of staff to General Pershing. For many years General McCoy has been closely associated with General Wood, first as his *aide* in governing Cuba and subsequently in many capacities up to the time when he came to the East in 1921 as chief of staff to the Wood-Forbes mission. When Wood was made governor-general of the Philippines, McCoy was appointed his assistant, and for a time it was reported that he would succeed Wood when the latter retired. Like his chief, General McCoy has always been a great sympathizer with Japan's many complex problems, and immediately realized that the great calamity offered an exceptional opportunity to convey to the people of Japan something of that real American friendship which has been so distorted the past few years by one-sided propaganda. It was also fortunate that the same ideas were shared by every American on the relief mission, and when the same spirit was reciprocated by the Japanese leaders, it created understanding and mutual respect that will have as far-reaching effects as the Washington conference. We know of no situation which required such tact and diplomacy as the one which sent the American fleet and the army transports hurrying to Japan with relief supplies and placing their distribution under the supervision of a general officer of the American army. One false move and the whole effect of the generous response of America to the urgent needs of a proud people would have been lost. That such complete understanding and friendly regard has resulted from the contact of the American mission with the Japanese authorities is due in large part to the scrupulous concern for the Japanese viewpoint adhered to at all times by Ambassador Woods and General McCoy.

In view of the many petty criticisms against Japanese methods and the many absurd stories spread broadcast by foreigners who caught only a fleeting glimpse of the working of the Japanese government in the days immediately following the quake, and to convey to the American people some idea of how the Japanese met the situation and are preparing to handle the relief supplies, General McCoy recently gave out the following official interview. Special stress is laid on the proposal of the Japanese authorities to sell certain supplies at cost or below cost to those who can afford to pay for them while distributing freely everything to the actually destitute. This official statement from the highest American relief officer on the spot is deemed necessary to forstall stories that even now are hinted at, to the effect that the Japanese are selling the supplies so freely contributed by foreigners for succoring the unfortunate victims of the disaster, General McCoy says :

" Both because the American people ought to know the facts and because the Japanese ought to receive proper credit, it is a great satisfaction to me to be able to say that their government has functioned with remarkable ability and their people have behaved with exemplary self-control and courage, even during the acute moments of this unprecedented catastrophe at the very centre of government and at a time when a cabinet crisis was on and there was no constitutional heads of departments functioning.

" Although the Japanese cabinet, which Count Yamamoto formed after the death of Admiral Kato, was sworn in on the afternoon of the day following the disaster, the different departments of the government met the emergency with commendable skill and determination: The army paid for its existence by its prompt and efficient energies, which were notably free of any unduly officious character, while the navy brought relief and gave assistance by sea. The government at once realized the necessity of organizing new bureaus and promptly created them, particularly what might be called a commission for reconstruction and the relief bureau.

" It is this latter bureau and the Japanese Red Cross with which the American contingents are operating, the navy and army supplies being delivered through the Japanese navy to the relief bureau, and the American Red Cross agency working directly with the Japanese Red Cross. The relief bureau has at its head the prime minister himself, the minister of war, and the home minister, men of ability and outstanding character ; and it and the Japanese Red Cross have appointed Mr. Tokutaro Sakai, a graduate of Harvard University, one of the ablest and most responsible business men in the country, to operate directly with us."

" The relief bureau is being conducted as we Americans would expect, not only under the direction of experienced statesmen in a cabinet of non-party character but by captains of industry and practical leaders accustomed to handling large business affairs, who are at the same time men of high integrity and philanthropic disposition. In other words, the Japanese have met this crisis in the same manner in which we met the crisis of the great war by calling out their best talent to face the emergency, regardless of party affiliations. The result is that the machinery for relief and reconstruction throughout the earthquake area is beginning to operate quickly, smoothly, efficiently, and, above all, honestly. The Japanese authorities and people are determined to have no graft or inefficiency in the relief work, and profiteering has been effectively prohibited. The Japanese are throwing practical safeguards around the work and they are as anxious and determined as we would be to prevent or eliminate any discreditable behavior such as might naturally occur in any country in so unusual a situation.

" It is important that our people at home should understand a special feature of the relief bureau's work. The bureau has shown, in my opinion, wise foresight in announcing the intention of giving free relief to the actually destitute while at the same time providing for those whose pride and means enable them to obtain supplies of clothing without impairing their self-respect and without pauperizing many who at this time of strain and stress might be compelled or disposed to accept free distribution. The bureau has evidently realized the danger of being misunderstood in establishing what amounts to a revolving fund, and their representatives have been solicitous that their policy should not be mistaken by the American people, whose generosity has won full appreciation and even astonishment, and whose good-will Japanese of all classes desire to retain. I have assured the Japanese that their plan shows careful consideration which would appeal very strongly to the common sense of the American people ; and I go into this matter at length because some uninformed Americans, on learning that the relief bureau was selling supplies contributed by the American Red Cross, might misunderstand what is being done. It is planned that the funds derived from sales at cost and less than cost to those who are able to pay shall be expended again for other suitable supplies, thus turning over and over again even the gifts of the American people.

" With regard to our particular share in the relief work, it ought to be very gratifying to the American people to know that the policy which Ambassador Woods and Mr. Payne, head of the American Red Cross, decided at the beginning should govern the relief work is proving most effective. The ambassador stated immediately after the catastrophe that a million dollars here on the spot would be worth more than five million expended in the United States ; the money was sent to him and the Japanese were given a free hand in buying in near-by countries the things most urgently needed. The ambassador's decision to leave to the Japanese the actual distribution, which they could more effectively perform than Americans knowing nothing of the Japanese language and customs, was a wise decision heartily appreciated by Japanese officials. In consequence we are delivering our supplies directly to the Red Cross and the relief bureau and transferring our hospital units to the Japanese one after another as soon as they are able to organize staffs to take them over.

" After the relief bureau had had time to study the question of future needs we were able to obtain from them a statement of supplies which they believe will be necessary to carry through the coming winter the two million people who will be living only in improvised shelters. This statement, providing largely for clothing

and blankets, has been cabled to the American Red Cross and has been approved, so that both governments and both Red Cross Societies are working together without waste of effort and looking far ahead. Practically all American Red Cross purchases in the future will be made in the United States.

"We have figured that the full relief which will have been received from the United States will succor unfortunately only five per cent. of the afflicted people. Splendid as the American demonstration has been and profound as has been the Japanese appreciation of our quick and spontaneous generosity it will be seen that we are planning only to undertake a comparatively small portion of the relief that is essential, to say nothing of the gigantic cost of reconstructing the devastated area. This last is an undertaking which only the Japanese themselves can perform, but which they are entering upon with determination and characteristic philosophy."

# Radio's Part in Japan's Reconstruction

WHEN the cables broke and the telegraph and telephone lines in eastern Japan went out on September first and newspapermen were rushing through to Kobe in order to get their dispatches through via Nagasaki and China, one modern long-distance radio plant on the Japanese coast near Iwaki, a hundred and fifty miles from Tokyo, kept Japan in touch with the world. Only one railway telegraph line, connecting Uyeno station with Osaka, survived the great quake, the operator sending bulletins through until 5.30 p.m. when the conflagration caught the station passed over and obliterated it. The Osaka papers issued extras based on the bulletins which came from Uyeno and the Associated Press correspondent there had sense enough to shoot his stuff home via Shanghai. As soon, however, as it was learned that the Iwaki radio station was intact, the news from Tokyo was broadcasted by that station continuously throughout the disaster. However, it has since been learned that the Iwaki station had radioed San Francisco on its volition, on the afternoon of September 1, the first news of the disaster and subsequently carried the first official dispatches of our ambassador to the department. A courier service between Tokyo and Iwaki was quickly established for the dispatch at first of official and emergency relief radiograms, but this also served as the real outlet of news to the world, the radio reaching America before the cable. Through this station America first and through America, the rest of the world was apprised of the news of the great disaster. By the 8th wire connection between Tokyo and Iwaki was restored and opened to public service on the 11th.

During the stress of the disaster, there was a prevailing opinion among radio operators on board vessels in Yokohama harbor and Japanese waters that the Japanese were deliberately attempting to jam the ship's radios. In justice to the Japanese, this is very far from the truth. The Funabashi station was the only outlet the Japanese navy had for signalling all its ships and, needless to state, every vessel in Japan was quickly carrying out its full share in the relief work, throwing an immense load on the naval station. Now the Funabashi station operates with an arc transmitter and anyone familiar with arc mush will understand why the vessels in Yokohama harbor could not receive distant signals. When the attention of the Japanese admiral was invited to this situation he at once set aside two hours daily for ship communication.

The splendid service rendered by the radio plants during this period of great anxiety once more brings up the plan whose development was interrupted by the death of Admiral Viscount Kato. On July 27, Premier Kato announced a radical change in the traditional policy of the Japanese government with respect to electric communications, when he stated that it was the intention of the government to permit private operation of high-powered radio stations under suitable government control and that a bill would be introduced in the next diet modifying existing radio laws and granting a government guarantee to the stock of the proposed new corporation. He invited some thirty-eight leading business men and financiers to form a corporation. The invitation was accepted and these gentlemen appointed Baron Shibusawa as chairman of the organizing committee empowering him to select its members. This he did. A meeting of this committee was set for September 6, but the quake intervened.

In view of the pressing demands that will be made on the treasury for reconstruction, a subsidy for such a purpose is now perhaps out of the question. However, the business interests of Japan should not despair, as it is perfectly feasible to organize a suitable Japanese organization, which if able to obtain the proper concession from the government, will be easy to finance and put into operation. This corporation could take over the existing high-powered stations for trans-Pacific communications and erect another high-powered station for communication with Asia and Europe. If such a plan could be made acceptable to the authorities, Japanese business can free itself from the present most inadequate official supervision over their electric communications. For the next few years, rapid, accurate and cheap foreign communication with the markets of the world is one of the foremost essentials in economic rehabilitation. The cost of reconstruction will be greatly reduced by keeping in immediate touch with prevailing market prices. Radio helped to save the situation arising from the quake; it will help to save millions during reconstruction, if properly developed and managed.

## The Radio Corporation of America in China

It is of special importance at this time for the government and business men of Japan to take some positive step that will enable their radio communication system to keep up with the rapid developments in other parts of the world and Asia. Although it has recently been reported that Foreign Minister Koo of China had declared his ignorance of the existence of any contract between his government and the Federal Telegraph Company, the following statement given out by General Harbord, president of the Radio Corporation of America, on his return from attending a meeting of the consortium of international radio companies held in Europe, will clarify the atmosphere from the American viewpoint.

General Harbord interpreting the recent radio developments between his company and the Chinese government said : "perhaps we had better begin at the start of these negotiations back in 1921, when the Chinese government granted the Federal Telegraph Company an independent contract to erect five radio stations in various provinces of China for communication with America. Since that time, the Federal Telegraph Company of Delaware has been formed which incorporates the Chinese radio interests of the Federal Telegraph Company and the Radio Corporation of America, and in which the two American companies will participate jointly under the assignment of the 1921 contract recently approved by China.

"This undertaking calls for the erection of five powerful stations in China, the principal one to be located in Shanghai. This station will engage in direct communication with the RCA stations at Hawaii and even San Francisco, over five thousand miles distant. Shanghai will also operate a station of lesser power for communication with similar smaller stations to be located at Peking, Canton and Harbin, each of which cities are separated by approximately 800 miles. In this way the central station at Shanghai will have "feeder" stations in the principal provinces, through which traffic from these several territories will be routed to the giant station at Shanghai for transmission to the western hemisphere. Conversely, Shanghai will be the gateway through which communication from points east will pass into the Chinese interior. These stations will be operated jointly by the Federal Telegraph Company of Delaware and the Chinese government, thus placing the project under Chinese-American administration.

"The confidence of the Chinese government, in entering into active participation in this program was enhanced largely as a result of the limitation of armament conference held in Washington in the fall of 1921. There are no exclusive or monopolistic features in this contract and from the very inception of negotiations, the project had the whole-hearted support of the state department who views the recent completion of plans as a signal accomplishment in international diplomacy.

"American business-men will be quick to appreciate the commercial significance of this comprehensive plan: inasmuch as there is to-day only one cable crossing the Pacific to China. And this new, strong link of friendship cannot help but play its own important part in the cause of better understanding between these two countries, and indirectly the people of the world."

General Harbord was recently elected president of the China Society of America, an institution for the promotion of Chinese interests in the United States. For that reason, he has a special interest in the contract, from the standpoint of the far-reaching business and social influence of the Society.

Work on the stations will begin this fall, and the inauguration of service is expected during the latter part of 1925, although the plan may reach maturity before the time. Test signals will span the Pacific from China well in advance of the official opening, however.

# American Appreciation and Sympathy for Japan

WHAT is said by leading Americans who had the opportunity of witnessing the work of the Japanese after the earthquake needs no comment. In addition to the words of praise by General McCoy presented in a separate article, here are a few remarkable observations, made in a statement sent to the United States by the American ambassador to Tokyo, Cyrus E. Woods. The letter from General Leonard Wood to the new Japanese Minister of War, General Tanaka, may be taken to indicate the new attitude of the Philippines towards Japan; and last—but first in character—is the message of sympathy sent by President Coolidge to the emperor of Japan.

To this list has been added two addresses, one made by Prince Tokugawa, president of the Japanese house of peers, at a simple luncheon given the American embassy and special American relief delegation at the Peers Club, one of the few club houses still standing in Tokyo. The tribute is one of the finest expressions of appreciation among the many that the Japanese have given to the American representatives. The other address was by Baron Ijuin, the new foreign minister, and is likewise conspicuons in character.

The co-operation between the American Asiatic squadron, under Admiral Anderson, and the Japanese squadron, under Admiral Kobayashi, was dealt with in the following statement which Ambassador Woods gave to the American press the day after the American fleet sailed away from Tokyo Bay.

Now that the flagship and most of the vessels of the American Asiatic squadron have taken their leave of Tokyo Bay I want to say that their coming has played a tremendous part not only in performing a great work of humanity but in demonstrating to the Japanese a sincerity of friendship that will have far-reaching effects. Our ships came of their own volition and without a moment's delay, bringing the first relief that came from abroad, and Admiral Anderson placed them at once at the disposition of the Japanese government, who in turn showed their complete understanding and appreciation and promptly made use of our service.

The co-operation between the fleets could not be improved upon. And when, on taking their leave of the premier and the naval minister, Admiral Anderson and his chief of staff, Captain Stearns, were received at the premier's official residence, the sincerity of friendship that had been established made the occasion one of the most impressive it has been in my diplomatic experience to witness.

A magnificent piece of work has been accomplished by a group of men who were willing to give with a thoroughly generous spirit, and on the other hand by a group who were willing to receive with similar grace and manliness.

This was the first time in the history of the two countries that their navies have had the opportunity to co-operate in a great undertaking. The engagement was upon a mission of peace and humanity, and service and friendship was the watchword.

The appreciation of the Japanese is profound; I hear it on every side from common people as well as officials.

Our navy prepared the way which has been made smooth and easy for the Red Cross work, upon which we are proceeding likewise with the most effective and friendly co-operation of the Japanese.

CYRUS E. WOODS.

Tokyo, September 22, 1923.

General Tanaka, the newly appointed minister of war, received the following letter from Leonard Wood, governor-general of the Philippine Islands, a personal friend, who, in his communication, gives evidence not only of the sympathy but also of the admiration of American officials who are in a position to know the stoical and philosophic character of the Japanese people:—

DEAR GENERAL,—I can't tell you how much I appreciate your telegram with its message of personal friendship and regard. I immediately wired you as follows:

"Appreciate deeply your telegram and assure you of my deep and sincere sympathy in the great catastrophe which has befallen the people of Japan and of my desire to do everything possible to aid. Congratulations on your appointment as minister of war. I fully reciprocate your expressions of friendship regard."

We are all greatly distressed at the calamity which has befallen your people, and you can be assured that the American sentiment here is one of very deep and sincere sympathy, as is that of the Filipinos. We are all united in doing what we can to aid you in this hour of grief and sorrow.

I feel that the people of Japan are to be congratulated on your appointment as war minister.

With renewed expressions of friendship and esteem, and with kindest regards.

Very sincerely yours,

(Signed) LEONARD WOOD

*(Governor-General)*.

The president of the United States sent to his majesty the emperor the following message through Mr. Cyrus D. Woods, the American ambassador in Tokyo :—

" At the moment when the news of the great disaster which has befallen the people of Japan is being received I am moved to offer you the most heartfelt sympathy and express to your majesty my sincere desire to be of any possible assistance in alleviating the terrible suffering of your people.

CALVIN COOLIDGE."

In appreciation of the American work, Baron Ijuin, the foreign minister, read the following address before a gathering of representative Americans brought together by the America-Japan Society of Tokyo on October 1 to a small luncheon :—

At this unusual moment, it is with heartfelt appreciation too deep for words that I greet our honored guests from the United States of America.

I was in Port Arthur at the time of the great earthquake. No sooner was I astounded by the news of the terrible occurrence than that I was gratefully impressed by the personal visit of Captain Stearns, aide to Admiral Anderson, who under instructions from his chief, offered the resources and services of the Asiatic fleet for relief of the afflicted population. The next thing I learned about the fleet was that it had cruised to Tokyo and was busily engaged in given succor to the Japanese sufferers.

What then impressed me most was the news from Tokyo. The American embassy was totally burnt down ; Ambassador Woods, his family and members of his staff narrowly escaped ; and for all that on the very next day his excellency was found energetically engaged in relief activities for the Japanese refugees in entire negligence of his own ineffable hardships.

Another remarkable report followed. Geneial Wood was sending a relief contingent to Japan with an enormous amount of supplies and materials. Only a few days later telegrams began to describe that a wonderful relief work was started by the American relief mission under the efficient command of General McCoy.

When I was coming to Tokyo, I also learned of the spontaneous and very generous manifestation of sympathy by the government and people of the United States proper. The relief fund drive by the American Red Cross was reaping such a great success that the original call for five million dollars had by that time been far exceeded by the subscription. Foodstuffs and building materials were quickly being shipped. Fifteen hospital units were being brought over. It was amidst such a shower of sympathy from America, as well from other countries, that I took up the portfolio of the minister for foreign affairs.

I understand that a hospital created by the American relief mission at Yokohama has recently been handed over to the Japan Red Cross Society. Two more such hospitals will also be donated to us in Tokyo shortly. Their benefit to our stricken population at this moment cannot be overestimated.

The overwhelming generosity and the wonderful promptitude with which our American fiiends brought us relief have ingrained in the heart of the Japanese nation a lasting gratitude.

Our reward for this great friendship from America is, to my mind, the successful reconstruction of our national capital. The Japanese people, heartened by the sympathy and good-will from foreign countries, taking to the gigantic task with determination and courage. When a new Tokyo rises from the ashes of destruction a few years hence, it will be our great pleasure to welcome you here again as our staunch friends, whose friendship was severaly tried and found not wanting.

Now, Mr. Ambassador General McCoy, and the other honored guests, let me thank you again for all you have done, are doing and will do for us and propose your health and prosperity in the interests of happy relations not only between our two nations but throughout the world.

Prince Tokugawa's statement is notable for its restraint as well as its conspicuous warmth.

I am not given much to speech-making, but there are occasions when one cannot remain silent without gross injustice to oneself and unpardonable negligence of duty. And this is pre-eminently one of those exceptional occasions.

Our pride humbled by a visitation the like of which has seldom befallen a prosperous nation, and our hearts chastened and our imagination clarified, we are now enabled to see in a new light the eternal realities of life and realize with a quickened consciousness the significance of the great lessons which our present calamity hold out to us.

One of the great truths that have been brought home to our minds in a most forcible manner, is that no disaster can ever occur which does not bring with it some compensating good, and the greater the disaster the greater the good. What could be more impressive, for instance, or more significant than the great wave of sympathy that has swayed and that still sways the hearts of mankind in all parts of the world for this stricken people of far-away Japan ? For the moment one noble sentiment unites the whole civilized world, East or West, and regardless of race or religion. Such stirringe of noble sentiments cannot fail to produce profound results in favor of human fellowship and solidality. If so the many thousands of our poor fellow countrymen who were buried dead under the falling *débris* or consumed by the raging flames have not died in vain.

Be that as it may, of one thing we are quite sure, and that is that the spontaneous and universal expression of deep and active sympathy by all the nations of the world has drawn us the Japanese people much closer to them than half a century's association under ordinary circumstances could possibly have drawn us.

And to no nation have we been drawn more closely than to the great republic on the other side of the Pacific a nation which seventy years ago rescued us from a fatal security of seclusion, which has since never grudged us help and assistance whenever we needed it in our work of modernization, and for which we all fell profound admiration and sincere friendliness. Indeed, nothing could be more gratifying and more touching than the promptness and efficiency with which the whole people of the United States have spontaneously responded to the call of human brotherliness in this moment of our need and distress.

Gentlemen, you will all agree with me when I say that the Washington conference, at which it was my good fortune to have had a humble part, ushered in a new epoch of mutual trust and friendliness among nations, especially between the United States and Japan. And now through the merciful ordering of fate we are happy to witness the memorable treaties and agreements then signed receive a fresh and double ratification by renewed sympathy on one side and by deepened and lasting gratitude on the other side.

We have lost tens of thousands of valuable lives and tens of billion yen of wealth. But in spite of the terrible losses we have sustained in these respects, we fell at this moment immensely richer than ever before in things that no amount of money, however great, can buy. We are incalcurably richer, for instance, in the greatest of all assets a nation can desire, namely, the esteem and friendship of the civilized world.

And no nation has made a greater contribution to this new spiritual wealth of Japan than the great nation whose distinguished representative has so kindly condescended to grace with his presence at our humble luncheon to-day. Mr. Ambassador Woods has been amongst us only for a short time, but it is a striking testimony of his uncommon personality that he has already won a place in our hearts which even a long resident diplomat may well envy. And he has now endeared himself to us in a much more intimate and endurable way by sharing with us, and shaiing a lion's share, in all the anxieties, worries, discomforts and losses incident to being well shaken and cleanly burnt out. We are now sure that Tokyo, with its terrible earthquake and fire, will ever remain one of the most, if not the most, conspicuous landmarks in his mental vista of life experience, and we hope and trust that the ineffaceable bond that nature's rutheless dispensation has thus strang. ly established between him and this land of his official sojourn will remain a band of personal fiiendship and good-will.

It is our special pleasure and privilege to-day to have as our quests a number of prominent citizens of America who have come to us as bearers of their country's message of sympathy and help. We extend to you, gentlemen of the American Red Cross mission, our waimest welcome, and we ask you each and all to accept our most heartfelt thanks for your coming so far and so promptly to help us in the noble work of ministering to the sick, wounded and needy. The self-denying zeal and the splendid efficiency with which you are carrying out your great work commands our deepest admiration and giatitude. Your mission will long remain one of the brightest spots in the long and bright records of American help and sympathy foi Japan.

# Dramatic Documents

## From the Government of Japan

LITTLE more than a word of explanation is needed to accompany the following documents issued by the Japanese government during the first month following the earthquake. The papers generally speak for themselves. They have a dramatic quality that shows the influence of the unprecedented catastrophe upon the minds of the men who compiled them. It will be seen that the Japanese Government was not dazed or harassed but, on the contrary, realized soberly from the beginning not only the extent of the disaster which they suffered but the effect it would have upon both the internal condition and the international position of their country.

The remarkable determination of the Japanese was noted by every unbiased foreigner capable of fair judgment. They faced a disaster suddenly put upon them without warning, striking at the very centre of their government and the metropolitan district of their industry, a disaster greater in toll of lives and in extent of damage than any catastrophe which has hitherto befallen them; and yet it was met with less disorder and more philosophy than probably any European state or the United States could have taken it.

Probably the most important, at any rate the most picturesque, documents that was issued was the imperial edict; and, at the same time, this document coming in the name of the emperor himself, is that which would naturally have the most far-reaching effect. Only in times of crisis or unusual events is such an edict promulgated. The language is conspicuously to be noted.

" Mindful of the grand examples set by our imperial ancestors and the glorious chronicles of our national progress, we have sincerely hoped to prove a worthy successor in the great task of restoration undertaken by our august father and have always exerted our utmost efforts to conduct a successful administration. It is our great fortune that, through the divine help of our forebears and the loyal co-operation of our people, we have been able to maintain our national repose and security despite the occurrence of the world war of unexampled dimensions.

Now without forewarning and suddenly there has occurred the terrible earthquake of September 1. So severe were the vibrations that numberless houses were ruined and tens of thousands of men and women perished. Fires broke out in all directions, the flames and smoke reached to the sky, and Tokyo, Yokohama, and other cities and towns were burnt to the ground overnight. All means of communications were obstructed, and wanton rumors widely circulated. The public were alarmed and excited, adding more to a disaster already of appalling magnitude. It is imagined that the catastrophe was even more tragic and ghostly than the historic occurrence of the Ansei era.

Whilst we deplore the happening of such calamity under Our own rule, it is beyond human will or effort to prevent the inexorable convulsions of nature. We consider that the only course left us now is to lose no moment in doing all that is within our power and to set at rest the mind of the people. At an extraordinary moment an extraordinary decision is needed. If we cleave fast to the rules and regulations of ordinary times and do not rise to the situation; if we fail correctly to appreciate the relative urgency and importance of needed measures; and if, at all, in an attempt to guarantee the interests of individuals or groups, the security of the afflicted many is menaced,—then the sentiments of the people will be agitated to limitless degrees. We entertain deep concern in this regard and have commanded the government officials to devise measures for quick relief, and, by providing for the urgent needs of the people, to bring our sympathy and love toward them into immediate evidence.

The city of Tokyo, being the capital of the empire, has been looked upon by the people as the centre of political and economic activities and the fountainhead of the cultural advancement of the nation. With the unforeseen visit of the catastrophe, the city has entirely lost its former prosperous contours but retains, nevertheless, its position as the national capital. The remedial work, therefore, ought not to consist merely in the reparation of the quandam metropolis, but, in ample provisions for the future development of the city, completely to transform the avenues and streets. We confidently trust that our loyal people, who always courageously proffer their services and make sacrifices for the public welfare, ardently desire, with us, to enjoy the facilities and security obtainable. We have, therefore, commanded our prime minister to establish at the earliest moment a special institution for the reconstruction of the capital, and to discuss and study the great project, which, upon completion, will be submitted to the highest body of advisers and also to the houses of the law-givers, so that there shall be no miscalculation in the conception and execution.

The government officials are charged, in application of our sincere purpose, to engage in the prompt relief of the suffering people and in the strict suppression of wild rumors, so as to inspire security in the public mind. The general nation are ordered to assist in the realization of the government's undertakings and earnestly to fulfil their duty to the public, thereby strengthening the foundations of our empire.

At this moment of catastrophe unparalleled in history our stricken heart goes out in abundant compassion to the people. Ye, our subjects, are commanded to follow our desire above set forth.

IMPERIAL SIGN MANUAL.

PRINCE REGENT'S SIGN MANUAL.

September 12, 1923.

Countersigned:

PRIME MINISTER.

OTHER MINISTERS OF STATE.

Following after the publication of imperial edict the following dramatic cabinet proclamation was put out on September 16:—

"His most gracious and benevolent majesty, the emperor, being deeply concerned over the appalling devastation wrought by the recent catastrophe, has been generously pleased first to make a grant of Y.10,000,000 out of the privy purse and then to issue an edict to indicate ways of sympathy and love toward the sufferers. Having received this august message only a few days after taking the oath of office, I am filled with trepidation, but, mustering courage, I hope to be able to put the heart of my sovereign at ease, to give security of life to the afflicted multitudes, and to devise plans for the reconstruction of the capital. The earthquake covered one *fu* and four *ken* (respectively urban and country prefectures.) The destruction was severest in Tokyo, Yokohama, Sagami, Awa, and Shimosa. Vast numbers of sufferers roam among the ruins, some with singed hair and burned skins; some had their houses burned, some lost their parents and relatives, and all, in want of food and clothes, are suffering privations verging on death. There were also a great number of sufferers amongst foreign residents, official and civil. This grieves my heart, too. At this moment, the heads of foreign states and also the officials and people of foreign countries are expressing their sympathy in deeds as well as words. With my countrymen, I feel that we cannot adequately express our sense of gratitude. I am glad that many sufferers, in risking dangers and withstanding hardships, retained their self-composure. It is to be regretted that there were some who more or less deviated from proper behavior, but they were prompted by temporary misunderstanding, and such incidents have by this time entirely ceased.

As a matter of course the government promptly took urgent measures to deal with the results of the catastrophe, declaring martial law, distributing foodstuffs, beginning the building of barracks, and suppressing to the best of their ability the circulation of wild rumors. At the same time, the people, in co-operation with the government, in great numbers volunteered to perform works of relief and benevolence. The more urgent needs were thereby met, but temporary relief does not permanently assure the livelihood of the afflicted. The government, therefore, is making every effort to recover communications, by land and water, to effect the smooth working of financial systems, in as far as the government treasury permits, and to gather the necessities of life for distribution through-

out the stricken regions. In face of such circumstances, officials and people are urged to bend to the exigencies, following the dictates of justice and humanity and assuming responsibility whenever necessary, without cleaving fast to the rules and regulations of ordinary times.

I am most anxious lest some individuals and companies shall, in trafficking in the necessaries of life, reap extravagant profits, availing themselves of the opportunity of this unexampled disaster. This is a thing, about which his majesty is deeply concerned, that ought to be discountenanced most emphatically. It is necessary that everybody be prepared to share fears and hopes with his brothers and to perform his public duty in disregard of private interests. The insurance companies, which by their nature aim to provide security for the public, should display careful consideration, and, in this extraordinary situation, evince a spirit of sacrifice, so as to requite the trust placed in them by tens of thousands of people, and thus best serve their own ultimate interests. Again, business men engaged in lumber trade and shipping will aim at the simultaneous prosperity of our brethren and make utmost efforts to distribute materials, dissociating themselves from the object of profit.

The government is to the best of its ability amassing supplies and is trying to distribute them impartially alike among urban and country districts. The local officials in whose hands the distribution is entrusted will aim at wide and quick distribution of supplies, and the general officials are ordered to perform their duties as long as their bodies and minds permit, and, especially those whose duties are to maintain public peace and order, shall take good care of the people and suppress disorderly action.

With regard to Tokio, the city was personally selected as the national capital by the late emperor at the time of his accession to the throne. Fifty-six years have since elapsed, the equipment of the city has become established, and it is the political and economic centre and the source of education and enlightenment, being looked upon as such by foreigners and Japanese alike. The nations of the world are watching our endeavors for reconstruction, and whether we succeed or fail will prove the test of our national power and ability. The rebuilding of the capital is, therefore, not merely the question of a city; it is an important national undertaking, essential in the promotion of the progress of our empire. It is accordingly necessary, in application of the emperor's purpose, to devise a project not only for the recovery of former prosperity but in anticipation of future development. For this purpose the government will newly institute a "Council for the Reconstruction of the National Capital," where wisdom will be gathered from official and private experience, and the project discussed. Later, an appropriate organ will be established for the execution of the project thus devised, and its consummation will be undertaken according to the relative urgency of the features which the plan contains. Thus a worthy national capital will be created.

In respectfully reading the imperial message, I am deeply moved and filled with gratitude at his majesty's love and benevolent purpose. It is a moment when officials and people alike should rouse themselves. On account of the long reign of peace and tranquillity, the public mind has gradually become loose and frivolous, and this untoward tendency, the result of years of deterioration, could not be turned in spite of the instructions and endeavors of a series of cabinets; and now, at this moment of unusual calamity, we are giving anguish to the imperial heart. Multitudes of our brethren in the stricken regions are separated from their blood relations; they have lost habitations and are now exposed to the elements clad in ragged garments and have for their food only a handful of unhulled rice. Such is the situation to which they are reduced. If you have sympathy, exercise frugality and live simply, warning one another to leave off luxurious living and cleave to reasonable life, and, with the power thus gained, respond to the call of the suffering, at the same time and with one mind, in co-operation, give assistance as best you can in the difficult undertaking of the reconstruction of the capital.

Thus to strengthen the foundations of the nation and to respond to the imperial purpose, this is what I sincerely desire.

COUNT GOMBEI YAMAMOTO,
*Prime Minister.*

September 16, 1923.

The foregoing might be described as the two great documents of the earthquake period, but there were also a number of minor papers crowded with important information. Those relating particularly to the United States include a message sent on September 6 by Count Yamamoto, the prime minister, to the president of the United States. The message began with a declaration of international policy and then made the following statement:—

"At this time a great earthquake has occurred in our capital and its vicinity, followed by an extensive conflagration, and indescribable havoc and disaster has resulted. From their majesties the emperor and empress down to the authorities and the people, all are suffering deep grief and anxiety.

"Immediately after the coming of these calamities, the commander-in-chief of the United States Asiatic squadron proposed to dispatch the vessels under his command to the districts visited by earthquake and fire to help in transportation and other work necessary for meeting the emergency, and a part of those vessels have already arrived at Yokohama.

"The government of the Philippine Islands has also ordered to come here several transports full loaded with various articles and provisions. Furthermore, the president of the United States has issued a proclamation to the American people urging them to extend aid to our people.

"These reports have already reached the ears of a large number of people suffering from misfortunes and they are deeply moved by these humane measures so promptly taken by the authorities and people of the United States on their behalf.

"At the same time, the American ambassador and the members of the staff of the American embassy in Tokyo are making self-sacrificing endeavors for the relief of the sufferers, notwithstanding the fact that the embassy buildings have been reduced to ashes; and American residents are also serving in relief work.

"For the above facts, I, representing the Japanese government, express my heart-felt gratitude to the United States government, and, at the same time, convey the warmest gratitude of our sovereign and people for the profound sympathy of the president and people of the United States.

"I wish to add that the manifestation of such genuine and cordial friendship by the government and people of the United States at this unfortunate time of calamity will further increase the intimacy of the two countries and strengthen those bonds of concord and peace that exist throughout the world."

On assuming office as foreign minister in the newly formed Yamamoto Cabinet, Baron Ijuin gave the following interview to foreign newspaper correspondents.

"Although we have been dealt with severely by the forces of nature, humanity is giving us an unexampled demonstration of its finer qualities. The stricken area of the country is receiving aid and supplies from the rest of Japan, where people are depriving themselves in order to be of assistance to their stricken brothers, while foreign countries seem unlimited in their generosity. Our whole nation is deeply touched by the sympathy that has come to us from abroad. The Japanese newspapers report daily the coming of ships bringing relief and daily increases in the funds being gathered for us in foreign countries. This demonstration of kindly human sentiment has impressed us deeply and will have long enduring effect.

It is impossible for me to outline in detail how we shall achieve the reconstruction; the task is too great. The government plans, as you know, to rebuild the capital, and we must, of course, recreate a port in Tokyo Bay. We intend to take advantage of the clearance made by the fires to lay out improved and modern cities. We shall proceed as quickly as possible to provide or promote the construction of permanent dwellings and business buildings to take the place of the temporary sheds that the people are now raising above their heads; but the execution of the whole project of rebuilding the metropolitan area will require many years and will cost enormous sums of money, and such a program must be undertaken only after most careful consideration by technical experts in the many branches of municipal and general government science. Happily, we are assured of whatever financial and other help that we may require from abroad.

It is fortunate for us that our foreign relations are in the best possible condition. We have no serious issue before us and we foresee none in the future that will embarrass our good relations with

any country. It is most satisfactory to me, on assuming the post of foreign minister, especially at this peculiar moment, that no change in our tested and pledged policies are advisable or contemplated. The present government approves of the policies laid down by our predecessors at Paris and Washington, and I am happy to say that the country as a whole overwhelmingly supports those policies. It is my purpose to continue them and to strive to make permanent the clear understanding that we have reached with the great powers both in our relations directly with them individually and in our co-operation with them collectively where our interests are general.

There is only one blemish in the situation. That was the absurd scare which was circulated among the Japanese that the Koreans were taking advantage of the situation to throw bombs and make other attacks. It is said that this ridiculous rumor was launched by the Young Men's Society of Tokyo, which, in turn, is said to be one of the institutions inspired by the old militaristic devices. The result of the report was that a number of individual Koreans were attacked and wantonly slain. It is difficult to ascertain how many were killed, but it would seem that a score would more than cover the number. At the same time a number of Japanese were mistaken for Koreans and lost their lives. The government immediately realized the seriousness of the error and issued on September 5 the following cabinet proclamation, also issuing orders to the military authorities to give protection, which was at once provided; and the Koreans thereafter were amply protected.

"It is understood that there are some citizens who entertain unpleasant feelings towards Koreans on account of alleged disorderly acts by some Korean malcontents, who took advantage of the recent seismic disaster. In case any Koreans are found in the act of menacing performance, notification shall immediately be made to the military or police officers in charge of the district, who will take the necessary measures in the matter. That the citizens themselves should thoughtlessly persecute Koreans is entirely in contravention with the basic principle of Japanese-Korean assimilation and further would bring blemish upon our honor when reported abroad. Such uneasiness of mind has no doubt been brought about by the sudden and difficult situation, but it is my ardent desire that our people will, at this extraordinary moment, maintain their usual composure and exercise special care in their actions in keeping with their spirit of self-restraint and love of peace and justice.

I express my sincere wish, with all the emphasis at my command, that every one should absolutely refrain from thoughtless actions and preserve their self-respect.

COUNT GOMBEI YAMAMOTO,
*Prime Minister.*

# Reconstruction of Tokyo

IT was only natural that the first news of the disaster to the national capital would be taken advantage of by Kyoto to advance its claims for special recognition as the seat of government and by Kobe to advertise its advantages as the chief shipping port to supercede Yokohama. To the minds of dwellers in other cities it looked during the first week of the disaster as though the capital would have to be transferred, pending reconstruction at least, but as the people began to recover from their first depression and took stock of their assets, it was quickly realized that any change in the seat of government would be a mistake, and by common impulse the plans for reconstruction were pushed forward. The great opportunity had arrived to carry out some of the plans drawn up last year for the construction of a Greater-Tokyo and place the capital on a par with other great cities of the world, boasting wide streets, sanitary improvements and up-to-date buildings. The preliminary studies for the improvement of the capital had been carried out last year when Dr. Beard, the American municipal and town planning expert, spent several months in Tokyo at the invitation of Viscount Goto, and the clean sweep of the conflagration in several of the principal wards of the city provided the opening to initiate improvements that under normal conditions would have necessitated huge outlays of capital for the purchase or expropriation of property. It did not take long for the higher authorities and business interests to decide that Tokyo would remain the capital and seat of financial, economical and commercial activity and formulate their plans for reconstruction. The first step towards this end was the creation of a supreme organ for the restoration of the capital composed of a commission of twenty members under the direct control of the emperor with an advisory and executive body to carry out the plans passed by the higher commission.

The official announcement giving details as to the powers and *personnel* of the capital restoration commission was made on September 16, in which it was decreed that the commission is to answer the inquiries made by the premier regarding the restoration of the devastated capital and other regions. It is to be presided over by the premier, assisted by a chief secretary and several other secretaries of the commission.

The members are to be chosen out of the ministers of the empire, former ministers, and officials who were appointed by the emperor and others who are eminent in scholarship and experience. They are to receive similar treatment as ministers of the empire.

The following persons were selected by the government as members of the commission:—

Count Gombei Yamamoto, premier and foreign minister.
Viscount Shimpei Goto, home minister.
Mr. Junnosuke Inoue, minister of finance.
Baron Giichi Tanaka, minister of war.
Dr. Keijiro Okano, minister of education.
Admiral Takeshi Takarabe, navy minister.
Baron Den, minister of agriculture and commerce.
Mr. Tsuyoshi Inukai, minister of communications.
Mr. Ichiji Yamanouchi, minister of railways.
Dr. Kiichiro Hiranuma, minister of justice.
Count Miyoji Ito, privy councillor.
Viscount Keigo Kiyoura, president of the privy council.
Viscount Korekiyo Takahashi, president of the Seiyukai.
Viscount Takaakira Kato, president of the Kenseikai.
Mr. Yukio Ozaki, leader of the Kakushin Club.
Mr. Masami Oishi, former minister of agriculture and commerce.
Viscount Eiichi Shihusawa, veteran businessman.
Mr. Toyoji Wada, president of the Fuji Spinning Company.
Dr. Takuma Dan, of the Mitsui Bussan Kaisha.
Mr. Otohiko Ichiki, governor of the Bank of Japan.
Viscount Nobumitsu Aoki, of the Kenkyukai.
Mr. Kazuyuki Egi, of the Chawakai.
Baron Hisaya Iwasaki.
Baron Ijuin, foreign minister.

Premier Yamamoto is president of the commission, and Viscount Goto, chief secretary.

Mr. Seiji Tsukamoto, vice-minister of home affairs, Mr. Sukehide Kabayama, chief secretary of the ministry, and Dr. Joji Matsumoto, newly appointed chief of the bureau of legislation, were selected as secretaries to assist Viscount Goto.

The regulations governing the operations of the commission consist of twenty-six articles. The first article provides that the board be under the direct control of the prime minister and execute all matters relating to the town planning and reconstruction of Tokyo and Yokohama.

The second article fixes the officers of the board as follows:

President, 2 vice-presidents, 1 chief engineer, 7 managing chiefs, 15 secretaries, 30 attaches, 105 engineers.

The third article provides that the board consists of six bureaus, namely planning, land readjustment, construction, public works, supplies and management.

In addition to this the secretariat of the president will belong to the board.

The article provides for the establishment of a council board. This council will consider important matters when submitted by the president. It will consist of one president and several members. The members of the council will be appointed by the cabinet through the recommendation of the prime minister.

The regulations were put into operation on the same date as published.

The following *personnel* of the executive board having charge of the direct work of capital reconstruction was announced on October 2: President, Viscount Shimpei Goto; Vice-Presidents, Shunji Miyao and Kan-ichiro Matsuki; Director of the Planning Bureau, Hiroshi Ikeda; Director of the Land Readjustment Bureau, Shunji Miyao; Director of the Construction Bureau, Riki Sano; Director of the Bureau of Public Works, Rintaro Naoki; Director of the Bureau of Supplies, Kan-ichiro Matsuki; Director of the Accounts Bureau, Shinji Tokawa; Chief Engineers, Yenzo Ota and Hakuai Yamada.

The yearly expenses of the board is placed at Y.1,200,000.

The board started work on October 2 and one of the first signs of its activities was the submission of a complete plan for the reconstruction of Tokyo by Mayor Nagata. The scheme calls for a total expenditure of Y.2,350,000,000 covering a period of twenty years. In the event of establishing new additional parks and constructing ward offices the sum is expected to reach between Y.2,500,-000,000 and Y.2,600,000,000.

The general policy is to have a network of rapid-transit subway lines constructed, starting from the points on the boundary line between the city and "guns" (counties) and concentrating around Marunouchi in the neighborhood of Tokyo station, like a spider's web. Canals and streets are to be readjusted, in order to facilitate traffic. The present surface street car lines shall be extended. In addition, four new lines shall be constructed, leading to Shinagawa, Shibuya, Meguro, Shinjuku, Ikebukuro, Otsuka, or Sugamo and Fujagawa districts, and also a rapid-transit car line laid down from Senju to Shibaura and Tsukishima, to connect with the surface lines.

The imperial railway ministry shall be requested to complete the work of constructing elevated lines between Manseibashi and Ueno stations, and between Ryogoku and Kanda stations. Starting from the Honjo and the Koume stations of the Tobu Railway, car lines shall be constructed to facilitate connections between street cars and steam railways at Ryogoku station.

In addition to the surface system, the following under-ground tram lines, viz., Shinagawa reclaimed ground—Kanegafuchi, Gotanda-Senju Ohashi, Yebisu-Sugamo, Shibuya-Susaki reclaimed ground, Ehinjuku-Sunamachi, Ikebukuro-Kameido, aggregating 52.7 miles, will be laid at a cost of Y.210,000,000.

## To Widen Canals

The canal system will be improved for a length of 57,540 *ken*, of which 6,150 *ken*, 36,870 *ken* and 14,520 *ken* will have a width of 20, 30 and 50 *ken* respectively. The total cost is estimated to reach Y.290,000,000.

According to the said plan canals (20 *ken* wide) will be constructed between the mouth of the Furukawa canal and Shinohashi as well as between Furukawa bridge and Shibaura, whereas the Shiodome canal will be extended to Toranomon and made so as to flow into the Sumida river at Hamacho Nichome after connecting at the outer moat (Sotobori) and Shibaura.

Other improvements in the canal system will be the widening of canals as follows:—the Nihombashi canal to 50 *ken*, the Kyobashi, Ryukan and Hamacho canals to 30 *ken*, the mouth of the Kanda canal to Manseibashi bridge to 30 *ken*, the Onagi canal to 50 *ken*, as well as the lengthening of the Nishidome canal to flow into the Kanda canal, the extension of the Ryukan canal to Mikuramae Katamachi with a width of 30 *ken* and the branching of the said canal at Katamachi to the Sumida river and Mikawajima at a width of 50 *ken*, the extension of the Sanya Horikawa canal to Oji (30 *ken* wide), the widening of the Tategawa canal to 30 *ken* as well as the joining and widening of several other canals in the Sumida district.

In addition to the existing parks, the broad open space in front of the imperial palace at Marunouchi, as well as the Hama detached palace, the Otsuka munition depôt, the Gokokuji temple, the Zoshigaya cemetery, the Meiji shrine grounds, the Aoymaa cemetery, the military cadet school at Ichigaya, the botanical gardens at Koishikawa, the Fukagawa branch of the military arsenal, Baron Iwasaki's estate will also be made into parks. Furthermore parks will be established on the bank of the Sumida river at Hamacho, as well as near Tengenji, Shinohashi, the upper source of the Edogawa river, Surugadai, and at Mukojima, the site of the military clothing depôt in Honjo, the Sanno hill at Akasaka, the Toyamagahara plain, and Tsukudajima, which will bring the total area of parks up to 2,850,000 *tsubo*.

The sum of Y.140,000,000 has been put aside for the purchase of 922,000 *tsubo* of personal estate in order to materialize this plan.

## To Build Harbor

As regards harbor works the former municipal budget estimate of Y.72,000,000 will be increased to Y.100,000,000 in order to allow of the free entry into Tokyo harbor of vessels of 10,000 tons.

The sum of Y.100,000,000 will be required for various underground structures which may, however, be possibly increased to Y.300,000,000.

As for waterworks the extension of the present municipal waterworks system will necessitate an appropriation of Y.70,000,000, and Y.150,000,000 will be required for improvements in the sewage system of the city.

The central municipal market will be established on the site of the naval academy, and branch markets at Ryogoku bridge, Akihanohara, Ikebukuro, Shinjuku, Shibuya, Osaki and Shinagawa.

According to the new reconstruction plan, the area of canals in proportion to the area of Tokyo will be increased from 5 to 9.6 per cent., that of streets from 16.1 to 24.3 per cent. and that of parks from 2.3 to 11.5 per cent.

## Streets

On the surface over the subway lines, trunk street lines shall be constructed emanating in all directions from the centre of the city in Marunouchi. This plan was embodied in a plan before the earthquake made for the improvement of Tokyo. The width of the streets shall be increased between 144 and 240 feet. The proposed Maki-cho street, 168 feet wide, shall be widened to about 360 feet.

Other trunk lines are to be constructed from Shinagawa to Minowa and to Senju.

The Ginza and Nihombashi streets are to be left as they are. A trunk line shall be constructed along Sanjikkenbori, parallel with the Ginza line, joining at Kanasugi Bashi to lead to Shinagawa.

The outer-moat line between Akasaka Mitsuke and Kagurazaka shall be left as it is, while in other parts the street shall be widened to 120 or 180 feet.

Nothing definite has been decided about the streets between the Detached Palace to Shiba Park, between Roppongi and Shinanomachi in Yotsuya-ku, and other encircling lines, connecting Yanagimachi, Ushigome, Vegetable Garden, and Hakusan, in Koishikawa-ku, etc.

## Broader Streets Planned

The street improvements will consist in the widening of the main thoroughfare from Shinagawa to Seiju via rear of Tokyo station and Uyeno Park as well as the Makicho route and the thoroughfare from Mukojima Ukechi to Manseibashi bridge via Ryogoku bridge to 40 *ken* wide at an estimated cost of Y.1,100,000,000. The construction of streets will extend over a length of 163,590 *ken*, which, when divided into the various widths will be:—20 *ken* wide 75, 420 *ken*, 25 wide 32,970 *ken*, 30 *ken* wide 43,500 *ken*, and 40 *ken* wide 11,700 *ken*.

## Freight Stations

The policy of establishing freight stations at Konakigawa, Minami Senju, Shinagawa, Shiwodome, Takata-no-baba, Tabata, making those places switching stations, is for the Imperial Railways to decide.

### Markets

A large public market shall be erected on the former site of the naval arsenal in Tsukiji, to which freight tracks may be built from Shiwodome and Shinagawa stations.

The carrying out of these plans over a period of fifteen years at an estimated cost of three billion yen will call for financing at the rate of Y.200,000,000 a year. In discussing the program to be followed, the board made the following statement at the privy Council :—

" Three plans may be formed with regard to the reconstruction. To place the capital on its pre-earthquake basis by the restitution of the prefectural public works, private companies, banks and individual enterprises, roughly about Y.5,000,000,000 will be required. If the reconstruction work is to be limited to the prefectural and provincial public works about Y.3,000,000,000 will suffice. For the reconstruction of prefectural public works alone about Y.1,200,000,000 will be required."

The first question to be settled in any scheme for the reconstruction of Tokyo and Yokohama is that of finance and here there are various opinions, some holding to the view that the money can be found within Japan, while others are decidedly in favor of raising foreign loans. The domestic resources will undoubtedly be drawn on to the fullest extent but the opinion now seems to have solidified in favor of going abroad, especially to America, for financial assistance. While it is too early to state with any exactitude what the financial program will be, it is accepted that when the time arrives a mission will be sent to America and England to negotiate the loans. It is reported that this mission will include Mr. E. Fukai of the Bank of Japan, Mr. R. Ichinomiya, vice-president of the Yokohama Specie Bank and Mr. E. Ono, governor of the Industrial Bank of Japan.

One of the first problems to be settled before any loan policy can be adopted is whether the cost of reconstruction is to be paid out of the municipal, county or national treasuries. In view of the great dimunition in the municipal revenues of Tokyo and Yokohama, there would seem to be little likelihood that these communities can find the necessary guarantees for any foreign loans thus throwing the burden of financing the reconstruction upon the imperial government. Yokohama has ceased to exist as a self-supporting community while Tokyo has met with such a serious setback that it is hardly in a position at this time to formulate its budget. As the result of the destruction of the business sections of the capital, which represented more than one-half of the total tax revenues, no levy is possible under present conditions. The returns from the water system, tramways and other sources will all experience a great decrease. According to the investigations of the home office, the estimated Tokyo revenues for 1923 from house taxes and school fees was Y.2,695,709 which has now been reduced to Y.876,641 or 65 per cent. The city of Tokyo had outstanding at the end of 1922 the following debentures :—Y.173,936,116 ; sterling, £5,553,160, Francs 91,895,500. Yokohama debts exceed £1,000,000 sterling and Y.26,000,000. With nothing to meet these obligations, the national treasury will be compelled to shoulder all the expense of reconstruction, in which case, the privileges of self-government in Tokyo and Yokohama, will have to be suspended as far as their loan-making powers are concerned.

The shrinkage of revenue in consequence of the government's cut in taxes and suspension of import duties and other causes is expected to amount in Tokyo alone to Y.130,000,000 of which income taxes (third class) occupy Y.40,000,000, business taxes Y.20,000,000 and land and inheritance taxes Y.60,000,000. In order to meet this financial emergency the diet will be convened in extraordinary session in November, when the cabinet will ask its approval for the large expenditures for reconstruction instead of acting on its own responsibility, as well the extraordinary expenses incurred in relief work.

An immediate feature of reconstruction is the immense amount of *débris* that must be carted away, for which the Tokyo authorities have asked the government to appropriate Y.12,000,000 without delay. It is proposed to fill in and raise the ground level in the low lying districts in Honjo and Fukagawa with the *débris* of the burnt sections. This will call for an immediate increase in the transportation facilities, and create a market for trucks and dump cars that will probably be served from abroad.

# Destruction of Property

MANY rough estimates of losses have been made by government bureaus and private concerns which in most cases are under, rather than over the actual figures being based on building costs when the structures were erected. Preliminary estimates are therefore very wide of the mark, and until sufficient time passes for an expert survey the first rough estimates are the only indication we have as to the value of actual property destroyed. The home, finance, war, navy, education, justice, agriculture and commerce and the Communications Ministries estimate their actual building losses in Tokyo, Yokohama and Yokosuka at Y.78,777,000. Reconstruction at present labor and material prices will call for at least ten times that amount.

The direct damage to the imperial government railways through destruction of stations, freight sheds, collapsed tunnels and rolling stock is placed at the rather low estimate of Y.35,000,000, while the decrease in operating revenues due to these causes is placed at Y.20,000,000. As a result, the railway authorities who have been pushing ahead elaborate plans for the electrification of the Tokkaido line under a five year program have been compelled to radically modify their plans and suspend for the time being all new construction.

The damage to the railway in the Tokyo zone alone is as follows :

Stations Destroyed by fire—Yuraku-cho, Shimbashi, Hamamatsucho, Kanagawa, Yokohama, Sakuragichi, Kanda, Manseibashi, Ochanomidzu, Suidobashi, Iidamachi, Uyeno, Akibahara, Ryogoku, Kinshicho.

Stations Collapsed :—Ofuna, Fujisawa, Hiratsuka, Oiso, Chigasaki, Shimosoga, Matsuda, Hayakawa, Nebugawa, Odawara, Tsujido, Ushigome.

Railway Bridges Destroyed :—Banyu, Rokugo, Arakawa, and Tone rivers.

Tunnels Collapsed :—Tunnels Nos. 2, 3 and 4 between Yamakita and Yaga, between Totsuka and Hodogaya, two places at Shimidzudani, between Dzushi and Taura, 3,500 tsubo at Yoshikura, between Aibara and Hachioji, 1,700 tsubo at Aibara, between Odawara and Manazuru, between Komine, Hayakawa and Nebukawa, between Yonegamiyama, Nebukawa and Manazuru, between Kanjo and Nagasaka, between Hamaganedani and Hoda, between Soga and Otsuna, between Iwai and Tomiura and at Kanaya.

Cars and Locomotives Destroyed by Fire :—Bogey cars 284, ordinary passenger cars 102, freight cars 817, locomotives 33.

### Tokyo Water System

The Tokyo water system was so damaged by the quake that the repairs will extend over a period of three years at an estimated cost of Y.10,000,000. The quake destroyed the mains in over a thousand places loosening the joints and breaking the pipes to an extent that entirely new pipes will have to be laid in many sections. The lesson of the fire is that a new reservoir must be built at Arakawa to supplement and reinforce the existing one at Murayama and provide two sources of supply instead of one. In order to make the fire defense perfect it is also proposed to lay a complete independent fire service drawing water from the rivers and canals. The frequency of quakes is a standing menace to the water supply and there seems to be no escaping the certain penalty when fire breaks out after an upheaval. As a partial remedy, a separate fire main system will be installed at an estimated cost of Y.5,000,000.

## Cotton Mill Losses

The quake and fire damage to Japan's cotton spinning industry is now believed to be about 28 pei cent. of the pre-quake spindle capacity. All mills suffering injury are conducting investigations to ascertain the extent of damage and in some cases perfect secrecy is maintained on the result of their finding. The following may give a general idea:

### Entirely Destroyed by Fire

| Co.'s | Mills | Spindless |
|---|---|---|
| Dai Nippon Spin. Co. | Fukagawa | 43,396 |
| Odawara Spin. Co. | Main plant | 30,720 |
| Fuji Gas Spin. Co. | Oyama No. 3 | 40,000 |
| ,, ,, | Oyama No. 4 | 44,288 |
| ,, ,, | Oshiage | 80,524 |

### Crumbled

| Co.'s | Mills | Spindless |
|---|---|---|
| Toyo Spin. Co. | Oji | 66,464 |
| Hattori Spin. Co. | Yokohama | 11,304 |
| Tokyo Spin. Co. | Nishi Arai | 23,600 |
| Nisshin Spin. Co. | Kameido No. 1 | 59,152 |
| Kanegafuchi Spin. Co. | Tokyo No. 1. | 30,440 |
| Fuji Spin. Co. | Oyama No. 1 | 30,192 |
| Fuji Spin. Co. | Oyama No. 2 | 52,472 |
| Sagami Spin. Co. | Hiratsuka | 76,184 |

### Partly Damaged

| Co.'s | Mills | Spindless |
|---|---|---|
| Dai Nippon Spin. Co. | Hashiba | 101,336 |
| Kanegafuchi Spin. Co. | Tokyo No. 2, 3, 4, 5 | 93,404 |
| Fuji Spin. Co. | Onagigawa | 13,824 |
| Fuji Spin. Co. | Kawasaki | 111,224 |
| Nisshin Spin. Co. | Kameido No. 2. | 52,996 |
| Tokyo Muslin Co. | — | 52,064 |
| Tokyo Muslin Co. | — | 108,810 |

The following table shows the damage done to spindles:—

| | Entirely destroyed | Totally crumbled | Partly damaged |
|---|---|---|---|
| Under 20's counts | 64,800 | 52,005 | 84,144 |
| From 30's to 42's counts | 114,424 | 141,404 | 297,902 |
| Gassed yarn | 29,480 | 100,131 | 93,372 |

The total number of spindles thus damaged reaches 977, 669, and that approximate 20 per cent. of all the spindles in operation in this country. The monthly capacity of all the spindles damaged is estimated as follows:—

| | Entirely damaged (Bales) | Totally crumbled (Bales) | Partly damaged (Bales) |
|---|---|---|---|
| Under 20's counts | 3,240 | 2,600 | 4,207 |
| Over 30's to 42's counts | 3,432 | 4,242 | 8,937 |
| Gassed yarn | 153 | 520 | 486 |

## Machines Damaged

The number of weaving machines affected by the disaster is reported slight, apart from the total loss of the 300 looms belonging to Odawara Spinning Company, the works partly damaged were as follows:—

402 looms in the No. 2, No. 3, No. 4, No. 5 works of the Kanegafuchi Spinning Company; 692 looms in the Onagigawa works of the Fuji Gas Spinning Company; 1,568 looms in the No. 5 Oyama works of the Fuji Gas Spinning Company; 329 looms in the No. 2 Kameido works of the Nisshin Spinning Company; 1,638 looms in the Azuma works of the Tokyo Muslin Company; 500 looms in the Tokyo Muslin Company.

## Raw Cotton Short

Many companies, who used to get supplies of raw cotton through Yokohama are now in a quandary. The following table shows such companies with their respective numbers of spindles:—

| Co.'s | Mills | Spindles |
|---|---|---|
| Daido Spin. Co. | Kawagoye | 10,100 |
| Daido Spin. Co. | Koku | 2,720 |
| Asahi Spin. and Weav. Co. | Sendai | 25,224 |
| Ashikaga Spin. Co. | Ashikaga | 15,000 |
| Nagoya Spin. Co. | Koriyama | 8,800 |
| Nagoya Spin. Co. | Niigata | 24,784 |
| Sanko | Head works | 15,000 |
| Toyo | Kuribashi | 6,000 |

Of all these spindles, 208,704 cannot be restored and the restoration of spindles in the works which have totally crumbled will take more than a year. Partly damaged works will l e repaired in about 6 months. Considerable activity is displayed in placing orders for new equipment.

## Industries Affected

Although the industrial heart of Japan is in and around Osaka many large manufacturing plants were located in the Tokyo and Yokohama districts and these suffered huge losses through complete or partial destruction, paralzing their earning capacity and output until such time as they can be rebuilt. In many cases, this means at least a year for reconstruction of the buildings, and although in some cases much valuable machinery has been salvaged, at least half the equipment will have to be replaced. These companies face a difficult prospect in raising new capital for reconstruction as the issuance of debentures within the country is regarded as being utterly hopeless forcing them to seek financial assistance from abroad. As a result, some concerns have already approached the minister of finance for permission to import foreign capital, but until such time as the government formulates its own financial policy and estimates its requirements from abroad for reconstruction, there is little hope that such permission will be granted. As the importation of foreign capital is expected to amount to a considerable sum in the next year or so, the government is not inclined to concede permission for private loan issues on foreign money markets that will hinder the more urgent and important official operations.

The following list of industrial losses covers some of the more important companies:

Dai Nippon Sugar Manufacturing Co.—The branch office in the Kakigara-cho, Tokyo, burned down and the Sunamachi works collapsed. The loss of the stock was slight.

Yokohama Kiito Kaisha.—The office in Yokohama, and a considerable amount of stock having burned, the total loss is estimated at Y.2,000,000. But the raw silk stock stored in the basement of the building of the company is expected to be safe. A provisional office was opened at the Mitubishi Shoji Kaisha's office.

Tokyo Keori Kaisha.—The Oji works suffered worst, while the damage to the Senju works was slight and operation is already going on.

Yensuiko Sugar Manufacturing Co.—The branch office of this company and the stock kept in the Mitsubishi, the Toshin, and the Teikoku Warehousing Companies were burned. The works, however, are in Osaka and Taiwan, and the producing capacity is unaffected. The works are reported as being operated at full capacity.

Nisshin Cotton Spinning Co.—The branch office in Kakigara-cho, Tokyo, was burned, and the first works of the Kameido factory crumbled. At present, the clearing of the wrecked buildings and the repairing of machinery are in progress.

Meiji Sugar Manufacturing Co.—The Kawasaki factoiy was burned down, and the stock lost amounts to about Y.400,000.

Nippon Kinema Co.—The total loss is estimated at Y.3,000,000. More than two-thirds of all the motion picture houses in Tokyo and Yokohama controlled by the company were destroyed, and the rest of them cannot be used for the time being.

Nippon Yusen Kaisha.—The building of the head office was damaged, and the branch office at the Kyobashi was burned down, but no ship was lost.

Asahi Petroleum Co.—Only the Oshima factory of this firm has been affected, but, the transportation of goods to Tokyo having stopped, transactions in oil are now at a standstill.

Niigata Iron Works.—The head office and the Tsukishima Works of this company was entirely destroyed by fire, and the Shibaura Works was damaged by the earthquake. After slight repairs, however, operations will be resumed ere long. The total loss is estimated at Y.600,000.

Oji Paper Manufacturing Co.—The Oji and Juji factories and the head office were burned down, and the aggregate loss is estimated at Y.3,500,000. At present, this company has opened a provisional office in the Imperial Hotel. The Oji factory will resume operation within this month, and the Jujo factory within two weeks.

Nippon Flour Mill Co.—The damage of the Oyama, Yokohama, and Kanagawa works of this company is estimated as amounting to Y.50,000,000. The Komatsugawa and the Toa Mills being untouched, the production is not expected to diminish very much.

Fuji Paper Manufacturing Co.—Though the head office of this company was lost, the damage to the Senju and the Edogawa factories having been slight, the production will be kept up in the same works as well as in the Shizuoka, Hokkaido, and Hyogo works of the company. A provisional office was opened at the Okawa-Tanaka Office, Marunouchi.

Asano Cement Co.—The total damage done on the Fukagawa and the Kawasaki works of this company reaches Y.3,500,000, and approximately Y.650,000 of raw and finished materials were lost. But orders will be filled from the output of the Moji, Taiwan, and Hokkaido works. As the demand for cement in reconstruction is expected to be active, the prospects of the company are considered improved. The Asano Slate Company in Fukagawa-Ku was also destroyed.

Nippon Petroleum Co.—This company's Yukakukan Building, factory in Narihira Cho, Honjo-ku, and Tsurumi works were damaged. The locality, in which the company's oil wells are situated was comparatively unscathed, so business will open from September 17. The damage is estimated at Y.300,000.

Hokkaido Coal Mine and Steamship Co.—This concern has opened a provisional office in the Kuhara Building. Owing to the destruction of branches in Tokyo and to the difficulty in transportation, actual business has not yet begun.

Asahi Glass Co.—The total damage is now under investigation. Reconstruction of the Tsurumi works has been started. Business was opened on the fifth story of the Industrial Bank building.

Dai Nippon Artifical Fertilizer Co.—The head office in the Industrial Bank Building was untouched. The Yokohama, Koyasu, and one other works were destroyed, the aggregate damage being estimated at Y.4,000,000. The Kinoshita, the Oji, and the Komatsugawa works will be operated at full capacity.

Nisshin Flour Mill Co.—The head office was burned down, and a part of the storehouse attached to the Yokohama works has crumbled. The production at present is 500 barrels in Kanto, and 2,500 barrels in Kansai.

Ishikawajima Dockyard Co.—A part of the office and the dock were destroyed; most of the machinery, however, is safe. The aggreagate damage is expected to reach an enormous sum. From about the middle of October, operations for the construction of bridges will be started.

Uraga Dockyard Co.—The works of this company was burned down, but the docks were not affected, and no damage to ships under construction was reported. The total loss is estimated at about Y.1,000,000. Operations will be begun from towards the end of October.

Toyo Muslin Co.—The third and the fourth factories crumbled, and the second was slightly damaged. The aggregate loss is expected to amount to an enormous sum. The Shizuoka Works of this company has already started operations.

Nippon Hemp Co.—The Omiya works was safe, but the Akabane factory, the mainstay of the concern, having been greatly damaged, the resumption of operations will take a long time.

## Government Printing Plant

The government has decided to construct an emergency printing office at a cost of 900,000 yen, the sum to be made available by discretionary disbursements.

With the burning of the government printing office building, with all its machinery, the government authorities are meeting no little inconvenience, and various plans have been made to rush the restoration of the printing office. The total cost of completely restoring the building is estimated at Y. 20,000,000 which sum, the authorities think, is not available at the present time.

## Japanese Steel Situation

Industrial circles are entertaining an optimistic view of the future condition of structural and other steel materials and the consensus of opinion at this moment is that the iron and steel market here will not witness unduly inflated prices.

With the exception of the Kawasaki mills of the Nippon Steel Tubing Company and the plate mill of the Asano Shipyard Company both of which are crippled, damage to nearly all steel works in the affected area is surprisingly unimportant. Even the Nippon Steel Tubing Co. contemplate resuming production by the end of this year at the full capacity of 8,000 tons a month.

It is surmised that the Yawata Iron Works will concentrate their efforts on the manufacture of structural steels, while all the other steel mills are not expected to lag behind unduly in the production of these materials.

Beside this, the speculation that there will be an influx of American steel materials to the extent of 150,000 tons, taking advantage of the lifted import duty, is encouraging this viewpoint.

## Flour Mills to Resume

The damage sustained by the flour mills is estimated at Y.1,000,000. The destruction of machinery of the Nippon Flour Mill at Kanagawa, the pillage suffered by the Nisshin Mill at Kanagawa, and losses of profit due to the suspension of work for ten days by other companies are some of the largest items. The Oriental Flour Mill (3,000 barrels) and the Nippon Flour Mill (150 barrels) at Onagigawa, the Matsumoto Flour Mill at Chiba (500 barrels) are intact, and running their factories with the usual efficiency. The main problem is the supply of wheat.

## Standard Oil Losses

The Standard Oil Company is probably the heaviest loser among foreign companies. Eight oil tanks at Kanagawa, a reservoir for the supply of the whole East, exploded, the loss in this alone being twenty million yen.

## Government Lumber Mill

The government is exercising its best effort in encouraging the production of worked lumber by advancing money at low interest to such lumber mills as are temporarily incapacitated by the quake and fire. On the other hand, the government intends operating a lumber mill in an extensive scale appropriating Y. 4,000,000 for this purpose. The enterprise will come under the jurisdiction of the capital reconstruction board.

## Telegraph and Telephone Losses

The department of communications was seriously hit by the earthquake and fire. The total loss is estimated at Y.300,000,000 The repair work on telegraph and telephone lines alone will entail a cost of approximately Y.250,000,000.

The number of telephone subscribers in the devastated area of the capital was reported to be 62,000 and although the authorities are busy towards the re-establishment of the services only one-half will be repaired before summer of next year.

Work on the repair of Yotsuya, Asakusa, Marunouchi and Sumida telephone exchanges is going on rapidly. A number of the telephones attached to other exchanges are at the same time being connected with the four exchanges which are at present in operation. Stress is being made in permitting the large governmental, financial, industrial and commercial organization the use of the means of communications for it will enhance the revival of the economic activities of the capital.

While making the repairs just described, the authorities have decided to install a number of public telephones attached to the post offices to be constructed in the devastated districts so that residents have the use of them.

In the restoration of the telephone and telegraph communications, the government is handicapped by the collapse of the great works of the Nippon Electric Company, whose new reinforced concrete structure came down at the first crash. Although much of the machinery and some of the stock has been salvaged, the buildings are a total loss holding up production until a new works can be erected. In the meantime telephone apparatus will come largely from America.

## Tokyo Tramways

One of the marvels of the aftermath of the disaster was the prompt and efficient restoration of the Tokyo tramway services which within three weeks had most of its lines south of the Sumdia River in operation. The municipal electric bureau lost in the recent catastrophe 820 tramcars, several transforming stations and over 80 miles of overhead wires. At present the street tram service is maintained with great difficulty with about 400 cars for sections covering about 80 miles. The number of passengers using the tram service exceeds 800,000 a day. The recovery of the street tram system to its former status will require several months.

In order to relieve further the congestion of traffic and facilitate transportation into the burned districts of Honjo, Fukagawa and Akasaka, the municipal council passed a bill for the establishment of

a municipal motor bus service as an auxiliary transportation organ. The plan was proposed by Mr. Nagao, director of the municipal electric bureau, and will be carried out without delay as soon as approved by the assembly. The scheme is to save the congestion on trams.

The bill provides for Y.2,000,000 and the greater portion of the amount is to be expended in the purchase of 1,000 passenger cars each accommodating 12 passengers. These cars will cost Y.1,850 each and will be ordered from the Ford Automobile Company of America.

## Tokyo Bridges

The transportation problem is made more difficult by the destruction of bridges throughout Tokyo. About 300 bridges of all types were either destroyed by the quake or wiped out in the conflagration. By the first of October only about 70 temporary structures had been erected in their place. The dearth of timber is greatly handicapping their replacement and whatever bridge work is done at this time to relieve the transportation tangle will have to be replaced later on by permanent structures. Much of the great loss of life during the conflagration is traceable to the destruction of the many wooden bridges which prevented the people from flying to the safer districts of the city, and any plan for permanent reconstruction must include either steel or reinforced concrete bridges that will assure at least a safe passage across the numerous canals for the people in the event of a future calamity.

## Underground Railway Project

As a part of the plan towards reconstructing the capital, the members of the Reconstruction Committee are contemplating starting work on the underground railway. The first plan included the building of six lines extending fifty-three miles, at a cost of two hundred million yen.

## Building Losses

It is perhaps too early to offer any serious comments from the lesson taught by the recent disaster on the style of structure best adapted to stand the effects of earthquake and fire. In due time we hope to present the full report of competent experts on the building problem, for the present confining our comments to the lessons which seem to stand out so that even the layman can profit by them. Building destruction by the quake itself was not confined to any particular style or type of architecture. The first great shake found the weak joints in Japanese and foreign style buildings alike and sent them crashing to the ground. Most of the Yokohama edifices erected a generation or more ago, went at the first tremor, while in Tokyo buildings of the same age built of brick and wood in many cases stood the shake admirably. The older brick office buildings in the Marunouchi district remained intact while many of the newer ones had their facings cracked or shaken down. The newer damage done to the steel frame structures erected in the past decade was slighter than in other buildings. The outside curtain or facing of brick or terra cotta, suffered in many instances and the inside partitions and walls were destroyed, but this was merely superficial damage which can be repaired at slight cost. The steel frame structure with concrete floors stood the earthquake test, but where the fire got inside, were licked clean of all woodwork. In the Marunouchi district these buildings have suffered only superficially, while in Nihonbashi and other districts swept by the flames they were gutted and left bare, with the stone facings cracked and melted by the intense heat. Examples of these buildings are the Marunouchi, the Nippon Yusen Kaisha, the Nippon Oil and the Tokyo Kaijo damaged only on the surface, while other buildings of lesser height came out uninjured. Of these, special mention must be made of the Tokyo Central Railway station and the Imperial Hotel. On the other hand many of the purely reinforced concrete type collapsed like a house of wood at the first severe shake. Examples of the failure of such structures are seen in the works of the Furukawa Electric Wire Works, the Nippon and the Tokyo Electric Companies, the Mitsukoshi Warehouse, and the unfinished Nagai Office building. The collapse in each instance was complete, burying many operatives under the ruins. It is difficult at this time to make any accurate statement as to the exact causes of these failures of buildings supposed to be earthquake proof, but at first sight the impression is gained that perhaps a weak concrete mixture coupled with inadequate steel reinforcement and general skimping of materials on the part of contractors lies at the bottom of their collapse. The Nagai office building facing the imperial palace on Babasakimon, would seem to indicate insufficient cement in the concrete mixture, as everything above the second floor crashed inwards, carrying concrete pillars, floor beams and floors with it, burying at least two score of workmen under a mass of *débris* two floors deep. The illustrations of these structures will help to convey some idea of how this class of structure stood the test. On the other hand, there were other large purely reinforced concrete buildings which admirably stood the quake to be later cleaned inside and out by the fire, leaving only the concrete shell.

To the layman, the first impression, one that has always been in our mind, is that the three to four story steel frame structure is the ideal type for an earthquake country like Japan, and the examples of such buildings which stood the test seems to confirm this impression. The Tokyo station came through without a crack. This is a heavy steel frame structure of three stories with a great floor area, and faced with brick. It was built in 1913 some years before the more modern and higher type of steel frame buildings were planned. In the same way, the Mitsubishi head office buildings of three and four stories adjoining the greater Marunouchi office structure came through the test without one brick being loosened on its facings or damage inflicted in its interior. The new three-storied Mitsubishi Bank across the street came through unscathed. The Imperial Hotel, however, stands as a monument to its architect and builder and fully vindicates his judgment. Perhaps no building in the world has been subjected to such scathing criticisms as the Imperial Hotel, the opinion being freely expressed that it would come tumbling down at the first real shake. Aside, however, from a very minor crack at one of the expansion joints, it suffered absolutely no injury and stands as the one safe harbor of refuge for the foreigners in a devastated city. With the exception of its central structure housing the grill room, theatre, and ball room, about five stories in height, the edifice throughout is of three rather low stories. The building superintendent (a Mr. Muller) improved on the original plans by insisting on about four times the amount of steel in the framing, and personally inspected every batch of concrete at the time it was mixed. The building is also on a floating concrete foundation and when the great shake came, it simply moved in harmony with a gentle smooth and even swing without shocks and jars. At any rate, the Imperial Hotel stands, in company with such buildings as the Tokyo central station and the Mitsubishi head offices, is a type that will undoubtedly appeal to the authorities as the standard for future construction.

The common opinion seems to be that the so-called sky-scraper of several stories has failed to stand the test, and although engineers may point with pride to the various good features of such structures, the people who have to work in them will have the last say. For the present at least, or until the people have forgotten their experiences, it will be difficult to induce men to accept positions in offices in these structures.

The extent of the damage to buildings in Tokyo may be gauged from the following list :—

### Kojimachi Ward

The Finance Department, Home Department, Government Printing Bureau, French Embassy, Board of Audit, Police Training School, Monopoly Bureau, Patent Bureau, Kojimachi and Hibiya Police Stations, Imperial Theatre, Metropolitan Police, Hibiya Grand Shrine, Central Post Office, Tokyo Electric Light Co., Central Telephone Bureau, Yurakuza Theatre, Yurakucho and Iidamachi Railway Stations, Kokugakuin College, Japan College of Dentistry, Kojimachi and Toranomon Girls' High Schools and Count Ii's residence.

### Kanda Ward

The Matsuya Department Store, Tokyo Gas Company, Commercial University, Chuwo Law College, Meiji University, Nihon University, Senshu University, Girls' Profession School, Tokyo College of Dentistry, all primary schools in the ward, and Kanasugi, Hamada and Inouye Hospitals, Nyudokan Variety Hall, five cinema halls, Manseibashi Station, Nishiki-cho Police Station, Meiji Kaikan Hall and Y.M.C.A. Hall.

### Nihonbashi Ward

The Bank of Japan Murai, Morimura, Tokai, Yasuda, Kawasaki, Daiichi, Daisan and Dai Hyaku Banks; Tokyo Stock Exchange and Tokyo Rice Exchange, Mitsukoshi and Shirokiya Department Stores, and Meijiza Theatre, Nihonbashi Club, Chugai Shogyo

Shimbun, 11 primary schools, Central Telegraph Bureau, and Hisamatsu, Horidome and Shimbabashi Police Stations, and Yanokura Hospital.

### Kyobashi Ward

The Hoshi Pharmacy, Chiyoda and First Mutual Life Insurance Companies, Takashimaya Drygoods Store, Jugo Bank, Hattori Watch Store, Asahi Shimbun, Jiji Shimbun, Kokumin Shimbun, Yorozu Choho, Yomiuri, Chuwo Newspaper Offices, Seiyoken Hotel, Kabuki Theatre, Department of Agriculture and Commerce, Shintomi Theatre, Communication Department, Tsukiji Naval Arsenal, and 16 hospitals.

### Shiba Ward

Shimbashi Station, Jikei-in Medical College, Railway Hospital and 18 hospitals, seven shrines, 48 temples, and Hamamatsu-cho Works of the Tokyo Municipal Electrical Bureau.

### Akasaka Ward

The American Embassy, Baron Okura's residence, Okura Fine Arts Gallery, and Yotsuya and Shinjiku tram cars sheds and two cinema halls.

### Koishikawa Ward

The Military Arsenal.

### Hongo Ward

A portion of the Tokyo Imperial University, High Normal School for Women, residences of Dr. Okano, Count Raiju Matsudaira and of Count Uyesugi, Hongoza Theatre and four temples.

### Shitaya Ward

The Iwakura Railway School, Uyeno Girls' High School and 11 other schools, Ichimura Theatre, Hino Hospital, three cinema halls, Uyeno Station, Shitaya Ward Office, Uyeno and Sakamoto Stations.

### Asakusa Ward

The Higher Technical School, 11 primary schools, 8 hospitals, 12 shrines, 4 temples, 4 police stations, Hanayashiki Garden, 37 theatres including cinema halls, and the entire quarter of Yoshiwara.

### Honjo Ward

The entire area including :

Three police stations, Military Provisions Department, the villa of Mr. Yasuda, Ekoin Temple, and 1 middle school.

### Fukagawa Ward

The entire area including :

Three police stations, the villa of Baron Iwasaki, Mercantile Marine School, Marine Products School and 10 other schools, Asano Cement Works and 12 large factories and all buildings of Susaki gay quarters.

In Yokohama, the following official figures of destroyed buildings are given out by the authorities :—

| | |
|---|---|
| Houses before the calamity | 93,840 |
| Burnt houses | 55,826 |
| Collapsed houses | 18,149 |
| Saved houses | 19,865 |

Detailed information on the population of Yokohama is as follows :

| | |
|---|---|
| Population before the calamity | 441,048 |
| Foreign residents | 7,492 |
| Population who lost home in the fire | 226,070 |
| Population whose houses collapsed | 87,118 |
| Population in the saved houses | 95,352 |

Nearly all the government offices are to be housed in temporary wooden buildings with galvanized iron roofs, pending the completion of plans and the appropriation of funds for permanent structures.

The new buildings will be concentrated at Otemachi, covering a gross area of 65,000 *tsubo*, at a total outlay of ten million yen. The offices will each measure 48 feet in the front, and be intercommunicable by means of verandas. The government intends to adopt soon two important measures for the benefit of Tokyo public, one of them being assistance in the reconstruction of hospitals and the other the re-inforcement of police forces in Tokyo.

More than 100 leading hospitals were destroyed in the recent flames together with large stocks of medical stuffs, tools and implements.

For the next few years Tokyo and Yokohama, in fact, all the towns in the devastated area will revert to primitive barrack communities hastily constructed of wood and galvanized iron, calling for immense quantities of timber and roofing.

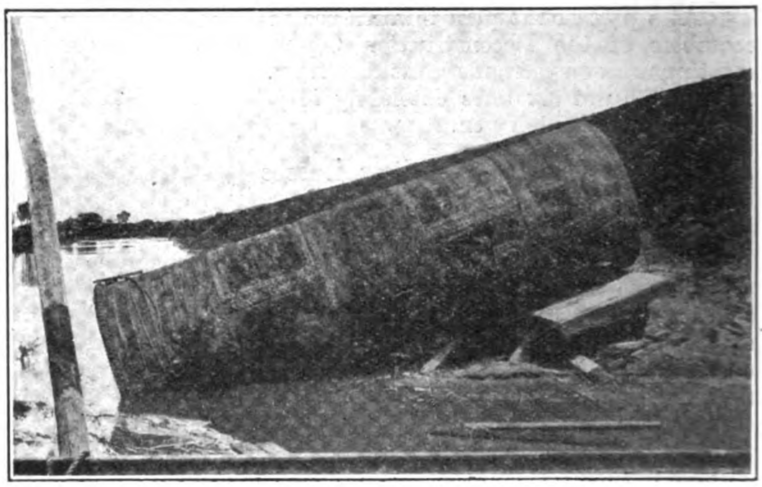
Barrack villages and towns, each housing from 3,000 to 10,000 refugees, are appearing in various parts of Tokyo and Yokohama. In Tokyo alone, there are enough barrack sheds for 150,000 persons already, and more are being put up, it is said.

According to the present plans of the Tokyo municipal officials, in most of these barrack villages or towns, the refugees are to be asked to organize public health, fire, and night patrols and to exercise self-government as far as possible.

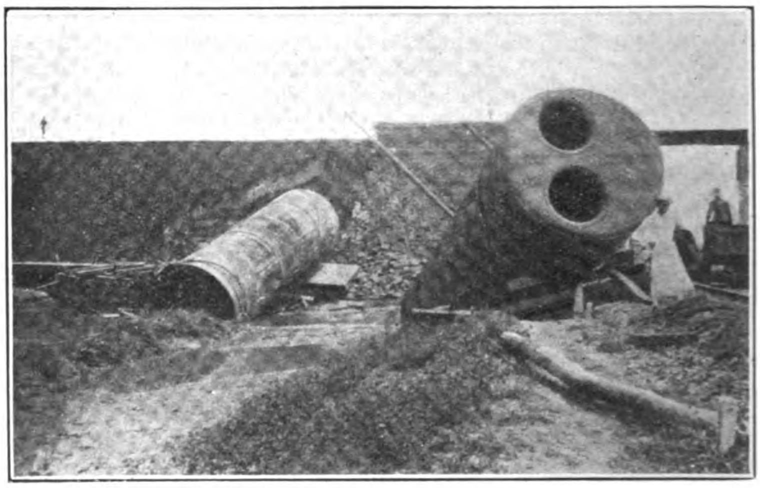
Schools, nurseries, and public bath houses are also planned for these communities. Some of the larger barrack communities are located in Shiba Detached Palace premises, Shiba Park, Hibiya, Ueno, Kudan, and the Meiji Shrine premises.

## The Force of the Wind

During the big typhoon, which occurred early in August of this year, several freak incidents took place. In the northern port of Chinwangtao a great deal of damage was done to both life and property. Five inches of rain was recorded in less than twelve hours, flooding the city and surrounding country, including the Liu Chang Coal Mines some thirteen miles north of the port.



These same mines had just received a shipment of two Lancashire type boilers from Davy Brothers, Ltd. of Sheffield, purchased through their Shanghai agents, The Representation for British Manufacturers, Ltd. The boilers, just landed at Chinwangtao, had been loaded onto flat cars and run on a siding to await an



engine to be hauled to the mines. They never got any further, that is to say along the railway, for the fury of the elements caused the road bed to be washed out and the gale, running 150 miles an hour, lifted the boilers, cars and trucks off of the track and deposited them in a near-by rice-field.

# Japanese Silk Production

*By J. S. M. Ward*

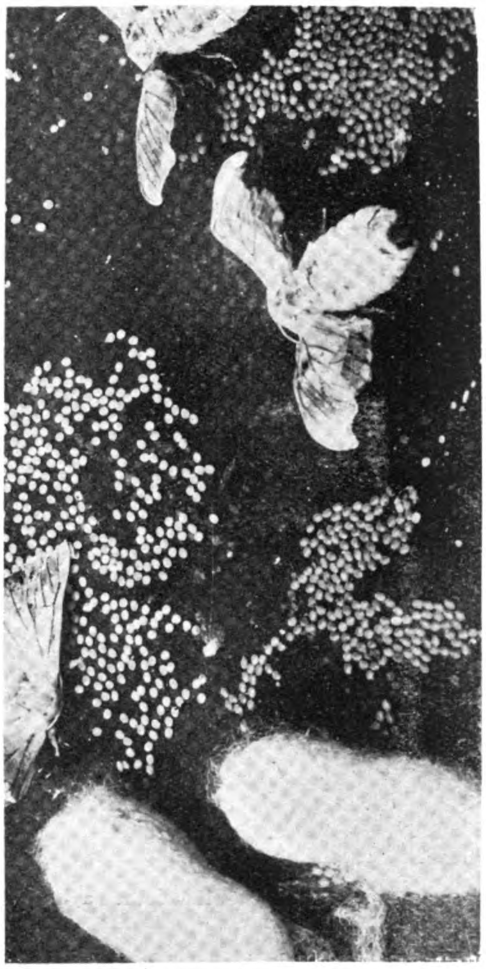
Silk Worms Feeding

THE general method of sericulture is the same throughout the world. The food of the silkworm is of course the mulberry, but in the East special types of mulberry have been cultivated for generations, as the success of silkworm raising is largely dependent on the food supplied. The soil in which the mulberry grows, and the age and condition of the tree, are important factors. It is found in practice that as a rule an elevated position with a dry and well-drained soil produces the best quality leaves.

The eggs are usually hatched by artificial heat just when the mulberry leaves are ready for the feeding of the larvæ. These eggs are very small, about 100 of them weighing a grain, and a large number of worms may at first be kept in a small space, but they grow rapidly and must be transferred to fresh trays every few days. Pieces of paper with small holes punched in them are placed over the trays where hatching is proceeding, and as soon as the worms burst their shell they creep through these openings towards the light, and thereby scrape off any fragments of shell which adhere to their skin. These fragments if not thus removed would kill them by constriction. The rearing-houses in which they are kept must be well lighted, ventilated, and clean, and so far as possible the temperature must be controlled. A variation in temperature of from 68 degrees to 78 degrees F. does not injure the worms, but a higher temperature is very destructive. On the other hand a lower temperature retards their growth and development, but their health and vigor are increased and the cocoons they spin are much bigger in proportion. The worms increase in size with great rapidity, and their appetite is enormous. They cast their skins three or four times after hatching, and when the moulting period approaches they gradually cease eating, and at such periods they have to be left undisturbed and in quiet.

When they are mature and ready to undergo their transformation into the pupa condition they eat no food and begin to crawl up the brushwood branches provided for them, and spin their cocoons. It is at this time that they need much attention. If they crowd together two worms may spin together and so interlace their threads. From these double cocoons only a coarse and inferior thread can be obtained. The insects take three or four days to complete their cocoons, which, after an interval of two or three days, are collected, the pupa being killed in order to prevent them developing further and bursting their shells. Those cocoons which are selected for the purpose of producing fresh eggs are freed from external floss and preserved at a temperature of from 66 degrees to 72 degrees F., and after a lapse of about 11 to 15 days the moths begin to appear.

The spinning of the silk from the cocoons is done by somewhat primitive methods in Japan. The first step is to separate all cocoons stained by the premature death of the chrysalides, pierced cocoons, and any other imperfect ones. These are put aside for spun-silk manufacture. The uninjured cocoons are sorted into classes according to color, size, and quality of fibre. On the successful carrying out of this process depend the uniformity of quality, and evenness and regularity of the fibre. The natural gum of the cocoons is then softened. The ends of the filaments must be caught and laid together during the process of unwinding, so as to form a single uniform rounded strand of silk. As the reeling proceeds the reeler has to watch the thickness of the strand, and introduce new cocoons to replace those from which all the reelable thread has been removed. In this manner a uniform fibre of indefinite length is produced.



Silk Moths, Eggs and Cocoons

## The Human Factor

The skill of the Japanese, whose trained eye and delicate touch produce a raw silk of remarkable smoothness, more than counterbalances the somewhat primitive character of the machines they use.

The manufacture of silk has been a leading industry in Japan for many years ; indeed, it is difficult to find a time in Japanese history when silk was not produced and manufactured in Nippon. The industry probably was introduced from China, like most of the arts and crafts of Japan.

Naturally, in those early days, it was made on hand looms, and even to-day hand looms are far more numerous than machine looms. In 1908, out of a total of 783,155 looms, 745,525 were hand looms and only 37,630 were machine looms. Since then the tendency has naturally been to increase the number of machine looms, but the number of hand looms has not substantially decreased, although it has fluctuated. In 1917, out of a total of 849,836 looms there were still 671,263 hand looms, which is only a very small decrease. On the other hand, the number of machine looms had increased nearly fivefold, and the total in that year was 178,573. In 1908 the total output of woven silk goods of pure silk according to official Japanese statistics was worth £9,955,552 (99,555,518 yen), whereas in 1917 the value was £21,972,290 (219,722,896 yen). The production of mixed silk and cotton goods had risen in value from £2,468,991 (24,689,907 yen) in 1908 to £4,598,228 (45,982,274 yen) in 1917. The industry is largely operated by female labor, more than eight-ninths of the employees being women. This is due to the fact that in a large measure it is still a home industry, and the women work the hand looms in their own homes.

## Supply of Raw Material

Sericulture is also a very old industry in Japan, and is still in a flourishing condition. Both in quantities and value pro-

**Silk Moths Laying Eggs**

**Silk Worms Just Coming out from Thin Eggs**

duction has greatly increased. Whereas in 1908 the value of raw silk produced was £14,866,267 (148,662,670 yen), in 1916 it was £32,255,166 (322,551,660 yen). The export trade has also grown very rapidly. In 1908 32 per cent. of the output was consumed at home and 68 per cent. was exported, in 1920 23 per cent. was consumed at home and 77 per cent. was exported; or, in other words, raw and waste silk to the value of some £26,700,000 (267-000,000 yen) was exported. At the same time the amount of wild silk imported rose nearly fivefold, the total in 1918 being no less than £750,000 (7,500,000 yen) worth, but it should be mentioned that this was an unusually large importation, the previous year's imports being worth only £250,000.

Cocoons are also imported in large quantities, the value of the 1918 imports being over £300,000 (3,000,000 yen), but that was a phenomenal year, when silk rose in value throughout the world; the previous year's imports were worth only about £133,334 ($1\frac{1}{3}$ million yen).

It should be noted that silk is still largely used in the bulk of the people's clothing, although it is slowly giving way to cotton and cheaper goods among the working classes, and with the increased use of European costume it is no longer a *sine qua non* for festivals, as it was a few years ago.

From the point of view of the outside world, the side of the silk industry of greatest interest is the export trade, which has certainly shown a most remarkable development in recent years. In considering the export figures it must be remembered that the value of everything has increased at least twofold, and more in many cases.

**Feeding Silk Worms**

Brushing Eggs off the Paper

The export of silk (Noshi and Kibiso) in 1912 amounted in value to £1,500,000 (10,500,000 yen), and in 1918 to over £2,700,000 (27.000,000 yen). The two countries which took the bulk of these goods were France and the United States—France importing nearly £1,300,000 (13,000,000 yen) worth, and the United States £1,150,000 (11,500,000 yen) worth. Raw silk exports rose in value from £15,030,000 (150,300,000 yen) in 1912 to £27,030,000 (270,300,000 yen) in 1918. By far the largest buyer was the United States, which in 1918 purchased £33,867,000 (338,670,000 yen) worth, France coming second with £4,160,080 (41,600,800 yen) worth, and the United Kingdom third with £729,400 (7,294,000 yen) worth. Sales of silk tissues (*habutae*) to foreign countries increased tremendously. Whereas in 1912 their total value was only £2,230,000 (22,300,000 yen), in 1918 it was over £7,000,000 (70,000,000 yen), Great Britain being by far the biggest individual purchaser. In 1918 she took over £2,200,000 (22,000,000 yen) worth, the United States coming second with £1,670,000 (16,700,000 yen) worth.

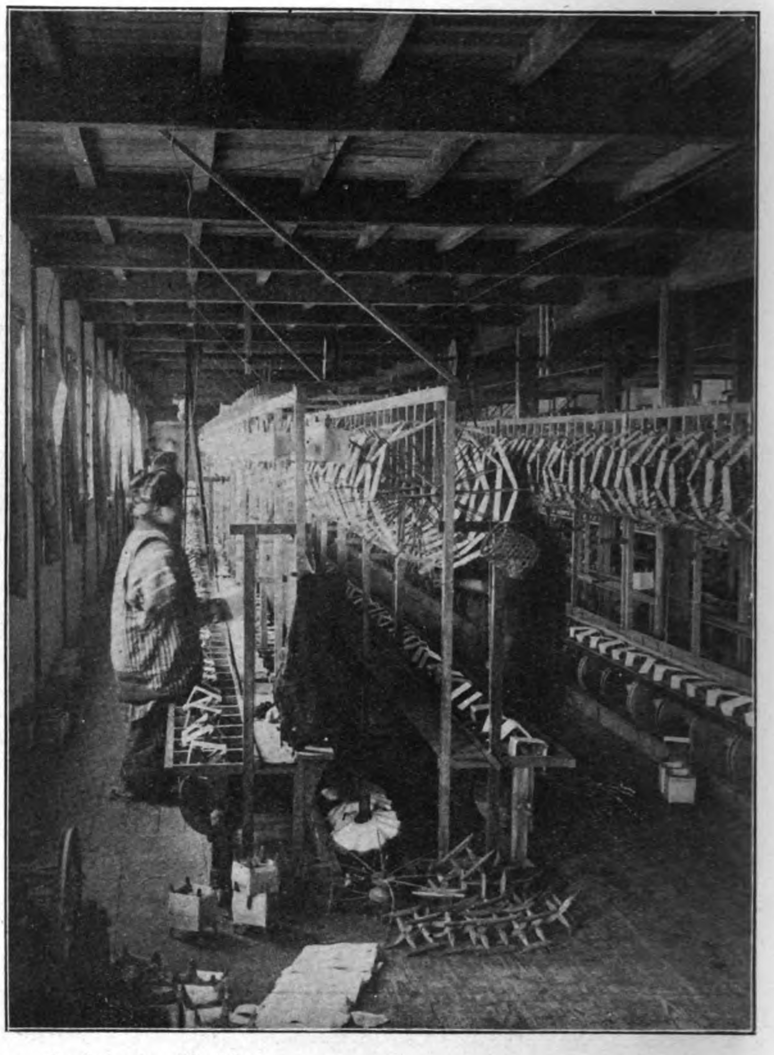
## Handkerchief Trade

Of considerable importance is the development of the manufacture of silk handkerchiefs, which in 1912 were exported to the value of £470,000 (4,700,000 yen), a figure which rose in 1918 to £898,000 (8,980,000 yen). Here again the United States was the biggest purchaser with £300,000 (3,000,000 yen) worth, followed by Great Britain with £110,000 (1,100,000 yen) worth. But it must be borne in mind that the Japanese yen in 1918 was rapidly appreciating in value, and the sterling equivalent was greater at the time. On the whole, summarizing the position before the trade slump set in, it can be asserted that the silk industry in Japan had developed steadily in every direction. Some of the increase in output value was no doubt due to the actual intrinsic value of the goods, and does not necessarily imply a huge increase in exports; but it must still be remembered that the peak of the boom was not reached in 1918, but in 1919.

The year 1919 witnessed a period of unusual activity in the Japanese export trade in silk. It is true that the first half of the year was comparatively dull owing to the reaction that followed the prosperous times during the close of the war. This was particularly the case in special kinds of silk textiles, but after April in 1919 the demand for Japanese silk textile fabrics increased steadily in the United States, Canada, Australia, and India. On the other hand, exports to Europe decreased owing to the continuous depreciation in the exchange rates of those countries, which naturally affected Japan's trade with Europe, for the Japanese yen by this time was becoming one of the most appreciated monetary units

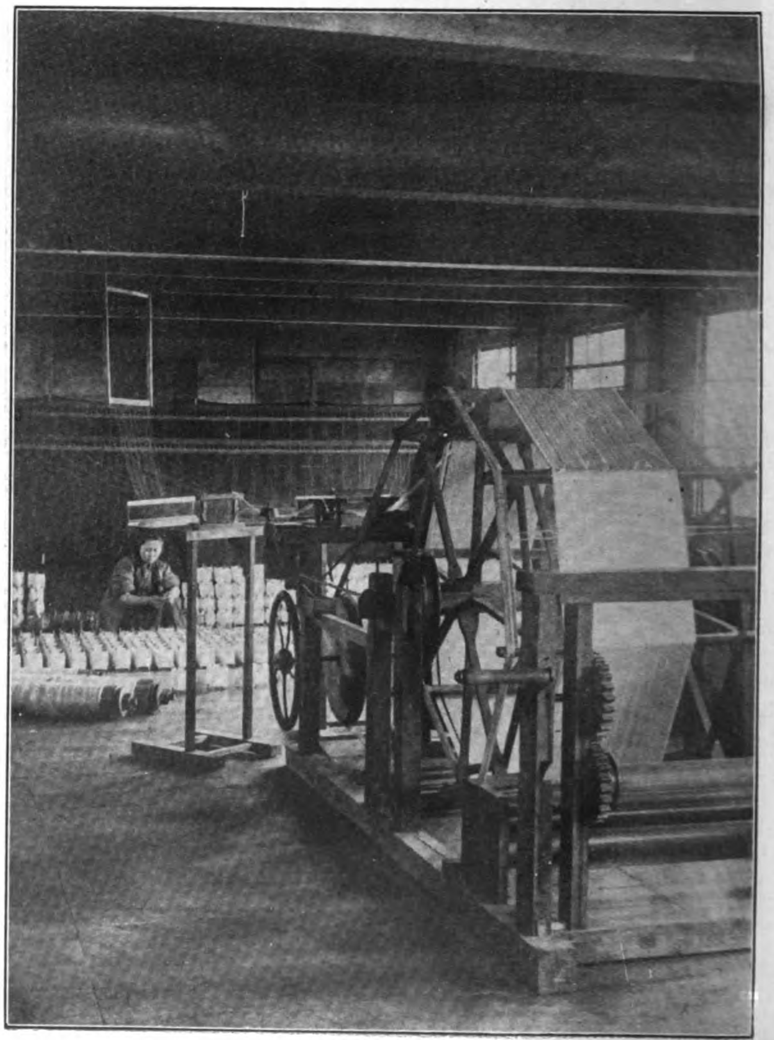
Picking out False Cocoons

A Silk Filature

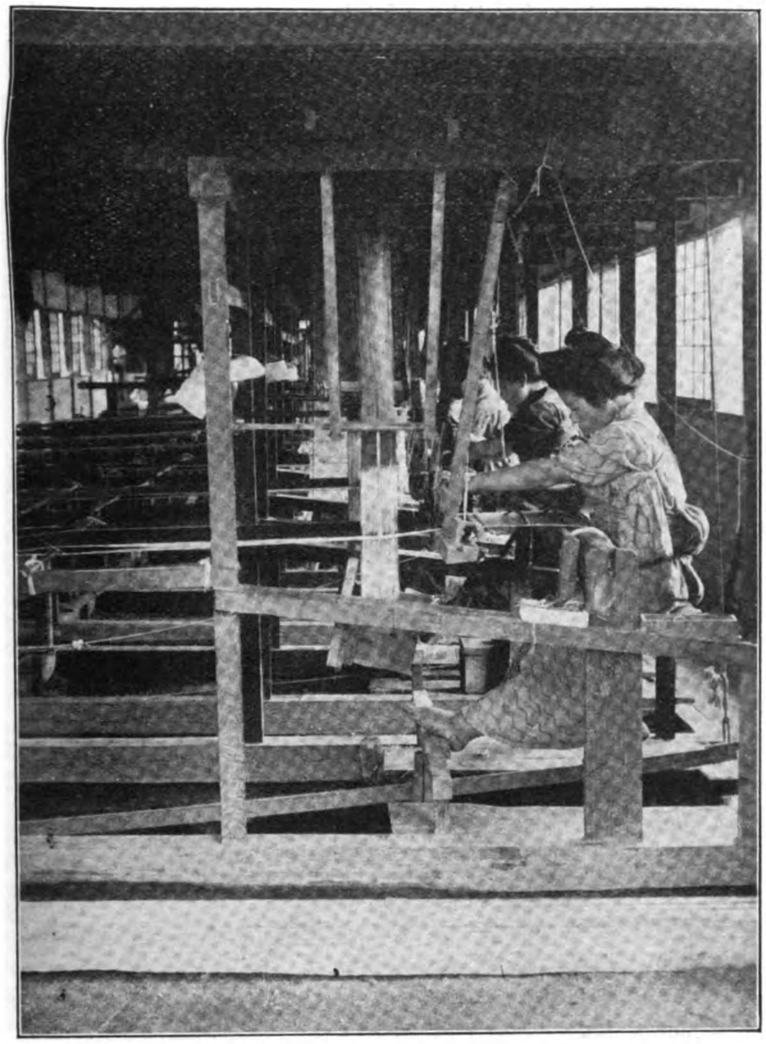


Winding Silk on a Tube by Means of a Spinning Machine

Preparing Silk for Weaving



Reeling Silk by Machine



Improved Loom for Silk Weaving

in the world. The huge increase of exports to North America, however, more than compensated for the loss incurred on account of the decrease in the exports to Europe, and this, coupled with a constant rise in the market price of silk yarns, added to the almost unprecedented figures in this class of Japanese exports. The staple industry, therefore, during 1919 attained a remarkable development, particularly in the Ishikawa and Fukui prefectures, which are important centres of the *habutae* industry. In the Fukui prefecture alone the production was between 40,000 and 65,000 rolls in each of the first four months of the year and increased to over 100,000 rolls in July and August. In Ishikawa output expanded from 50,000 rolls a month in February and March to about 85,000 rolls a month in September and October. It was during the late summer and early autumn of 1919 that the export trade in *habutae* reached its maximum, and this boom, coupled with a continued advance in prices, was reflected in the enormous trade returns.

Thus in the eleven months ended November 30 exports of *habutae* amounted in value to £7,586,847 (75,868,470 yen), and these figures represented shipments through the port of Yokohama only. During the same period the export of other silk manufactures amounted in value to £2,070,000 (20,700,000 yen) of "Chirimen" silk, £2,160,000 (21,600,000 yen) of other silk textile fabrics, and £600,000 (6,000,000 yen) of silk handkerchiefs, making a total of over £12,430,000 (124,300,000 yen). This figure was an increase of £2,365,000 (23,650,000 yen) over the similar figure for the same period of the previous year.

The opening weeks of 1920 still found the boom in progress, but very soon Japanese manufacturers in every industry began to experience difficulties with labor. Indeed, trouble had commenced in the previous year, but now was rendered more serious by the gradual development of the trade slump. In the main the silk industry does not seem to have suffered so severely as some of the other industries, notably the cotton industry, in Japan, but nevertheless it has been affected.

## Made in the Home

A notable feature, as has already been pointed out, is the considerable amount of silk which is produced under the domestic system and the bulk of the silk goods consumed in the country is still made in homesteads. In the silk industry, particularly, silk reeling and weaving form subsidiary occupations for farmers and their families, but the statement that the cottage industries are carried on by the farmers' families requires some modification, because in many cases the families of the poorer classes in the towns also play their part.

The silk industry is pre-eminently one in which women and young girls are employed, and wages on the whole are comparatively low, even in factories organized on western lines. Thus, for example, in pre-war days in the dyeing and weaving trades silk filature women workers received an average of only 28 sen (6½d.) per day, and men 40 sen (9½d.) per day, these rates ranking among the lowest wages paid in the dyeing and weaving industries. After wages had risen in November, 1918, women workers in the silk filature only obtained an average wage of 57 sen (13½d.) per day, and in spinning 54 sen (13d.) per day was the amount paid as a rule; the wages for men were 64 sen (15¼d.) per day for filature, 82 sen (19½d.) per day for spinning, and 83 sen (20d.) per day for weaving, women weavers receiving as a rule 54 sen (13d.) per day or less.

In Tokyo men filature workers might obtain as much as 1 yen 70 sen (3s. 5d.) per day, whilst the lowest daily wage was 20 sen (5d.). Of course it must be understood that the higher wage is paid only for men of special ability, and, taken on the average, filature silk workers were paid lower than any other type of men workers.

Putting the situation briefly, it may therefore be said that in the silk industry wages are low, even for Japan, and this in part is due to the fact that the bulk of the silk industry is still carried on as a subsidiary industry, and is not the sole source of income of those employed in it.

## Quality of Labor

Certain facts with regard to the labor situation in Japan strike the observer. First, labor is very plentiful, and in consequence labor-saving devices are conspicuous by their absence, and a large number of operations are done by hand which could undoubtedly be done more expeditiously and cheaply in the long run by machinery. One reason for this is that the high cost of installing machinery would involve a heavy initial expenditure, which means, of course, that the industry is held back by lack of capital, though to a certain extent the large profits made during the war have enabled Japanese industrialists to put more capital into their businesses than in the past. On the whole, it must be admitted that the efficiency of the labor is low, but undoubtedly in the last quarter of a century, there has been a distinct improvement in the quality of work, as well as in the amount of wages.

In considering the quality of Japanese labor, certain outstanding features are apparent at once. The average Japanese worker, though short, is strong and well-developed, and works very long hours at a stretch. This natural sturdiness he no doubt inherits from his peasant ancestors, but it has been noticed that the yearly records drawn from Osaka give a very low average of military "fit" men, which would indicate that industrial conditions in Japan tend to decrease the sturdiness of the population. Formerly in the mills there is no doubt that matters of hygiene were much neglected, but a great improvement is taking place at the present time.

The Japanese, on the whole, are skilful with their fingers, but their talent does not appear to help them much in factory work. They are undoubtedly docile as a rule, and will work long hours without complaining, but this is coupled with a lack of interest in the work almost amounting to apathy, which results in indifferent work. Although apathetic, the Japanese worker is, as a rule, a cheerful person, strange as this may seem, and can be quite contesnded and happy despite drudgery which would be almost in upportable to a European. The long hours of Japanese workmen are discounted by their inability to concentrate. They are very quick to learn, and workmen taught a particular task soon acquire a very fair degree of skill; but their employers complain that they require constant supervision or they become careless. As a result, the workmen get better results from simple rather than in-

tricate machinery, and their skill is seen best in their talent for reproduction down to the smallest details.

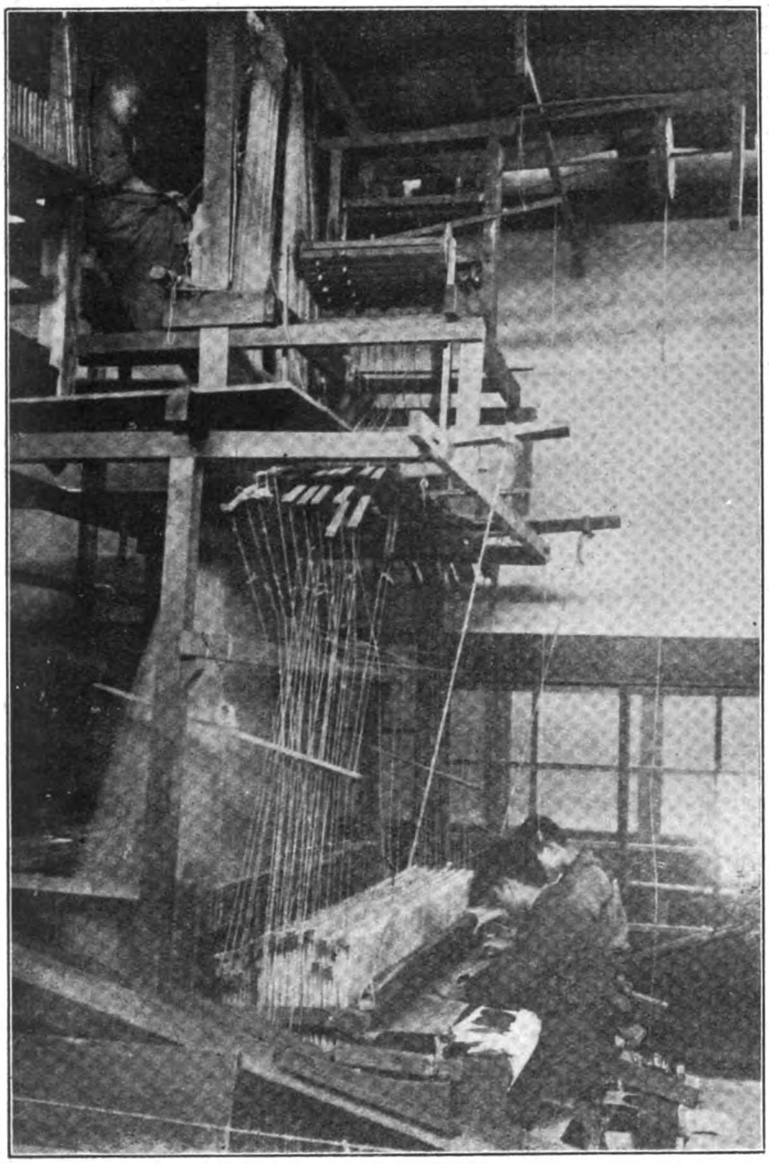
## Improvement in Quality

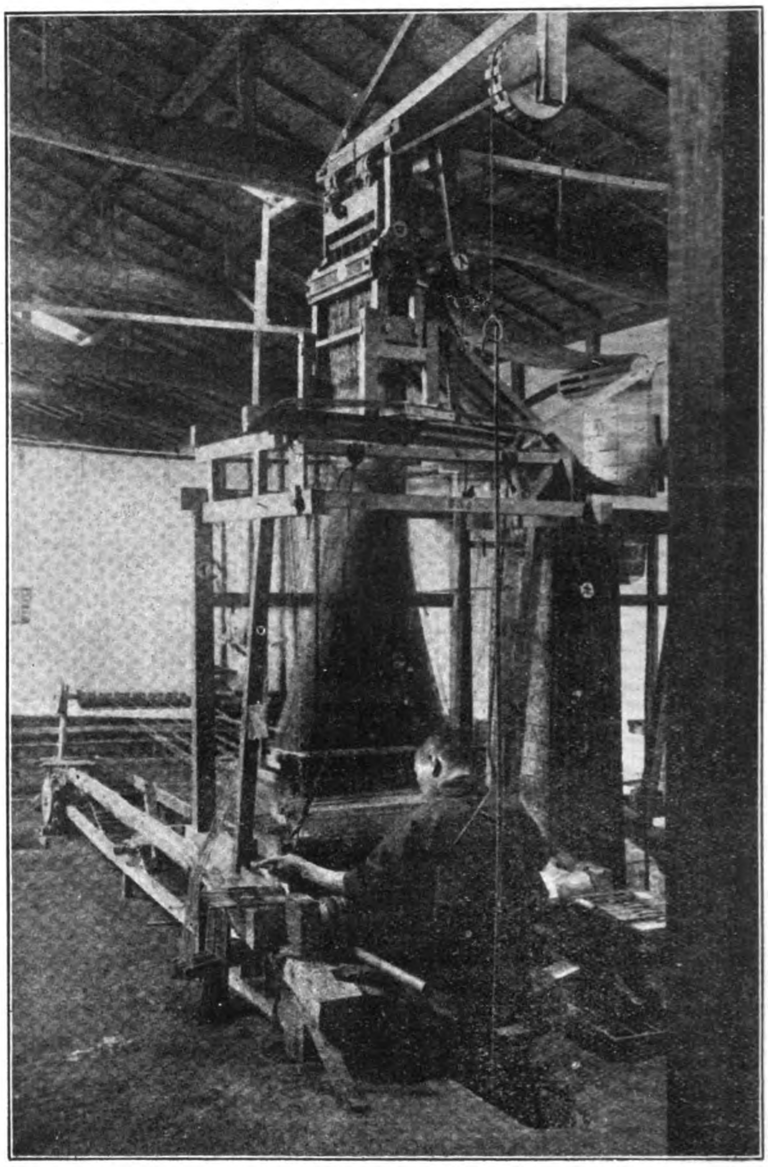
Yet Japanese workmen are distinctly excitable, and storms arise very suddenly. Once the trouble is allayed it subsides as rapidly as it arose. Much has been written about the intelligence of the average workmen, and in many industries it must be recognized that it is not of the highest. Careful observation indicates that, under suitable conditions, the average workmen can develop very considerably, and this is shown in the steady improvement in the quality of Japanese goods. In particular, it has been found that the firms who have adopted more up-to-date methods and treat their workmen best undoubtedly gain considerably.

One feature which cannot be ignored is the extraordinary amount of carelessness noticeable in many Japanese workmen. Accidents caused by pure carelessness are exceedingly frequent, and although nine-tenths of this carelessness is probably due to ignorance, indifference seems to play a larger part than one would expect. The Japanese are, of course, more stoical than the average European ; their military training has inculcated in them the belief that their lives are of no great importance, and suffering is meant to be borne. This, while it makes them excellent soldiers, renders them, perhaps, less careful than the average western worker would be. Incidentally, the Japanese workman gives little thought to the careful treatment of his machinery.

## Period of Transition

The industrial situation in Japan is at present passing through a period of transition. Forty years ago the factory system was unknown, but since then it has rapidly developed and, in particular during the last five years, great progress has been made. The consequences are naturally mixed. Some are good and many, unfortunately, are bad. Endowed with a plentiful supply of cheap labor, Japan has tended to devote her attention to the production of cheap goods. At the same time, as plentiful labor means low wages and low wages mean poor work, these goods were often of poor quality. Though the supply of labor is large, skilled labor in every industry is scarce ; but this factor is not so noticeable in the silk industry as in many others, due to the fact that there has been a persistent tradition of craftsmanship passed down through generations. Indeed, one of the reasons why the domestic production of silk





Silk Weaving Machines

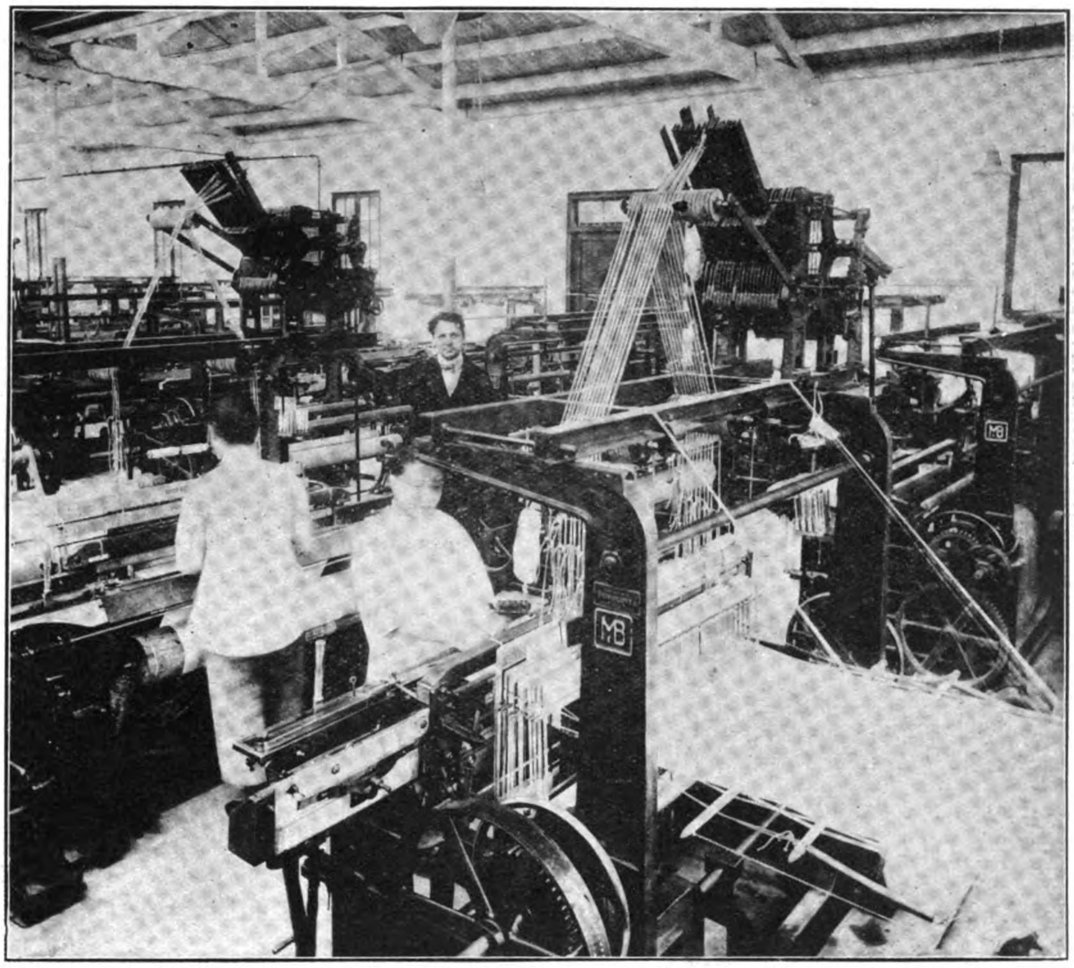
manufacture has been able to hold its own, in spite of increasing competition from machine-produced silk goods, is undoubtedly dut to the greater skill evinced by many of the producers. Recene tendencies point to a steady improvement even in factory-produced silk goods, no doubt due to the fact that the industry has now established itself on sound lines, and the proportion of skilled labor is steadily increasing. In factories the Japanese worker expects to work long hours, 10 to 12 on an average, with few holidays, and during the war most factories worked overtime. In the home industries long hours are also the rule, but they are more broken up, the industry being more in the nature of a second task, when farming or domestic duties are not employing the women.

## Cost of Living

The standard of living in Japan is not high and the bulk of the employees depend almost entirely on rice seasoned with a little dried fish and some fresh or pickled vegetables. Fresh fish and meat are as a rule beyond their means. Often as they cannot afford rice alone, they perforce mix rice and millet or wheat and millet.

The steady rise in the cost of rice has hit the Japanese workmen very hard and between 1916 and 1919 the cost of the staple article increased fully threefold. It was due to this tremendous increase in the cost of living that Japanese employers were faced with a number of strikes in the year 1919-20 and with considerable social unrest. This resulted in large increases in wages, in many cases amounting to two or three times the pre-war rates, but even then it is doubtful if the workmen were as well off as before the war.

At the present time the trade slump naturally affects the silk industry, though apparently not to the same extent as the cotton industry. There is no doubt, taking it on the whole, that the silk industry is one of the most stable in Japan and is in a better position than almost any other industry to carry on an export trade. There is a very steady demand for Japanese silk goods throughout the whole world, not only in Europe, but more particularly in the states. In certain cases in the United States it has been found cheaper to buy silk shirts than flannel or even cotton ones. Most varied opinions have been expressed with regard to Japanese silk, but the true explanation appears to be that the quality varies enormously; while it is probable that the average is not so good from the point of view of strength as Chinese silk, it nevertheless meets with a ready sale. Some of the finest silk meshes produced are in great demand, particularly in the Middle East, Burma alone taking large quantities which are used for the most part as scarves by the Burmese women, and, of course, there is the steady demand for various Japanese silk products in the United Kingdom.

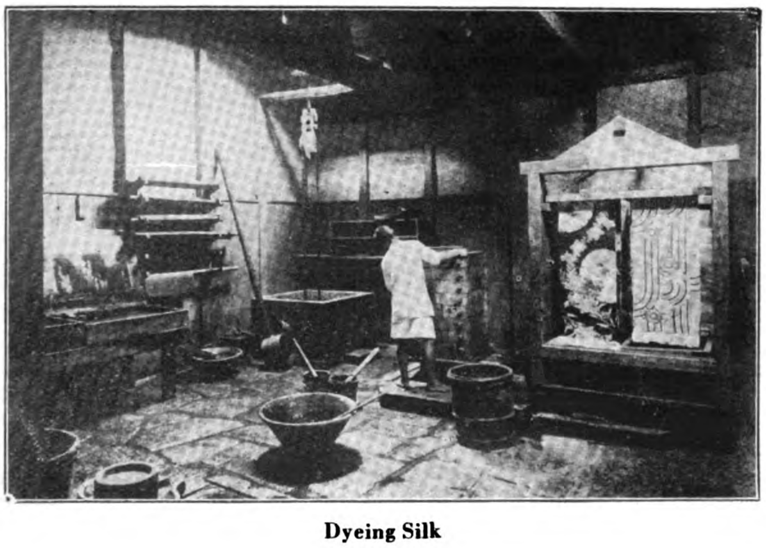


Modern Silk Weaving Machines are fast taking the place of hand labor

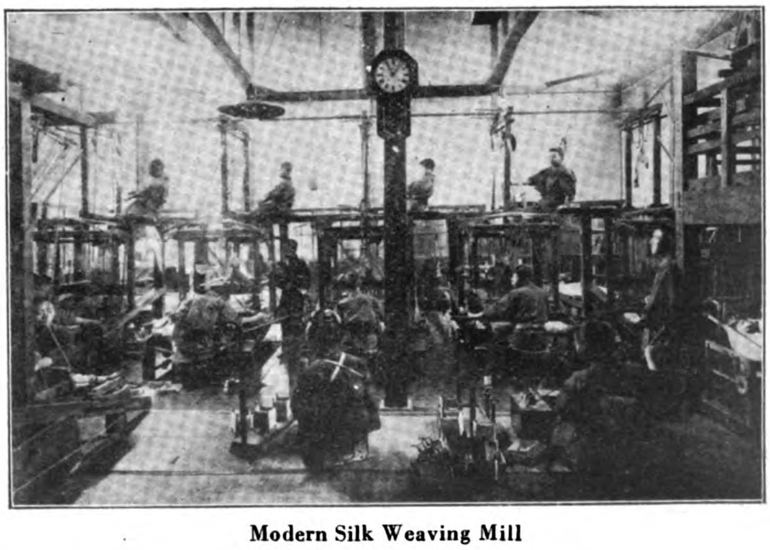
## An Ancient Craft

A factor which must be borne in mind in considering the silk industry is, as has been pointed out, that for centuries it has been a native craft and there are long years of experience behind the workers. This differentiates it entirely from the wool or cotton industries, which are of modern growth and for the most part organized on factory lines. The skill and knowledge acquired by generations of silk producers and manufacturers cannot fail to benefit the modern Japanese silk factory. It is in a position to obtain comparatively cheap labor which is at least semi-skilled, therein being in a happier position than the cotton mills.

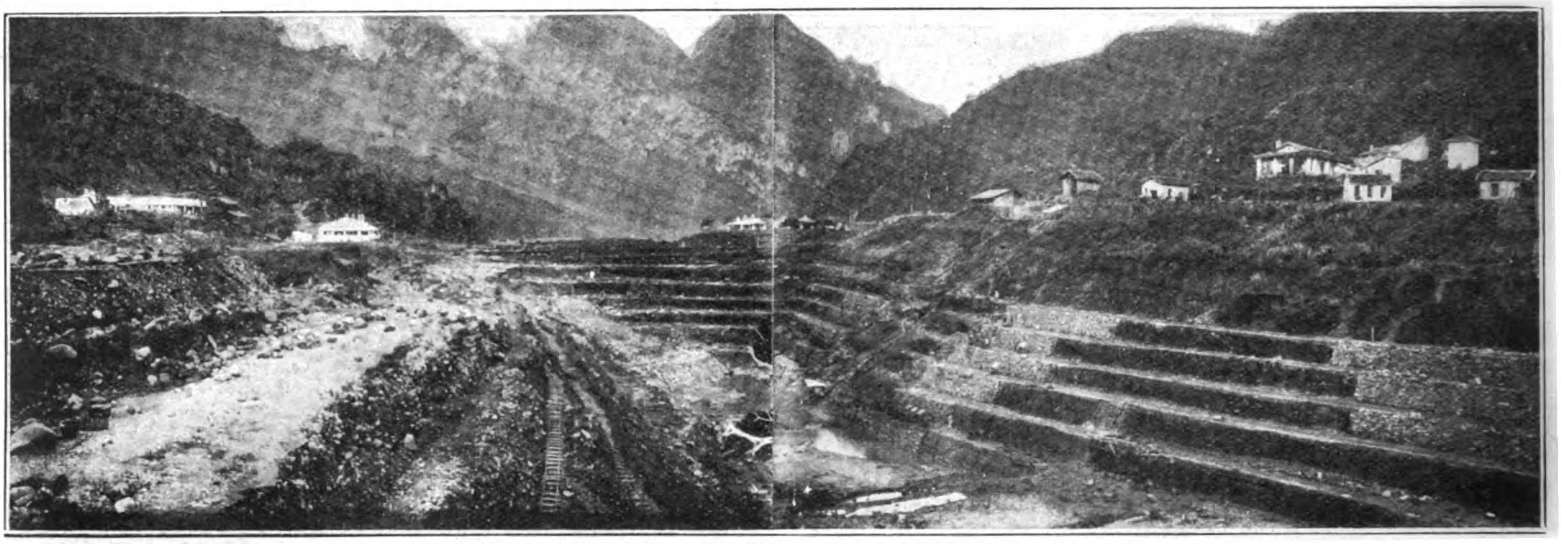
With regard to the future of the industry, it is difficult to prophesy, but there is little doubt that even during the slump Japan will continue to sell large quantities, for, everything considered, her prices are still comparatively low and the quality of her goods satisfactory. Further, as a supplier of large quantities of raw materials she is a most important factor in European silk manufacture, France alone taking large quantities of silk from her, despite her own home-produced supplies. British firms will watch with sympathetic interest the transformation of this age-old industry into a modern factory system, and it appears as if it was being effected in a satisfactory way. Yet it is probable that for many years the domestic side of the Japanese silk industry will continue to flourish and the peasants produce goods of higher quality than most of the factory-made materials.—*The Times.*



Dyeing Silk



Modern Silk Weaving Mill



Open Cut Tin Mines at Tinh-Tuc.

# The Mines of Indo-China

## Written by the Mines Department of the Indo-Chinese Government

*(Continued from September issue, page 612)*

### III.—Mines of Tin and Tungsten.

GENERAL.

(*a*) SITUATION OF THE MINING AREA.—METHODS OF BRINGING THE ORE DOWN.

The tin and tungsten mines of Tonkin are to be found in the granite group of mountains of Pia-Wak about six miles to the west of Nguyen-Binh and 35 miles from Cao-Bang. From the delta to Na-Cham is 112 miles by rail, whence there are 95 miles of motor road to Nguyen-Binh via Cao-Bang, followed by 7 miles of mule-path to Tinh-Tuc and beyond. The ore is brought down by these means and the cost of this haul to Haïphong varies from 50 to 60 piastres per ton according to the mine.

(*b*) NATURE OF THE DEPOSITS.

The Pia-Wak group, the highest point of which attains 6,332-ft., consists of a thrust of granulite breaking through the old overlying schist, which is transformed near the points of contact into a very hard crystalline metamorphic rock, known as aphanite.

The thickest lodes, containing wolfram either in particles too small to be seen with the naked eye, or in lumps of about a pound, are to be found in the aphanite ; Cassiterite is generally found on the walls of the lodes. In the granulite the veins are small varying from 4 to 12-ins. in thickness, but sometimes in sufficient quantities as to constitute a "stockwerk."

The metal is also found in all kinds of alluvial soil from that lying on the flanks of the mountains down to the real alluvium of the valleys, where it is deposited in pockets.

The most important deposits are : lodes in the aphanite on the north and north-western slopes of the Pia-Wak Concession Saint-Alexandre) ; stockwerks in the granulite of the south and south-eastern slopes of the same mountain (concessions Robert and André) ; the alluvial soil in the valley of Tinh-Tuc at the foot of the northern slope and the moraines, actually exploited in the Beau-site and Ariane concessions.

(*c*) OLD CHINESE WORKINGS.

Prior to the French occupation the alluvium of the stanniferous Tonh-Tuc valley was actively exploited by the Chinese. The lodes of wolfram and cassiterite were also worked, but the Chinese did not know the value of the former and so left it and now modern miners are recovering it from the tailings of the old workings. In the old days the lodes were not much worked owing the hardness of the rock and to the difficulty of winning pure tin from the mixture of tin and wolfram found there. Even to-day with all modern perfections the metal obtained from the lodes contains but 98 to 98.5 per cent. of pure tin, whereas that from the alluvial pockets contains 99.5 per cent.

(*d*) RECENT EUROPEAN WORKINGS:—

The following table shows what has been done in 1921:—

It is well known that the wolfram mines enjoyed an exceptional prosperity during the war when this metal was in much demand and its price even touched for a moment in the United States ten times its pre-war value.

On the other hand no metal has been so hard hit in the after-war crisis as tungsten, for the output of the mines, four times its normal during the war, suddenly dropped to but a small amount as its price dropped considerably owing to the universal depression and the substitution of other metals for tungsten, as well to the discovery of large and easily worked deposits in the south of China. The price of wolfram in gold is now about half of what it was before the war.

For this reason the mines of the Pia-Wak are now confining their attention to tin, the price of which has also fallen, but not to so great an extent. The average price in 1921 comes out at £130 gold per British ton as against the pre-war averages varying between £133 gold in 1908 to £209 gold in 1912.

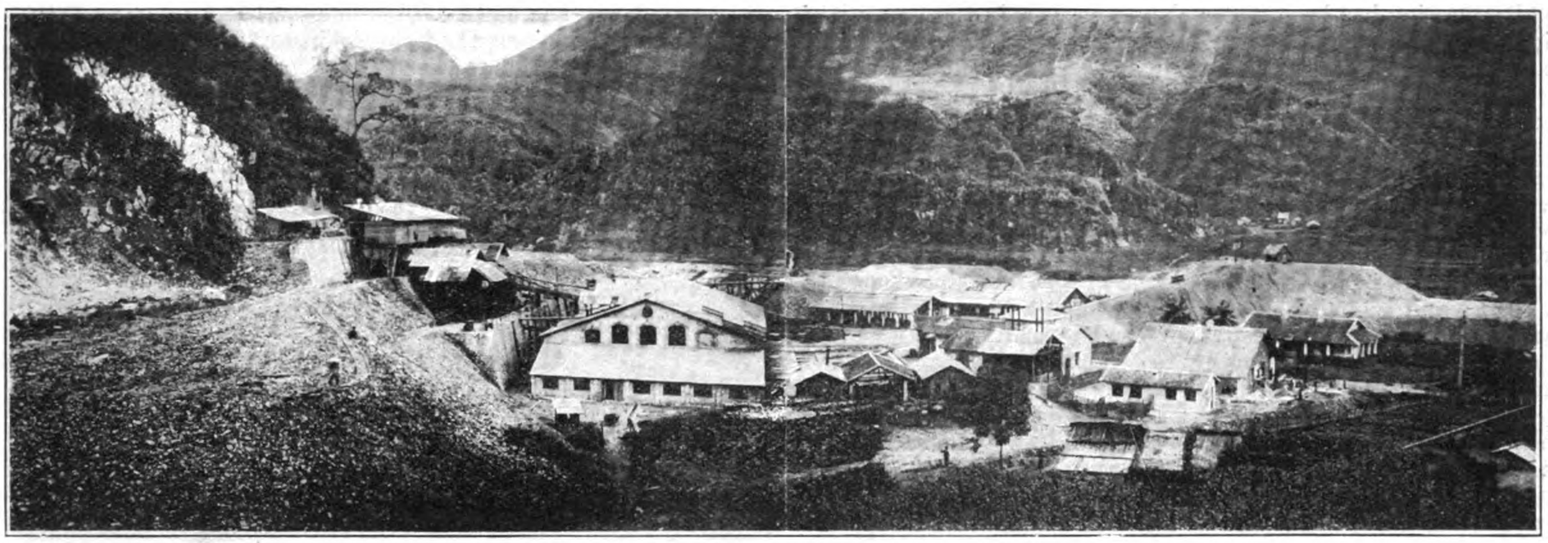
The chief workings are as follows :

SAINTE ADELE OR TINH-THUC MINE.

The Société des Etains et Wolfram du Tonkin, who up to 1919 had exploited lodes of wolfram in its Saint-Alexandre mine, restarted in November of the same year the working of the alluvium of the Tinh-Tuc valley, which had been suspended during the war. This alluvium is composed of blocks torn from the mountain side and embedded in a clayey and sandy mineral mass of cassiterite containing 4 to 5 per cent. of wolfram.

This soil extracted in open workings (15,700 cubic yards during March 1922) is passed through a washing plant, two-thirds of which is old-fashioned and cannot deal with more than 330 cubic yards per day, while the remaining third, being quite modern and only recently opened, can handle twice this amount. After being washed the ore is put through an electromagnetic separator and then is transported 17 miles—seven miles per pack-horse and ten miles per cart—to the furnaces at Ta-Sa which in 1921 produced 175 tonnes of metallic tin. Chinese furnaces have hitherto been utilized at these works, but a reverbatory furnace has just been installed.

The Company owns a 230-ft. waterfall at Ta-Sa producing at least 1,000 h.p. and has installed a hydro-electric station there with two 250 h.p. turbo-alternators, to which two more of the same size



Tinh-Tuc Mines—Mechanical Washing Shed and Annexes

will shortly be added. This supplies all the power required for working the mine, whither the current at 440 volts is carried by a 55-lb. aluminium cable.

### Beausite Mine.

The Société des Mines d'Etain du Haut-Tonkin is working in the lower part of its concession deposits in old landslides and in the upper part similar but less rich deposits as well as soil made up by the disintegration of the granite with the small lodes, it contained.

The simple methods of working and the extreme low cost of the same have enabled this mine to keep going when so many others have had to close.

### Various Deposits in the Pia-Wak Mountains.

The Ariane and Ganymede mines, recently closed, are in every way similar to their neighbor, the Beausite mine, just described.

The Société des Etains et Wolfram du Pia-Ouac Est are just keeping their mines on the northern and eastern slopes of this mountain (Robert and Minos mines) going.

## IV.—Other Kinds of Deposits.

Herewith a few notes on deposits which have been prospected.

### Argentiferous Lead at Ngan-Son.

Most of the zinc mines already mentioned contain lead ore which is more or less argentiferous, besides which lead has been located—very often associated with blende and iron pyrites—in at least forty places, in the neighborhood of most of which varying quantities of furnace slag has been found.

Of the old mines the most important and the best known—because they have been worked in recent years—are those which are to be found within a radius of three miles of the military post of Ngan-Son. This mining district is characterized by a mixture of crystalline limestone and old schists full of many faults marked by numerous Chinese workings, and the large heaps of slag, notably close to Ngan-Son, demonstrate the importance of the old workings. Further, the mine of Ngan-Son is mentioned in the annals of the court of Hue as being the most important silver mine in Tonkin. The attempt, made in 1889 to re-open the working failed on account of the insecurity of the district and the difficulties of transportation.

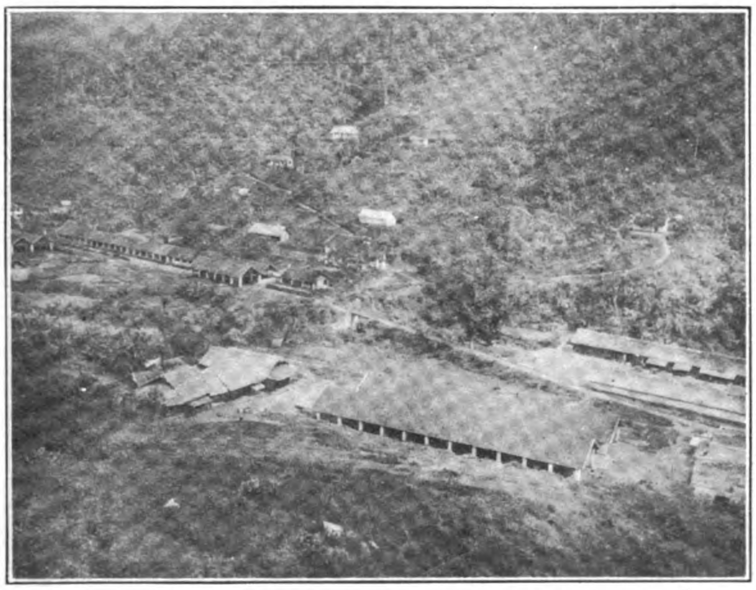
Since 1910 new and interesting discoveries have been made as the result of further searches. The ore has been found excessively rich in silver—in certain places up to 1 per cent. of the weight of lead—and is composed of galena blende, calamine, iron pyrites and accessorily of chalcopyrites, while the old workings are relatively very rich in blende, as the galena was carefully extracted, while the blende although containing as much as .3 per cent of silver per ton of zinc, was abandoned.

### Copper.

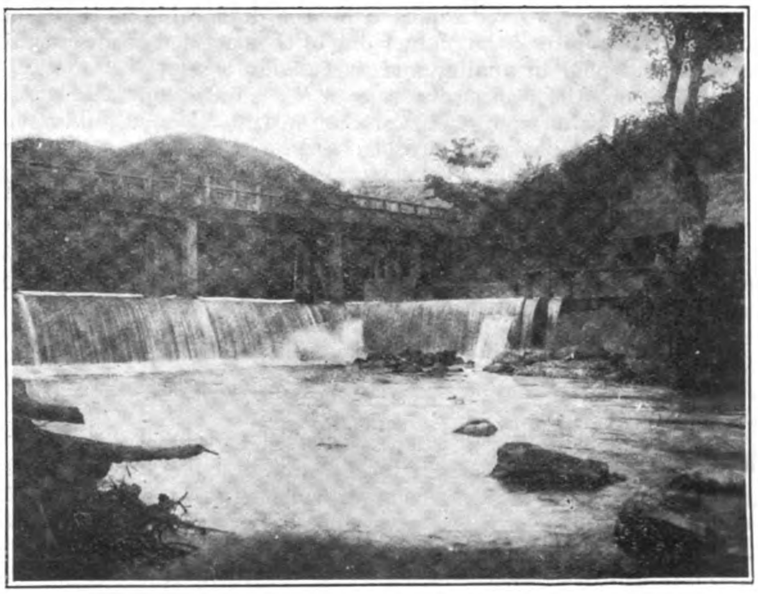
Copper in the form of lodes and lenticular deposits in malachite, azurite and phillipsite have been located, especially on the banks of the Black River and an attempt at working has been made at Van-Sai.

### Iron.

There is abundance of iron in Tonkin, but so far it has been worked on a small scale only and almost wholly by the natives, so that the importance of the deposits is as yet not fully known.



Chodien Mines—Railway Station at Banthi



Ta-Sa Dam

Prospecting has been undertaken, however, in the immediate neighborhood of Thai-Nguyen (Molinham, Monaluong, Cuvan, etc.) where there appear to be large quantities of very rich and very pure ore (hematite and magnetite, which in view of their favorable situation are worthy of attention by western metallurgists.

The conditions for starting an iron industry in Tonkin appear at first sight extremely favorable.

While it is true that a small improvised 15-ton blast furnace was lighted at Haïphong in 1919, using coke or a mixture of anthracite and charcoal in order to reduce local iron ore and was abandoned in 1921 owing to the few hundreds of tons it produced costing too high, yet it is obvious that such an attempt on so small a scale was in the very nature of things bound to fail, as iron smelting must be worked on a large scale and by technical experts. Anyway the time seems to have arrived when this question may be re-opened.

The cutting of a canal, which will be shortly commenced, along the northern edge of the delta thus establishing communication between the Song-Cau below Thai-Nguyen and the Song-Thuong near Phu-Lang-Thoung will enable 250-ton barges to reach Thai-Nguyen and so form a cheap water-way between this mining district and Haïphong as well as with the anthracite coal-fields of Dong-Trieu and Along Bay and the important deposit of fire-clay at Trang-Bach.

This canal would pass close to the iron deposits above mentioned as they are mostly to be found to the east of Thai-Nguyen, while on the other hand a mining railway, from six to nine miles long, would suffice to bring from Thai-Nguyen the coal and coke of the Phan-Me, Lang-Cam, basin, which recent prospecting has shown to be several miles long and is only awaiting being made accessible and receiving the necessary capital in order to develop all necessary underground workings.

When it is realized that the district of Thai-Nguyen, as well as those of Dong-Trieu and the Along Bay contain any amount of limestone it is not difficult to conclude. subject of course to further prospecting, that local circumstances appear technically very favorable to the erection in one or more localities of blast furnaces using either coking coal or coke or anthracite and producing iron at remunerative prices.

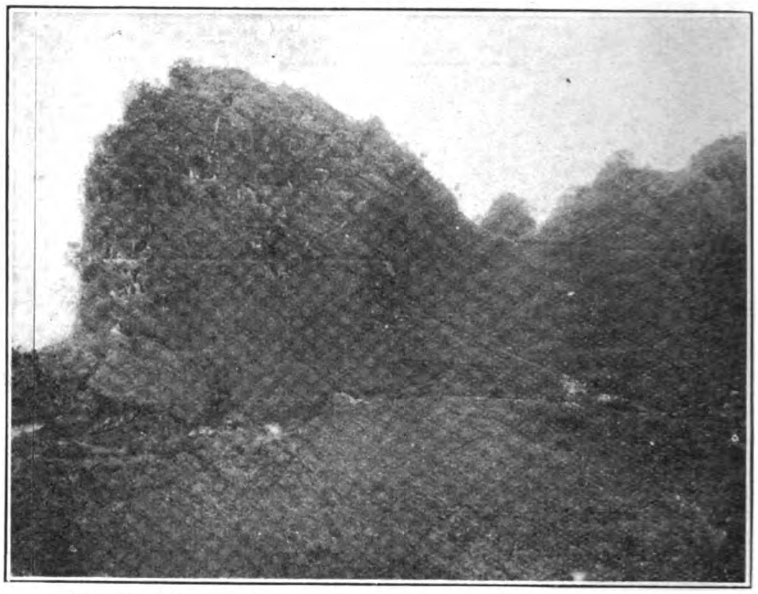
In fact the conditions for establishing such an industry appear to be better in Indo-China than in countries which have adopted European methods, such as Japan, which has to import a great deal of its iron ore—689,000 tons in 1920—or the Dutch Indies who although possessing plenty of good ore in the Celebes has no coal and is hesitating between importing foreign coke at high prices or reducing the ore by hydro-electric means thanks to the abundant water-power found in the island.

China possesses all the raw material for iron smelting but the present unsettled state of this country and the lack of expert engineers as well as their reluctance to learn from the foreigner makes it impossible to set up such a complicated industry. The plants at Hanyang and Hankow which produced in 1915 from their four blast furnaces and six Martin furnaces 140,000 tons of cast iron and 82,000 tons of steel had to close down in 1922, owing to reasons probably certainly as much economic as they were political. Engineers of repute have reported on the deplorable methods of work, which in spite of the plant being of the best, led to an output irregular and poor in quality and excessively costly.

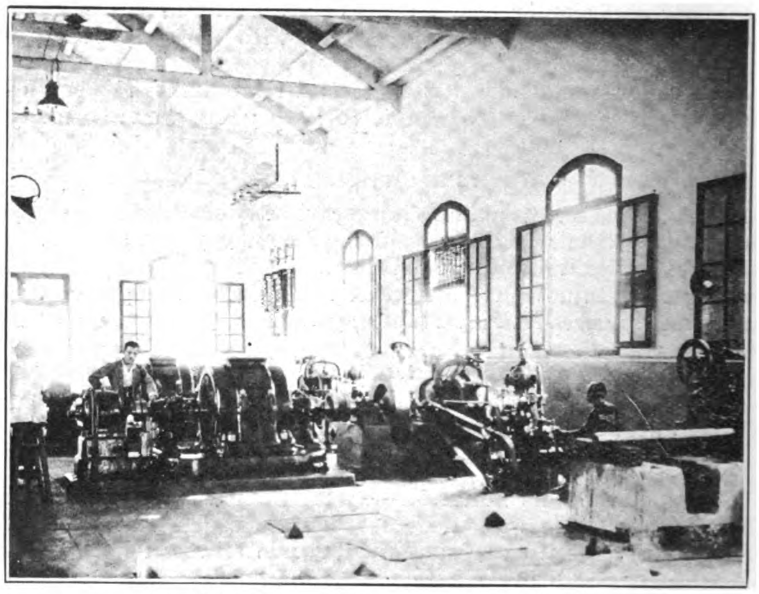
In spite of the coming increase in the building of railways it appears certain that steel works erected in Indo-China would have to look to foreign markets as well as the home one in order to keep going. There is, of course, the large market offered by China, with its teeming population and few railways, and on the other hand it is a known fact that for many years Japan has been seeking to obtain the iron which she lacks and that her emissaries have traveled over the whole of the Far East and the Malay archipelago and have even come to Hanoï with the proposal to work the Indo-Chinese iron mines and now, according to the *Génie Civil* of December 3, 1921, have passed a long contract with the Tata Iron and Steel Company in British India for a yearly supply of 100,000 tons of cast-iron.

With the possibility of such markets it should be easy for a Company to erect ironworks in Indo-China on a paying basis and without fearing that either through devoting itself to one class of material or to several with its attendant high cost it would fail to find a market for its products.

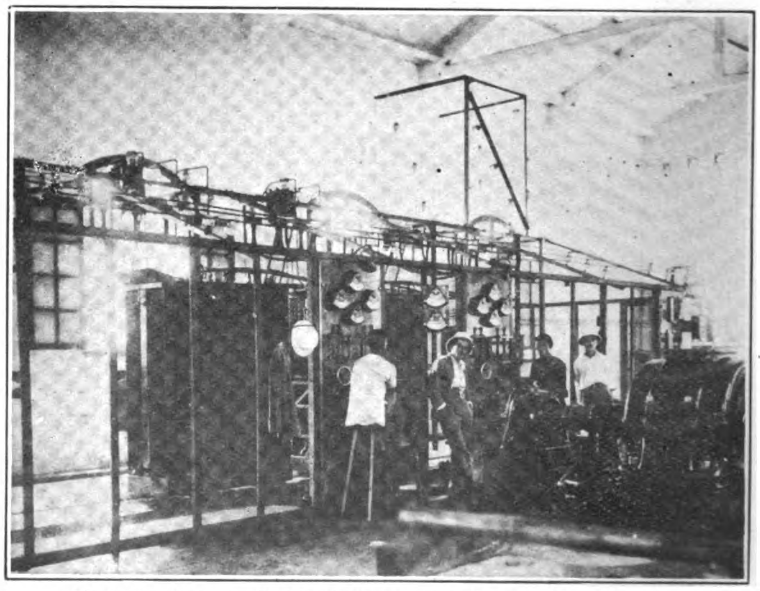
Our powerful French iron industry is naturally desirous of holding a good place in the Far Eastern market, but it would be outside the scope of this article to discuss under what conditions France could export the iron ore of Lorraine for instance. We can, however, once more call attention to the happy example of the Compagnie Minière et Métallurgique de l'Indochine who by treating the ore on



Chodien Mines—Showing Hillside Peppered with Mine Shafts

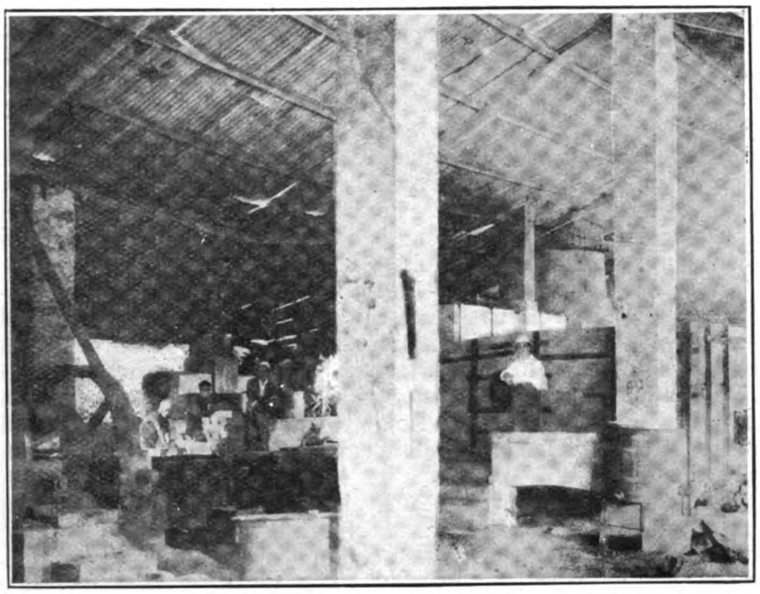


Tinh-Tuc Mine—Ta-Sa Hydro-electric Station

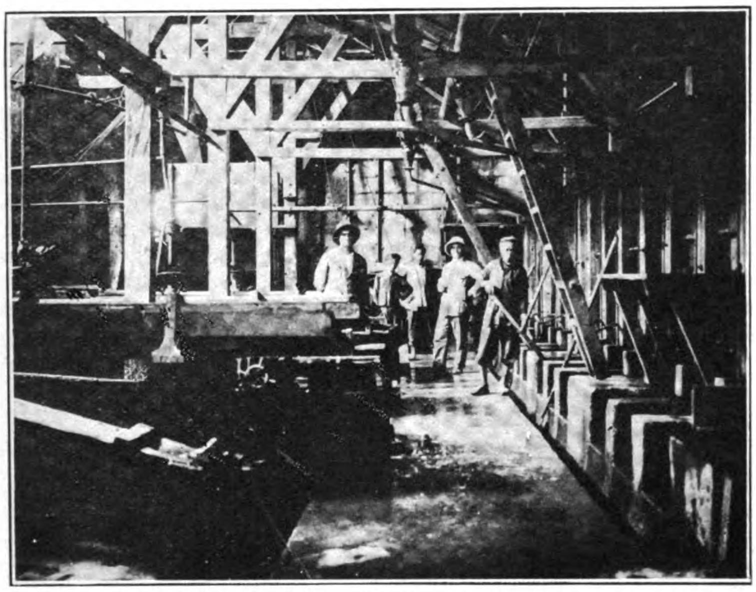


Tinh-Tuc Mines—Ta-Sa Hydro-electric Station Transformers

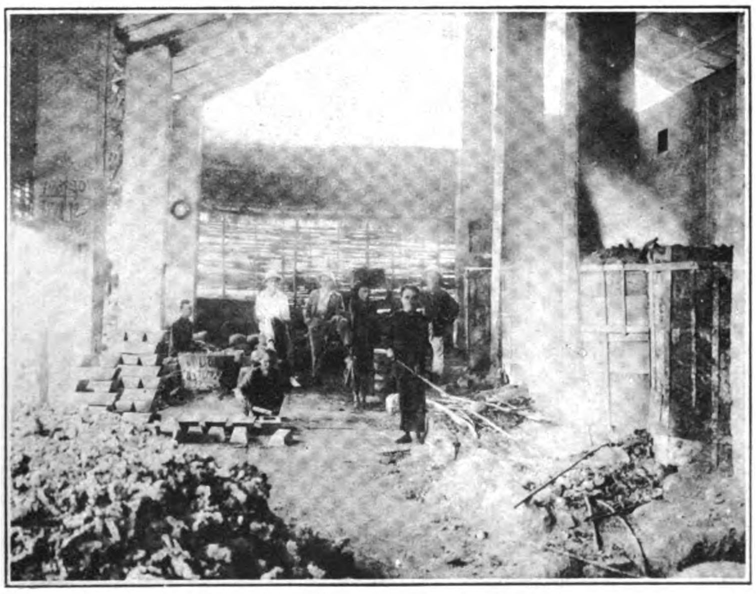
the spot instead of sending it raw to Europe increased the price of it in the European market before the war only by about 17 gold francs per ton of metal, that is to say about 3 per cent. of the price of the finished sheets on the European market, and in the



Tinh-Tuc Mines—A View of the Smelter at Ta-Sa



Tinh-Tuc Mines—Mechanical Washers



Tinh-Tuc Mines—Ta-Sa Smelters

Far Eastern market by only 117 gold francs or 17 per cent. In comparing the cost of iron imported from Europe with that produced in Indo-China there is an economy of 50 francs on rails, or 20 per cent. of their value. We would like our French ironmasters to carefully study the whole matter and thus form a basis from which it could be determined whether it would be better to import iron into Indo-China or to manufacture there, but this should be done immediately as the sooner a decision is arrived at, the better it will be for all concerned.

### Antimony.

Thanks to the high prices of this metal in the early years of the war the few deposits of this ore to be found in the district of Monkai to the north of Hongai in Tonkin enjoyed a short boom.

A foundry producing from one to two tons of regulus per day was improvised at Haiphong in 1916 thanks to the technical skill of local engineers, but the sudden drop in the price of this metal which supervened the same year dashed the legitimate hopes of the founders to the ground and necessitated the closing down of the works and the mines.

This ore is found either in the form of variously sized blocks of sulphide and oxyde of antimony scattered through the upper soil in uncertain deposits or in the form of lodes of quartzous gangue as at Monkai.

## Gold.

### (a) Auriferous Quartz.

Samples of auriferous quartz have been found at several places in the mountains of Tonkin, and in recent years attention has been called to the deposits of *Pac-Lang*, situated to the east of Ngan-Son, already mentioned in connection with silver, where several quartzous lodes are to be found, yielding at certain of their outcrops sufficient gold to justify further prospecting.

### (b) Auriferous Alluvium.

Alluvial deposits of gold were formerly worked by the natives, but these have not been sufficiently studied to form any real estimate of their value. They are of three kinds :

(1) Existing river alluviums, such as those of the Song-Bac-Jiang, Song-Luc-Nam, Trang-Xa river, etc. ;

(2) Old alluvium at the bottom of certain valleys and in circular valleys in the limestone mountains, such as the deposits of Molu and Muong-Bu in the province of Sonla ;

(3) Old terraces, such as those of the Clear River and Red Rivers and of the Song Ky-Kong, near Langson.

### Mercury.

Some years ago a few veins of cinnabar were found in the limestones 15 miles to the north and north-west of Ha-Jiang and mercury has been found just over the Chinese border.

The samples of cinnabar found in Tonkin are very good, but not sufficient is known as yet about these deposits to warrant any judgment being formed as to the possibilities of working them.

### Phosphate of Lime.

Small deposits of phosphates and phosphated soil are to be found in many places in the limestone mountains of Tonkin, notably at Than-Moi and Langson in the province of Langson, where they fill cavities in the limestone. The smallness of each deposit is made up by their great quantity and the native growers are already appreciating these phosphates when, they have been duly calcined and ground, as they appear happily to correct the acidity of the tropical soil, and to probably also favor the assimilation of tricalcic phosphates.

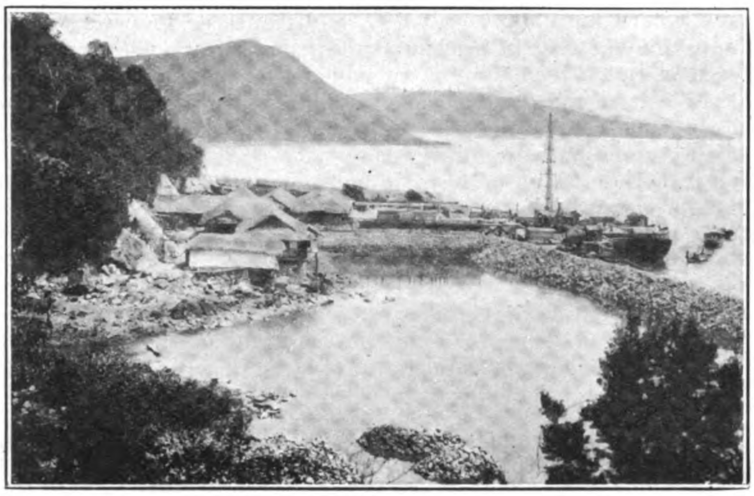
At Than-Moi certain caves are worked which yield a product containing after due preparation from 40 to 44 per cent. of tricalcic phosphates.

From 4,100 tons in 1919 the yield of raw phosphate rose to 12,000 tons in the following year, only to fall to 5,000 tons in 1921.

### Graphite.

The attention of prospectors has been recently called to numerous deposits of graphite in flakes found in the gneiss and mica-schist on the left bank of the Red River above the delta.

One of these, at La Banniere, near Laokai has furnished, after due mechanical preparation, some very good samples and has such



Hongay Mines—Port of Champha, S. G. T. B. A. Works

an extent as to justify an attempt being made to work, it, in spite of the bad prices obtaining since the war.

## MINES OF ANNAM.

### I.—Coal.

Coal is to be found in Annam in the same geological formations as in Tonkin and in the form of non-bituminous and anthracite coal of the secondary period and lignite of the tertiary period.

NON-BITUMINOUS COAL OF THE SECONDARY PERIOD.

A huge coalfield is to be found to the south-east of Turan, which is worked at Nong-Son, but is considerably larger than the concession known by that name. This field is formed of synclinal and anticlinal folds of long wave length running chiefly from north-west to south-east and is about nine miles wide and shows signs of coal in its entire width. To the south-east of the Song Thu-Bong where it soon strikes the granite, superficial prospecting has revealed no signs of its being possible to work it. To the north of this river, however, without mentioning the Nong-Son colliery described below, this field offers near the pudding-stone rock of its north-eastern edge at Vinh-Phuoc on the Song Vu-Jia, a group of seams which are being prospected and have already revealed two outcrops, one of which is 31-ins. thick. The length of this field is as yet unknown; its north-eastern end plunges under the alluvium some 18 miles from Turan while in the south-west at over 30 miles from this town it enters a region inhabited by savage tribes and not yet explored geologically.

The non-bituminous coal of this field is analogous to that of Along Bay and the Dong-Trieu but with 6 per cent. of volatile matter.

The local market is very restricted as factories are almost unknown in Annam, the only notable customer being the hydraulic cement works of Lang-Tho, a few miles from Hue.

The Central Annam railways (107 miles are now open), and other industries prefer to use wood which will always be cheaper as long as it is found close to the railway, so that the Nong-Son collieries export most of their coal to China via Turan, where boats of low tonnage come to fetch it.

All the same at the moment when the working of this colliery was suspended the owners received local orders for several tens of thousands of tons which they were unable to satisfy. There is no doubt that new markets will be opened as soon as the railway is joined up with those of South-Annam and Cochin-China, by filling up the gap of about 335 miles between Turan and Nha. Trang already in course of construction*, for not only could the railway utilize some of this coal itself, if only for local use, but it would open new markets in the south of the colony. Near Turan two routes have been proposed for the new line, the more westerly of which though somewhat longer would offer greater security from floods, and the rivers could be more easily bridged than would be the case nearer their mouths. Should this be decided upon it would pass through a corner of the great coalfield, crossing the Song Vu-Jia eight miles below Vinh-Phuoc and the Song Tu-Bong at Kwang-Hue about nine miles below Nong-Son at a point which in spite of the silting up of the lower reaches of the river can be reached at all seasons by 10 to 15-ton sampans coming from the colliery.

NONG-SON COLLIERY.

SITUATION, ETC.

This colliery is situated on the left of the Song Tu-Bong and close to the water about 40 miles south-south-west of Turan; to reach it an automobile road brings the traveler to Kwang-Hue (Jiao-Thuy) whence a sampan takes him for 9 miles up to the mine. The coal is brought to the river bank by a small railway and thence by water, as the Song Tu-Bong is connected with the Song Vinh-Dien, just before reaching the bay of Turan.

For fifteen years—from 1891 to 1906—this mine was attentively studied by various French companies† and it was then hoped —somewhat prematurely as it turned out—that the port of Turan would quickly develop. Anyway it seems that these companies devoted too large a proportion of their limited resources to works in the port, leaving insufficient funds to cover the intricate work of fitting up of the mine and the improvement of the means of transportation down to the port.

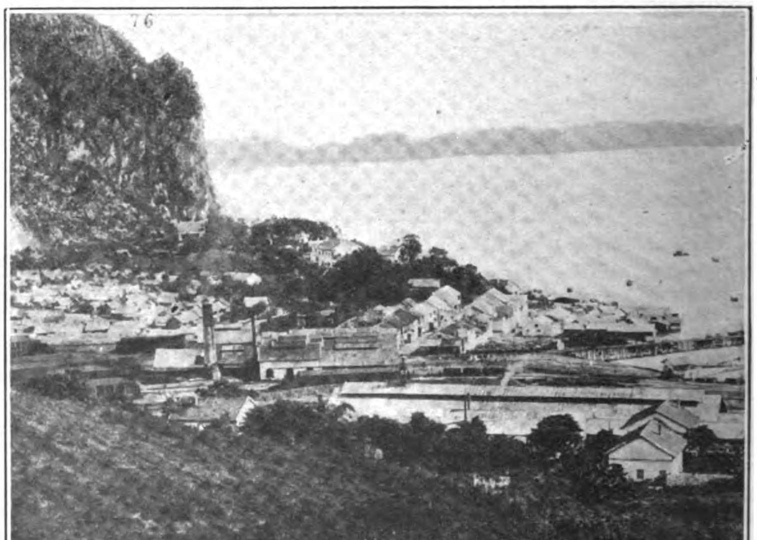
After the brankruptcy of the Société des Docks et des Houillères de Tourane the succeeding owners confined themselves to working the rising outcrop in the hills on the high bank of the river, from which they extracted an average of from 10 to 12,000 tons a year. In 1920 the output of 45 native workmen was only 6,000 tons, and in 1921 the colliery was closed down as the then private owner had not sufficient capital at his command to adequately continue the work.

WORKING CONDITION.

At Nong-Son a seam, of the Rhetian period, with an average thickness of a dozen yards of coal, has been worked on its outcrop, while some 200 yards to the east a 260-ft boring has been sunk to where it dips. Before, however, attempting to develop this colliery as it requires, it will be necessary to sink other borings so as to ascertain the extent of the dip, as well as to improve the means of transportation from the colliery according to the actual location of the main railway referred to above, as the silting up of the lower reach of the Song-Tu-Bong between Kwang-Hue and Kwang-Nam appears to make it impossible to reach Turan entirely by water.

*When this gap is closed, as well as that to the north of Dong-Ha, and from Saïgon to the Siamese frontier there will be direct railway communication between Bangkok to Langson in Tonkin and to Yunnan in China via Pnom-Penh, Saïgon, Turan and Hanoï.

†These companies were in the first instance the *Société Française des Houillères de Tourane*—a limited liability Company with a capital of one million francs—and the *Société des Docks et Houillères de Tourane*—a limited liability Company with a capital of three and a half million francs.



Hongay Mines—Native Village and the Great Rock

If, therefore, the silting up of the riverc annot be prevented and the railway takes the eastern route there will be no alternative to building an 18-mile mining branch line to the colliery.

LIGNITE OF THE TERTIARY PERIOD.

Among the coalfields known to exist in the northern provinces of Nghe-An and Thanh-Hoa mention may be made of those in the neighborhood of Cuarao, which produce a remarkably rich coal, but are situated 93 miles from the sea to which they are connected by the Song-Ka, a river but indifferently navigable, and that of Cho-Truc which is to be found close to the 33rd milestone of the Vinh and Tan-Ap section of the Trans-Indo-China railway now being constructed.

## II.—Metallic Mines and Deposits.

GOLD.

BONG-MIEU MINE.

(a) SITUATION.

At Bong Mieu Annam possesses the only important Indo-Chinese gold mine worked by Europeans. This mine which is in the centre of several similar deposits is to be found in the middle of the mountains of the Kwang-Nam province, some 60 miles to the south-south-east of Turan. A 19-mile carriage road runs from the mine to Tamky an interior port situated on the waterway—half river and half lagoon—which stretches for 50 miles along the coast of Annam between Turan and Phu-Binh—and is accessible to sampans of at least 10 tons.

(b) HISTORY.

The Bong-Mieu deposits were formerly worked on behalf of the Court of Hue, and were suspended, so it is said, some fifty years before the French in 1895 commenced prospecting.

Since then three companies, consisting of the same shareholders, have fitted up the mine and continued to work it with a tenacity worthy of a better success than what has been actually obtained. At the moment when the mine was just paying its way and that a proposed new chemical treatment of the ore, which would have improved the actual output of only 60 per cent. of metal, was on the point of being adopted, the termendous rise of gold prices, denoting the depreciation of the value of this metal as compared with other goods, started in the second half of the war and resulted in the closing down of so many gold mines all over the world. In Indo-China this meant a rise in the gold value of the piastre and consequently of labor, which in the winter of 1919-1920 had more than doubled its value in 1913. From 1918 this rise was over 60 per cent. and in the beginning of 1919 the Company had to liquidate. There is no doubt that had this not been the case the Bong-Mieu mine would have been to-day—when the piastre has almost regained its original value—one of the best equipped and flourishing mines of Indo-China ; anyway the machinery has been looked after so that it can be rapidly set going again.

(c) METHODS OF WORKING.

Several lodes have been worked, of which the principal, lying in micaschist and fairly regular is composed of iron pyrites and galena in a gangue of quartz and schist ; in the quartz itself the gold is found in sulphides and only in infinitesimal quantities.

These ores are transported to the works at Co-Bai by a rope-way ¾ mile long and capable of carrying 8 tons an hour. These works still exist and can normally treat 80 tons of ore per day and yield 30 tons of concentrated product. They contain three Dodge ore-crushers, five batteries of five stamps, pointed washing trays with a rising current of water, six Ferrari tables, ten cyanization basins and zinc cases for collecting the gold. The recovery of the gold from the tailings (15,000 tons containing 30 to 45 grains Troy to the ton) was being considered when work was stopped.

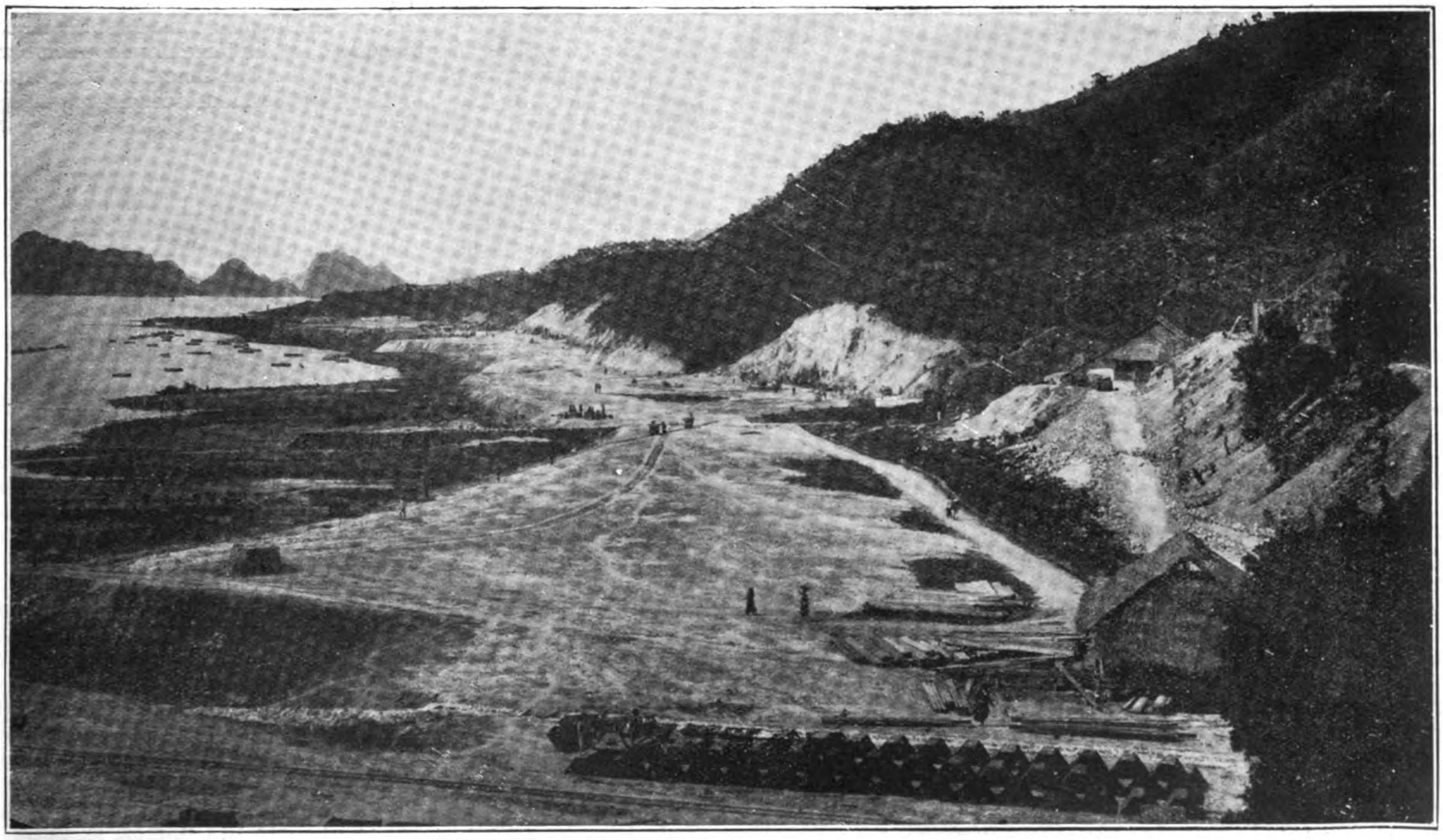
(d) OUTPUT.

The yearly average yield of the mine was 220-lbs. Avoirdupois in ingots containing 80 per cent. of fine gold and 20 per cent. of silver.

An electric central station run by a Neyret turbine of 150 h.p. and two 130 kw generators supplied power to the mines and the works.

OTHER AURIFEROUS DEPOSITS.

There is a deposit of sulphide and oxyde of antimony at 90 miles to the north-north-west of Vinh, consisting of great blocks



Hongay Mines—Port of Champha—View of Coast

scattered throughout the surface clays, which had been worked for antimony during the boom in this metal in the earlier years of the war. Later some of the quartz was found to contain a high percentage of gold and it is to be surmised that veins of this precious metal will be found in the neighborhood. but so far no prospecting has been undertaken.

At Kimson (Binh-Dinh) are to be found old gold mines, which traditionally are said to have been worked by the court of Annam for hundreds of years but were closed down about 1850.

### Zinc, Lead and Similar Metals.

A few deposits are known to exist in northern and central Annam and though none of them appear as important as those of Tonkin the following may be mentioned: at Duo-Bo a lode of mixed sulphides of zinc, copper and iron in the form of a column ot blende 33-ft. thick and 1,000-ft. long which it would be interesting to explore.

### Iron and Similar Metals.

There are numerous rich and pure deposits of ironstone in Annam—many of which are worked by the natives—notably in the provinces which bordering on Tonkin, are better known to prospectors. Mention may be made of the Doanh-Xa deposit, six miles to the north of Than-Hoa composed of a seam of magnetite which supplied a thousand tons of ore to the blast-furnace at Haïphong.

In the province of Than-Hoa a deposit of oxyde of iron and manganese is being worked by a local factory of cheap mineral paint, while at Van-Am and Nui-Nua in the same province chrome iron ore has been found but is as yet unworked.

Finally titaniferous sands are to be found on the beach and sand-hills around the bay of camranh, and a company is being formed to work the same.

## VARIOUS DEPOSITS.

### Phosphate of Lime.

Deposits of phosphates of lime, analogous to thse in Tonkin, have been found in the provinces of Thanh-Hoa and Nghe-An, and the first of these two provinces sent in 1921 some, 4,400 tons of raw ore to Haïphong where it was ground.

### Graphite.

From the Serevine mine at Hung-Nhuong in the province of Kwang-Ngai situated close to a navigable river and 22 miles from the sea, 7,450 tons of amorphous graphite were extracted in 1919 and exported without any further preparation to America. This did not pay and no further orders were received. The deposit consists of a series of pockets in the gneiss and micaschists and evidently contains a large amount of giaphite, but before being put on the market it requires a very large amount of mechanical manipulation, and in view of the large stocks of this mineral which have accumulated in the world since the war it would not pay at the present moment to work this mine.

## Mines of Laos.

Owing to the transportation of products from this country so far being practically confined to the Me-kong, with its difficult and slow navigation, as well as to the ladk of roads in the interior it is at present impossible to prospect there for metals other than the precious and rare ones. The opening of the road from Vinh to Takek in 1923 will place the long navigable reach of the central part of the Me-kong between Vientian and Savannakhek within one day's motor ride of the coast and within two days' reach of Hanoï and this should enable prospecting to be carried on much more easily.

Leaving on one side the few native workings for coal, iron, salt and precious stones (sapphires of medium quality at Houei-Sai on the Upper Me-kong) which are of purely local interest, gold and tin are the only metals which up to the present have seriously interested Europeans.

## TIN.

### Mines in the Basin of the Nam-Hin-Boun (Bantkua) and Neighborhood.

### Situation.

The only known deposits of tin are those found at Bantakua, Bo-Neng, Na-Phan, etc., on the Nam-Paten river, a left-hand tributary of the Nam-Hin-Boum which in turn falls into the Mekong from the left at Pak-Hin-Boum between Vientian and Takek. Ten-ton vessels can at all seasons reach the mouth of the Nam-Paten situated some 12 miles from the principal mine at Bantakua. When the water is high boats can sail up the Nam-Paten for another nine miles, and further, the company is improving the rough track which connects the mine with the mouth of the Nan-Paten, so as to make it passable at any rate during the dry season. It should thus be possible to take the necessary machinery (crushers, etc.) fairly easily up to the mine if the time of flood be taken to negotiate the Me-kong rapids (see article on Means of Communication).

### Deposits and Methods of Working.

These deposits are formed by stanniferous limonites embedded in a clayey soil of vast extent, and it appears probable that the form of this ore is due to the disintegration of adjacent lodes, but such have not yet been discovered.

The natives who have exploited this deposit from time immemorial by sinking small shafts very carefully sift the ore at the pit head and have become expert in picking out the fine particles of cassiterite. This picked ore, containing from 5 to 12 per cent. of tin, is taken down to the village where it is crushed and "panned out" and then reduced by means of charcoal and bellows in little Chinese hearths. The metal thus obtained is from 96 to 97 per cent. fine. The yearly output of 10 to 15 tons is exported by foreign middlemen (Chinamen) into Siam where it is said to be largely used for weighting fishing nets.

Between 1899 and 1903 these deposits were prospected by the Société des Etains de Hin-Boum, who found that the cassiterite was very unequally distributed both in the limonite and the clay and that it would be necessary to treat the whole of the clay and its contents, which on an average contained from 1 to 4 per cent. metallic tin, as revealed by the borings made in this ground. Owing to the small size of the particles of cassiterite the mechanical operations required to extract this would be very considerable and to this fact, as well to the difficulties encountered by the members of the Commission of enquiry who took several months to get from Saïgon to the mine via the Me-kong, it was decided to not to do anything at any rate at that time.

These difficulties are becoming less and less with the opening up of better means of communication as well as by improved methods of concentrating the ore and, if further methodical prospecting be undertaken, it may be found that it would pay to work this deposit, especially if borings revealed richer ore below the surface. The work now being carried out here by the Société d'Etudes et d'Exploitation Minières de l'Indochine—a company established in 1921—may lead to interesting developments.

## Gold.

### A. Alluvial Deposits.

Since time immemorial the people of Laos have worked auriferous alluvial deposits, either in the beds of the rivers or in old and consolidated alluviums on the banks or in those still leaning against the flanks of the mountains. So far superficial and rapid prospecting has revealed but little gold to the cubic yard of earth, but it appears probable that the bed-rock has not yet been touched.

Auriferous sand and gravel accumulate in certain river beds, where rocky ledges form a natural dam, and such are to be found especially in the upper reaches of the Me-kong above Luang-Prabang, where a prospecting concession was granted in 1904, which, however, was eventually withdrawn as work was never commenced.

Auriferous old consolidated alluvial soils are the most frequent, and the natves work such at Dong-Kieu and at Hat-Kam below Vientian on the Me-kong as well as in the valleys of the Nam-San in the province of Vientian, of the Sebang-Hien in Savannakhet, of the Houei Sang-Ngoi and the Khontha in Cammon and of the Ngam-Ngun in Vientian, etc. Provisional concessions have been

granted to French companies for all of the above deposits, but these rights have lapsed and in many cases no work even was done, and in one case—that of the Compagnie Minière et Industrielle—a dredger was with great difficulty and at great expense taken 50 miles up the Nam-Sane and was abandoned there, without any prospecting at all having been made as the company went into liquidation.

Auriferous alluvial soil on the sides of the mountains worked by the natives are to be found in the mountain group of Pou-Luong, between Pah-Beng and Xieng-Khon.

B. VEINS.

The Société des Gisements Alluvionnaiies has undertaken limited prospecting in several auriferous veins of pyritaceous quartz found in diorite at Bokham in Stung-Trenuand at Kontoum in Attopeg.

It may be conceded that the above deposits of gold should justify the undertaking of a systematic mineralogical survey of the country as soon as circumstances permit, nothing having as yet been done in this connection.

## Mines of Cambodia.

### Various Deposits.

SAPHIRE MINES OF PHAILIN.

GENERAL.

The only mine at work in Cambodia is the sapphire mine of Phailin near the Siamese frontier and about 50 miles to the southwest of Battambang and half-way to Chantabun. Some forty years ago Burmese hawkers related that they had seen blue stones in the hands of the natives who had no idea of their value and this story brought some of their fellow Burmans in search of gems to Phailin, and in this way the Burmese colony now engaged in exploiting this mine sprung up. Some twenty years ago this little colony was very flourishing under Siamese rule, and ten thousand inhabitants lived in comfort and had good times in spite of frequent epidemics of cholera, while many returned to their native land, their fortunes made. In those days sapphires of the first water were frequently found and they were sent by the grantee of the Siamese government concession to Chantabun where the principal native middlemen were located and thence to Bangkok, whence they were sent, still uncut, to London and Paris and were sold there, after being cut, as Siamese sapphires. Only local stones for local use were cut at Chantabun as the appliances were primitive and turned out poor work. Until recently, when the native authorities had to give way to the French, cuttng was prohibited at Phailin as this would have led to illicit traffic in the stones.

The Cambodian peasants were very glad to have this little colony among them as they sold rice and other foodstuffs to them at good prices and against ready cash.

Soon after the transfer of the province of Battamabng to Cambodia in 1907 the yield of the mines, which had been worked in a haphazard manner and without regard to either completely clearing the ground or taking note of previous workings, began ty fail and the population diminished. The long depression caused bo the war was the final blow and although work has not entirely stopped it is but a fraction of what it was, in spite of the fact that prospecting in virign soil is still rewarded by good finds.

It may be noted that the political change had no effect on the trade in sapphires which were still sent into Siam, and the Paris jewellers made no attempt to obtain them direct. For a long time this Burmese colony retained its political semi-independence and it was only during the war that the chief of the community relinquished his powers into the hands of the French, and even then the special unwritten customs as to the division of the land and the distribution of the water used in breaking down the soil and cleaning the stones, the partition of the stones between the owners, workers and canal proprietors, payment of the mining fees, etc., were as far as possible respected and this little mining community was exempted from the mining regulations obtaining in the rest of the union.

DEPOSITS AND WORKING.

These gems are found from six to ten feet deep embedded in a stratum of alluvial clay resting on crystalline rocks of various kinds. It is supposed that they are of basaltic origin, but as, so far, no sapphires have been found in this rock, more especially found near the richest soil, this hypothesis remains unproved.

The only stones of commercial value are the sapphires. Rubies, of a violet red colour but no sapphires are found half-way between Phailin and Chantabun, especially at Bonavon in Siam. The few rubies met with at Phailin are inferior to the blood-red Burmese stone.

OUTPUT.

In 1920 there was a slight rise in exported stones, the *verified* yield in this year being 3,413 carats of an estimated value of 360,000 frs. as against 2,853 carats and 215,000 frs. in 1919.

IRON.

The deposit of Phnom-Dek, 43 miles to the north of Kompong-Thom on the river of the same name navigable when the water is high, is exploited by the primitive tribe of Khouys who make tools of high repute.

Fuchs, who visited this spot describes the deposit in his "Memoir on the ore deposits of Indo-China" (*Annales des Mines*, 1882) as a great mass of rich and pure ore crossing a hill of eruptive rocks. This has been confirmed, but without bringing out any new facts, by poor superficial prospecting carried out since by a company who proposed to erect electric furnaces there, obtaining their power from the falls of Khong on the Me-Kong, some 90 miles distant, and using charcoal from the Cambodian forests.

PHOSPHATE OF LIME.

Deposits of phosphates similar to those in Tonkin have been discovered in the limestone mountains of the provinces of Kampot and Battambang. Those in the neighborhood of Tuk Meas near Kep in the province of Kampot lie close to a water-way accessible to large junks, and preliminary works undertaken in 1919 yielded 2,950 tons of raw phosphates. Nothing has yet been done with those near Battambang.

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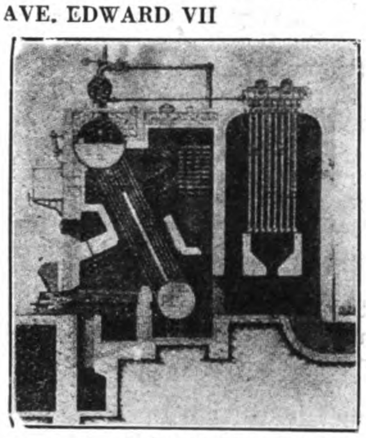
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目錄及關於工業上之問答等請直接本公司
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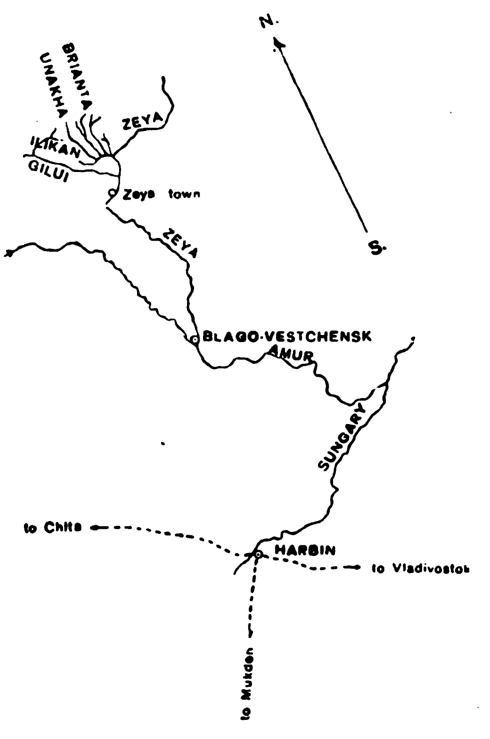
# Gold Occurrences in the Zeya Central Mining Area of Easteran Siberia

## Paper read before the Chinese Institution of Mining and Metullurgy

*By Y. T. Eve*

THIS is a short general description, with conclusions arrived at after a careful study of the district.

About two years ago I arrived in Peking in charge of an expedition whose object was to explore the mineral resources of northern Mongolia between Ta-na-oula range and the Sayan mountains. The troubles in Mongolia prevented me from carrying out the original plan, and subsequent events influenced me to propose the change of that plan to an investigation of the possibilities of gold mining in Eastern Siberia to the north of the Amur River. For the last year I was there exploring and prospecting for gold in the area between the rivers Gilui and Brianta (see map).



SCALE 1 = 320 Versts = 213 miles

It is not the object of this article to describe the political, etc., conditions of life in Russia. It is sufficient to say only that during my stay there I was treated with the utmost courtesy by the officials in charge, who on the whole seemed to me a quiet and efficient lot. I had not the slightest trouble with the workmen whom we employed. The same applies to the owners of the mines and other representatives of bourgeoisie who came back and are helping at the present moment to rebuild new Russia.

The area in question is situated in the corner between the Gilui range of hills and the Zeya River, and is bounded on other sides by the River Brianta and its affluents. It is a slightly undulating country, slowly rising from the Zeya divide of the Gilui range, which drops abruptly in step slopes towards the Gilui itself. The valleys of Brianta (extreme lower part excepted) and its affluents are narrow, deep-cut, and rocky. The gradient is high, and there are many dangerous rapids. The surface of the land consists of frozen marshes, with dense pine and larch forests. The prevalent rocks are gneiss and granite. The first one is predominant, and it is cut frequently, very frequently in some places, by dikes, etc., of diorite, granite, porphyrite, pegmatite, and aplite. Amongst the minerals the predominance of amphybole is noticeable, especially in certain areas of contact and in gneisses. The contacts are well formed, and extend widely in the neighboring rocks. Numerous lenses of quartz are frequently met with, but in no case have I traced the presence of a more or less extensive reef. Quartz was tested from many lenses, and was found in most cases to contain some gold. This and general conditions above described undoubtedly show us the possibility of gold being present and possibly partially collected from the area in question by the agents of nature, and deposited, as naturally would be the case, in certain alluvials.

In the area described above we find alluvials apparently of two distinctly separated ages. One, much the older, is represented by a belt of gravels situated high and dry on the hills between the rivers Gilui-Zeya-Brianta Unakha-Jlikan. Another, a modern one, is represented by gravels, etc., of the existing rivers and creeks. There is difference in composition between older and newer gravels. The first are composed mostly of gneiss and quartz, the second of the rocks described above without any special predominance of quartz or gneiss. It is a question for further study to decide whether both gravels are derived from the same rocks or not, and whether the present difference in composition is due to the decomposition of the older ones. The newer gravels are developed rather poorly. The reason for this, in my opinion, is that the country has begun only very recently to free itself from the grip of the north.

Apparently all alluvials were swept away by the advance of the ice during the last glacial period, all, that is to say, except such as were protected by the barrier similar to the Gilui mountains. Since then the country has been frozen. Under such conditions the formation of the new alluvials or soil could proceed but very slowly. We see everywhere proofs of the accuracy of such a statement. We see it in the thin blanket of soil ; in the courses of rivers, which seem to change their direction in true frozen manner ; we see it in the composition of the present gravels as related to the neighboring rocks ; we see it also in the distribution of gold.

The belt of older gravels is drained by the rivers Zeya and Unakha with their affluents. The area affected by them is large ; the heads and valleys of the creek are well developed. In many places the bedrock is already exposed. In many places the old gravel terraces still remain of considerable thickness, sometimes up to 50-90-ft. and even more.

This is the area the mines of which, though discovered at the end of last century, were still working at full speed at the outbreak of the revolution. A number of small and big Russian companies (foreigners were excluded) were working, employing thousands of men. Roads were built, telephone lines connected practically all mines of importance. The country was full of life. It is silent and more than half dead now.

The mines of the area in question were, in a great many cases, exceptionally rich. It is sufficient to mention, for instance, a creek Djalon, which on about five miles of its course yielded (officially registered) over 30 tons of gold.

Curiously enough all this system of small and large creeks was worked only in narrow strips along the side of the course of existing creeks, and no attention (with a few exceptions) was ever paid to the sides of the valleys or the gravel terraces themselves, and only very recently, to the great astonishment of all concerned, it was discovered that these terraces also contain a workable quantity of gold.

The reason for so remarkable an oversight lies possibly in the race to find rich mines, and rich mines only. This is one reason. Another is that the old working methods were extremely crude and primitive. Hand labor was employed for the most part, and only in a very few cases do we find attempts to use up-to-date machinery. And this was in country with good grades, abundance of water, cheap timber, and facilities of transport as offered by steamer navigation on the River Zeya. Absence of adequate machinery was impeding, of course, the work on low marshy grounds at the mouth of some creeks also.

The best values were mostly found in the areas where creeks were crossing the old terraces or a short distance below them. Only very light gold (something from 400 and upwards colors per 1c.) had time, apparently, to be transported any considerable distance at all, but, on account of the peculiar climatic conditions (frozen ground, shortness of summer, rivers freezing right down to the bottom in winter, etc.), was scattered on a long distance without forming any deposit of sufficient values, except some pockets or rich fringes on certain projecting sides of the curves of the rivers. The best example is offered by the Unakha-Brianta systems. The Unakha, by itself, does not cut through the old gravels. It skirts them, and receives the majority of creeks which do cut through them. On the average it is poorer than its affluents. The gold is much finer, and this state of affairs is best exemplified at its lower reaches near the junction with the Brianta. After junction, the gold values drop and the pay streak begins to be very patchy. Repeated attempts to trace any pay streak in the valley of the Lower Unakha gave negative results.

The pay streak seems to be limited to the present course of the river only, with few narrow variations to one or another side.

On the lower part of the Unakha a small dredge (5¼ cbf. nominal) has been working since 1912. It is the only dredge in the whole Zeya mining district.

This dredge was not built specially for the conditions of the Unakha, or for the north in general. Nevertheless, it has worked with great success.

I went up the Brianta for about 200 miles. I saw many small creeks which yielded no values at all. I saw a few which gave average and even good values. The good ones were practically worked out. I have not seen any signs of older gravels there, and the gold of the creeks was apparently derived from the neighboring rocks. All mines found there were small mines, and the Brianta itself carries no values worth consideration.

Everything seems to point one way. There were big rivers in some far-away district. Their carrying capacity was great. They formed big gravel deposits, with a workable quantity of gold. Such deposits, if cut through by creeks, gave mostly rich mines. These deposits were partially carried away by the advance of ice.

Then there are modern rivers, with their small carrying capacity, and shallow gravels derived from the surrounding country at a very recent age. These rivers or creeks are a succession of poor men's camps at the utmost.

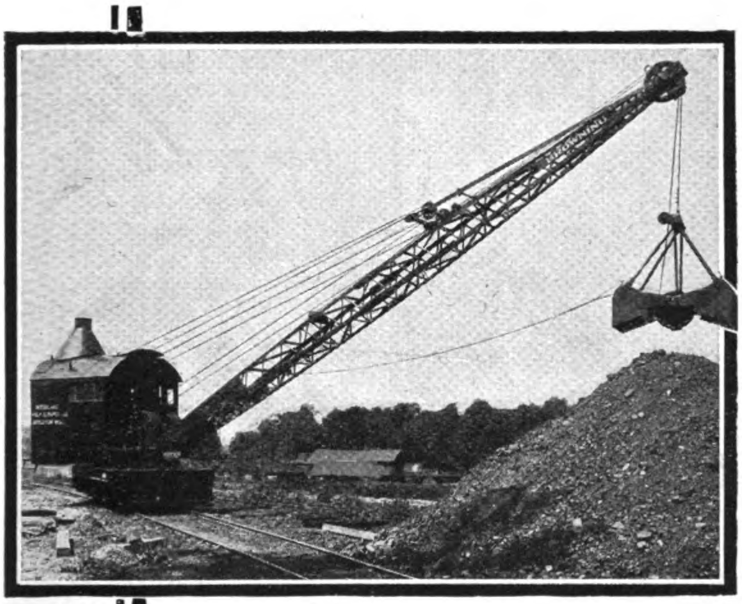
## World Electric Consumption

THE consumption of electrical current throughout the world has been carefully and picturesquely tabulated by the *Scientific American*, and in the June issue of that publication a most interesting diagram has been published. Here are some of the outstanding features of the portrayal :—

In total annual current consumption of the nations wherein a billion kilowatt hours or more is used America takes first position by a stupendous measure. The gross consumption in the United States for all purposes is 49,802,000,000 kilowatt hours. Next in rank comes Germany with 8,000,000,000. Japan with 6,925,000,-000 stands third, and Great Britain with 6,400,000,000 fourth. Then in order of rank Canada, Italy, Switzerland, Sweden, Norway, South Africa and Spain.

But in the consumption of current per *capita* of the population there is a very general alteration of the standing of the nations. Switzerland tops the roll with an annual average of 700 kilowatt hours per Swiss. Canada consumes 612 kilowatt hours per *capita* per annum and holds second place, and third comes Norway with 493 kilowatt hours consumed for each Norwegian. In this list America, with 472 kilowatt hours of per *capita* consumption, stands fourth, and after us come Sweden, South Africa, France, Germany, Great Britain and Chili, all of which use more than 125 kilowatt hours per person a year.

In the percentage of dwellings with electric light installation there is another alteration of order. Here Canada takes first place with 38.3 per cent. of her homes illuminated by incandescent bulbs. The United States holds second place with 36.8 per cent. of our domiciles electrically lighted. Third place falls to New Zealand with 30.8 per cent. of homes thus lighted. Fourth place goes to Japan with 29.9 per cent., and fifth to Denmark by the very narrowest of margins, for 29.8 per cent. of the Danes eat their supper under the glare of Mr. Edison's invention. Thereafter come Switzerland, Norway, Belgium, Australia, Sweden and Great Britain, all of which have more than 15 per cent. of their homes wired, and the rest of the world trails after with smaller lighting equipment.

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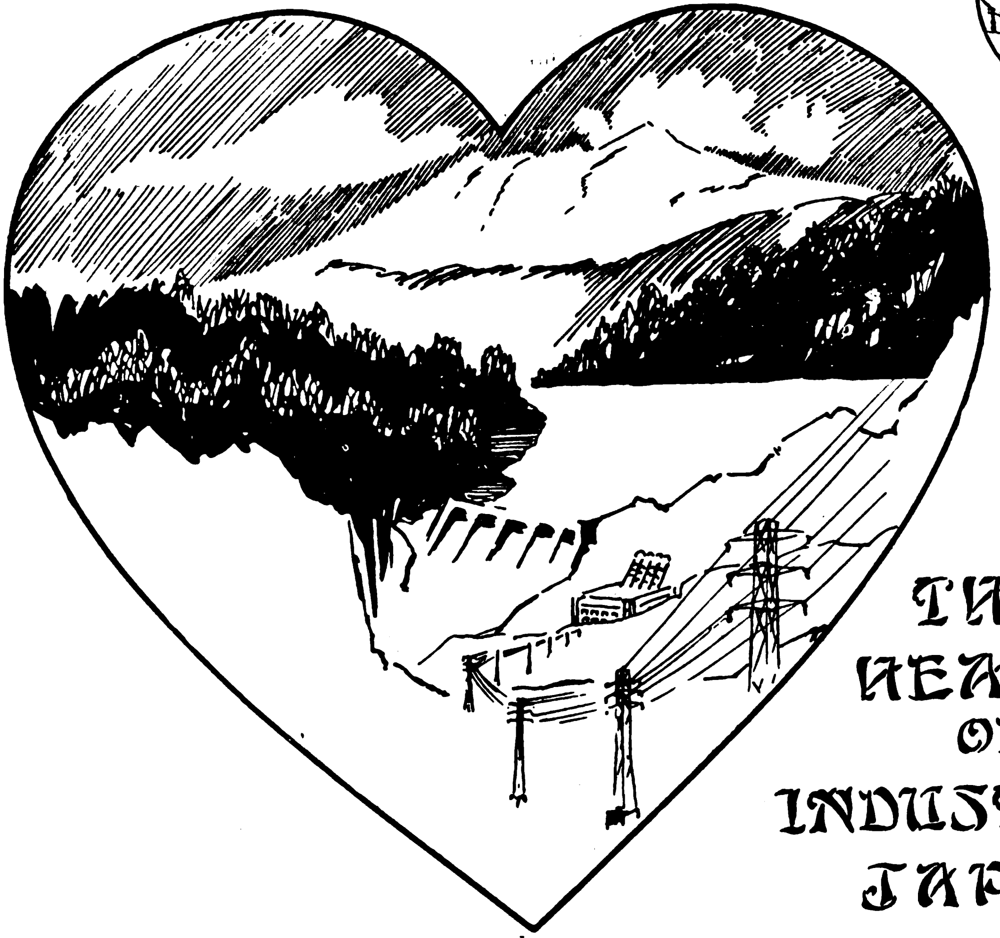

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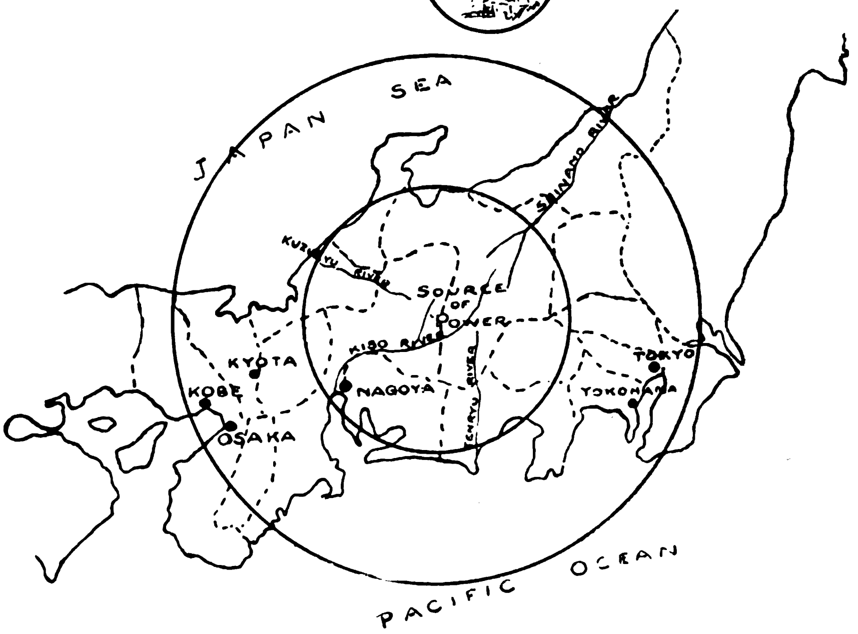


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# THE FAR EASTERN REVIEW

FINANCE ENGINEERING COMMERCE

## THE BRITISH EMPIRE EXHIBITION

THE JAPANESE TRAGEDY

AMERICAN RELIEF WORK IN JAPAN

A SUPERFLUOUS STATE DEPARTMENT

SHALL AMERICA CO-OPERATE WITH JAPAN ?

ELECTRICAL RECONSTRUCTION IN JAPAN

SUPER POWER ZONES IN JAPAN

TRAMWAYS IN JAVA

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Vol. XIX | November, 1923 | No. 11

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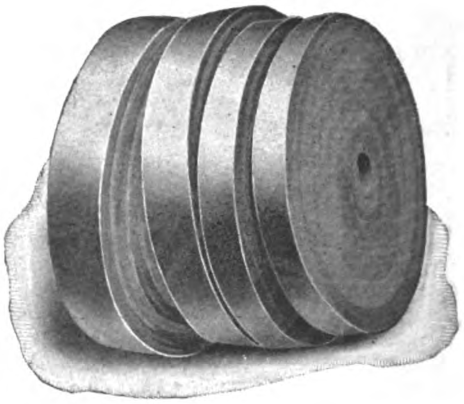

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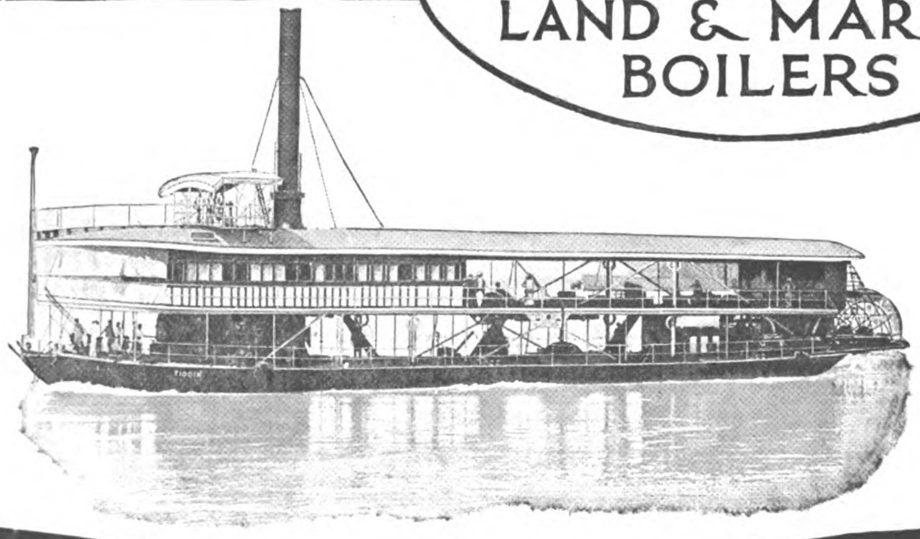


The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, NOVEMBER, 1923 No. 11

# American Relief Work in Japan

THE great disaster which overtook Japan out of a clear sky, provided a new and wider field for the exuberant imagination of professional rumor mongers to find fault with that country. The versatility and ingenuity displayed in inventing slanders and villifying the Japanese, fabricating what passed as news out of the wildest and most improbable stories together with a refusal to see anything but the shortcomings of a people laboring under a terrible emotional strain are characteristic of the traditional " bunder " and trouble-maker whose natural habitat is China. We could understand why this embittered group rejoiced at this fresh chance to poison the atmosphere with attacks upon the Japanese government and people—it is their only stock in trade—but it taxes our imagination to explain why they should assail their own government and Red Cross Society for an alleged failure to succor destitute Americans and set them up in business. The only reasonable explanation which comes to our mind arises from the fact that these dyed-in-the-wool anti-Japanese Americans failed to direct the relief work and prevent that close understanding between Japan and America which permanently undermines their efforts to foster international ill-will.

The first concern of Ambassador Woods and his efficient staff headed by Lt.-Col. Burnett, was the relief of Americans in the devastated area and their immediate transportation to zones of safety or to their homes in the United States. The little American relief organization composed of volunteer workers having its headquarters at the Imperial Hotel in Tokyo labored day and night for the first two weeks until every American was accounted for, the living succored and the dead identified and decently buried. On receipt of the first news of the catastrophe, the state department at Washington cabled urgent orders to Consul-General-at-Large Nelson A. Johnson to proceed to Yokohama at once with Consul-General Cunningham and Vice-Consul Wright, report to the ambassador, re-establish the consulate and extend every aid to American merchants and travelers. The first naval vessels to arrive in Yokohama rushed food, clothing and other essential supplies to the temporary embassy at Tokyo for the express relief of Americans and at the same time furnished the Imperial Hotel with food which enabled it to feed all its guests and refugees which flocked there for shelter. At all times there was a store-room and dispensary at the hotel filled with every possible requirement for the prompt relief of Americans residing in the devastated areas who came every day or so for fresh supplies of food.

When General McCoy arrived in Tokyo to assume charge of the American army and Red Cross relief measures under the ambassador, his very first step was to telegraph $25,000 gold to Mr. Shea of the American Trading Company at Kobe for the urgent relief of American destitute who had flocked to that port from every point in the danger zone. Unless further disbursements have been made from this fund since the middle of October, a large part of it remains unexpended. It was more than ample for every need. Long before actual funds had been placed at the disposal of General McCoy he had employed his own and those of his staff to assist Filipino refugees, and when these gave out and he explained his predicament to Mr. Lynch, manager of the Tokyo branch of the International Banking Corporation, the latter sent him a check book and told him to go the limit, he could have all the ready cash in the vault. This, at a time when the Japanese banks were doling out cash in very small amounts. Every American or Filipino who applied to General McCoy or the Red Cross for funds to defray their expenses to the homeland, were assisted. In such cases where the person had private means at home they promised to repay the money to the Red Cross Society on arrival or within a given time after reaching their destination. Those who could not give this assurance were made a present of the money. The Pacific Mail, the Admiral line and the Canadian Pacific liners which touched in Kobe and Yokohama during the fortnight following the disaster carried many destitute Americans and foreigners across the Pacific on their promises to pay.

While the work of assisting Americans at Tokyo was going on, the harder, more gruesome and heart-breaking job of recovering, identifying and burying the dead at Yokohama was carried forward by Consul-General Johnson and Vice-Consul Wright. Pending the arrival of the army transports *Merritt* and *Meigs*, an American station ship, served as a free hotel and office headquarters for those American business-men who, after seeing their families in a place of safety, returned to Yokohama to salvage their safes and documents of value and hold their trade connections. A camp furnished by the army was subsequently erected on the grounds of the consulate to serve as a free home for Americans who had business in Yokohama. The navy provided free transportation from to Yokohama for these men. At all times from the day after the quake, the first and foremost thought of the ambassador and his staff, Admiral Anderson and his fleet officers and General McCoy and his army assistants, was the welfare of their own countrymen, and to this end every rule, regulation and precedent in the state, war and navy departments was broken and set aside in order to bring prompt and efficient relief to their own countrymen.

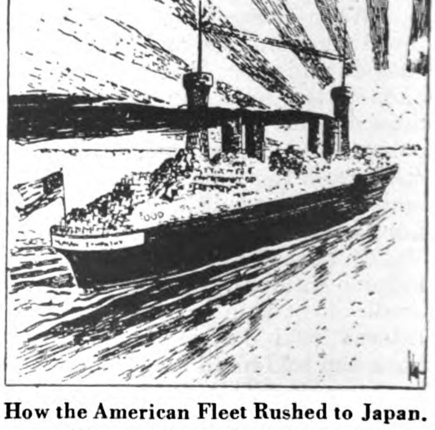
There was only one thing that the representatives of the American government and the Red Cross Society could not do. They could not reimburse Americans for their losses nor provide them with the funds to resume business. Every other measure of relief was anticipated and spontaneously extended, and if at this late date, there are some Americans who feel aggrieved because the millions contributed for relief were not handed over to re-establish their business, it was simply because these things are not done. The millions raised by the Red Cross Society of America came as the result of a direct appeal on the part of the president and the whole-hearted response of the people of America to the needs of a nation whose dead, wounded, homeless and destitute had a greater claim to their charity and sympathy than the urgent business requirements of their own countrymen.

It is true that many Americans suffered equally with the Japanese and deserve special assistance from their government in order that they may quickly resume business. The property of most of these Americans was duly insured and where such risks were not specifically covered by an earthquake clause they face a most difficult and obscure future. It is not easy to formulate measures that may serve as precedents for governmental assistance in restoring private property losses arising from acts of providence, as every year witnesses some fresh and unexpected catastrophe at home or abroad equally disastrous to Americans residing in or conducting business in the stricken locality. With few exceptions, American firms located in Yokohama occupied rented office space, and all of these immediately transferred their headquarters to Osaka or Kobe, which brought them into closer touch with the industrial centre of Japan and the actual purchasers of their products. In

*(Continued on page 682).*

ADMIRAL E. A. ANDERSON
Former Commander-in-Chief of the American Asiatic Fleet

ADMIRAL ANDERSON learned of the disaster at Chefoo, the summer rendezvous of the fleet in North China. Without awaiting instructions he ordered the supply ship *Black Hawk* to proceed to Tsingtao to load with provisions and relief supplies, sent similar instructions to every American naval supply ship on the station and authorized the naval purchasing officers at Shanghai and Manila to make the necessary purchases. After compromising the navy department to the expenditure of over $2,000,000, he proceeded under full steam towards Yokohama to place the entire American fleet at the disposition of the Japanese government. His action was fully supported by the navy department at Washington who cabled him to "go the limit." After the first rush of relief work was over and foreign refugees had been transported from the devastated regions to Kobe or placed aboard steamships bound for home, the American fleet quietly withdrew and returned to China. Within a month, Admiral Anderson was due for retirement, ending a splendid career with one of the most brilliant exploits in the history of the American navy, a victory for peace and good-will that will have a greater bearing on American prestige in the Pacific than any triumph of naval strength. The American army followed the navy in rushing relief supplies to Japan rounding out the campaign that has resulted in bringing together America and Japan in bonds of complete understanding. The navy, however, took the lead. To Admiral Anderson belongs the credit.



**How the American Fleet Rushed to Japan.**
*(From the "Columbus Dispatch")*

Consul-General-at-Large Nelson Johnson, who reopened the Consulate at Yokohama, identified and buried the dead, blew open safes and conducted a camp for American refugees and business men.

Captain David Tait, an American newspaper man and reserve officer of the Army, who directed the Relief transportation.

## THE AMERICAN EMBASSY RELIEF ORGANIZATION

Ambassador Cyrus E. Woods, in the only suit of clothes saved from the fire.

Major Faymonville, Assistant Military Attache. Lt.-Col. Charles Burnett, American Military Attache.

*Top Centre:* "Old Glory" flying from the charred top of the Embassy flagpole at Tokyo

*Centre:* The Ruins of the Embassy.

Mr. H. Saito, of the Foreign Office, Assistant to Mr. T. Sakai, in charge of Japanese Relief Measures. Mr. Saito has since been promoted to the post of Consul-General to New York

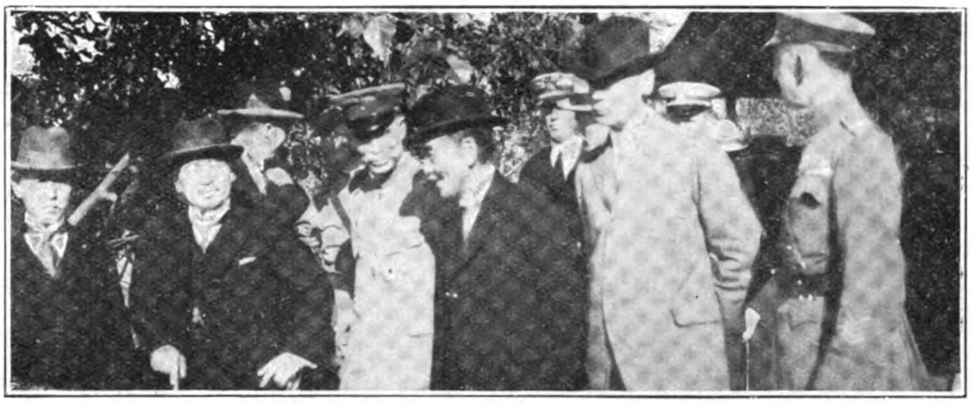
Baron Ijuin, Minister of Foreign Affairs, and Brigadier-General Frank S. McCoy, at the American Hospital in Tokyo on the occasion of turning it over to the Japanese Authorities.

Mr. Frederick Moore, a well-known American Journalist, now Councillor to the Japanese Foreign Office, whose advice materially contributed to the successful outcome of the American Relief Mission

Colonel George T. Langhorne, U.S.A., Assistant to Gen. McCoy on the Japanese Relief Mission.

Ambassador Woods and Gen. McCoy.

Mr. O. Matsukata, youngest son of Prince Matsukata, an able Assistant to Mr. Sakai in handling the Japanese end of Relief Activities.



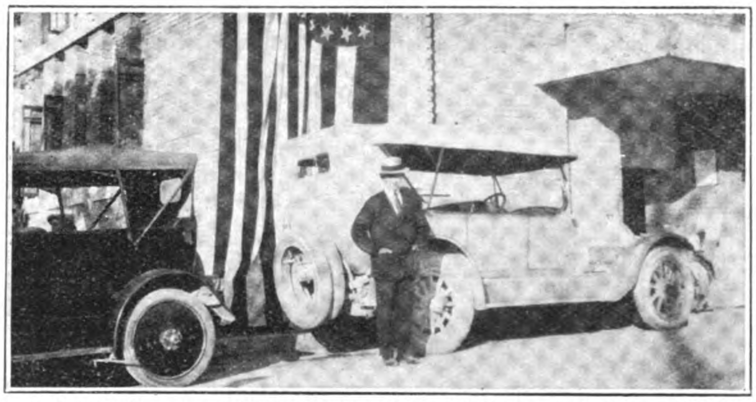
Turning over the American Army Hospital in Tokyo to the Japanese Government.
*Right to Left:* Gen. McCoy; Ambassador Woods; Baron Ijuin; Vice-Minister of Army.

Lt.-Colonel Hands, of the Artillery, in command of American Army personnel who erected the hospitals at Yokohama and Tokyo.

AMERICAN AND JAPANESE RELIEF HEADQUARTERS STAFF

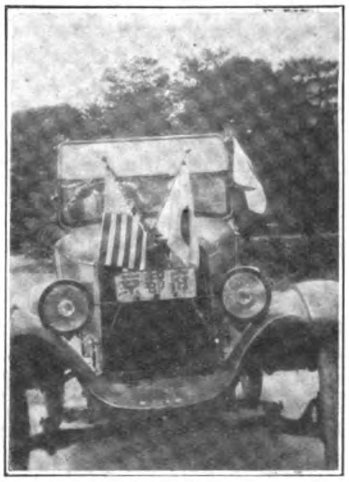
*Right to Left:* E. W. Mills, of Peking, assistant to Gen. McCoy; General Frank S. McCoy: Colonel Samuel Reber; Mr. T. Sakai, Director General of the Japanese Relief Bureau; Dr. Goto, of the Japanese Red Cross; Frederick Moore; H. Saito; Lt. Honda.
*Seated:* G. B. Rea and Colonel Geo. T. Langhorne.

Colonel Samuel Reber, Representative of the Radio Corporation of America, a most efficient officer who straightened out the radio tangle.



American Embassy and Relief Headquarters in Tokyo at the Imperial Hotel

Captain Fletcher, of the U.S.S. "Sacramento," and Lt.-Comdr. Zacarius, naval language officer attached to the Embassy.



Relief Car

Lt. Hasboeck, of the Army, and Jr. Lieut. Merrell, of the Navy, Aides to Gen. McCoy.

## AMERICAN RELIEF WORK IN JAPAN

*(Continued from page 677).*

many instances, the change will benefit their business. Most Americans doing business in Tokyo having their offices in the Marunoichi district face the future building boom prepared to get their share of the orders. On the other hand, those who owned properties in the devastated districts have little hope of recovering on their insurance policies, though we have heard of some with earthquake clauses on which they paid a higher premium, who are not worrying about the future.

Notwithstanding these losses, I have never seen a more genial, smiling and determined group than these same Americans who accept the situation in the same spirit as the Japanese, full of faith in the ability of the empire to pull through and confident of recouping their losses by dint of hard work and close attention to business. One hears no complaints from these men about the lack of consideration on the part of their government, no carping criticisms on the generous response to the needs of the Japanese or comments on how the Japanese comported themselves during their hour of trial. These men are sane, sensible and have the vision to see that the sentiment which prompted their countrymen to contribute millions for the relief of Japan is just so much capital invested in good-will in their own business, on which they will draw handsome dividends in the future. These men may be temporarily handicapped, but they are not alone. They face the future on the same footing as their Japanese colleagues, richer than ever before in the esteem and credit of those they must live and do business with.

American trade with Japan will not suffer by any failure on the part of the American government to extend financial or other assistance to enable its merchants to re-establish themselves in business in Yokohama or elsewhere in Japan. A few small firms may be wiped out, but those who have their roots firmly embedded in the country and do the bulk of the business will survive, while the losses of the few will be more than equalized by the increased volume of orders that will pour into our manufacturers through Japanese firms having their own branch offices throughout the United States. The unprecedented popular ovation that was given to Ambassador Woods on the occasion of his recent departure for America can be appreciated only by those who have lived a life time in Japan. The deep gratitude and cordial friendship which animated the thousands who thronged the great square in front of the Tokyo central railway station to honor the representative of the United States, is only a very small part of the capital on which the American merchant has to draw on in his future business relations with the Japanese. Only narrow-minded, or solid-ivory-domed Americans refuse to understand its meaning.

G. B. R.

# Shall America Co-operate with Japan?

UNDER the above caption this magazine printed an article signed by its publisher in March, 1920, which called forth the public resignation of its editor, the scathing denunciation of a contributor who runs the Chinese government as a side line to his journalistic activities and provided the opportunity for a venomous little anti-Japanese weekly purporting to reflect American official opinion to launch a business boycott against us. However, we have survived the campaign to " put us out of business " and once again propound the query : Shall America co-operate with Japan ?

*Yes, America will co-operate with Japan.* The answer comes direct from Washington voiced through its ambassador to the court of the Mikado. The pendulum has swung to the other extreme and where three years ago officials of our government opposed any suggestion looking towards co-operation with Japan and joined in the persecution of those who held other views, now heartily endorse a doctrine which has become the policy of the administration.

Ambassador Woods came to Japan with one object in view. A big, broad-minded man of affairs, he realized that the one guarantee of permanent peace in the Pacific, the one hope that the Washington treaties would be extended on their expiration, and the understanding with Japan expanded into an enduring friendship lay in creating business partnerships and closer financial relations and co-operation between the two countries. One day in Madrid, conversing with the German ambassador, the latter ventured the opinion that Germany had committed a serious blunder in failing to encourage and build up those close business ties with America which united America and Great Britain, to the point that it was difficult at times to understand where the interests of one ended and the other began. "Had Germany" he said, " followed this program, America would never have entered the war against us." He was mistaken in this view, but the fundamental truth was so sound that when asked to take the Japan post, Mr. Woods determined that the doctrine should guide his diplomacy in bringing America and Japan closer together. His views were fully endorsed by the president and the secretary of state and when he departed from Washington he carried instructions completely reversing the policies of the past decade and paving the way for that closer understanding which will lead to a new and different outlook on Pacific problems.

When Ambassador Woods arrived in Tokyo in the early part of August, he placed his ideas before a gathering of Japanese businessmen who honored him with a tiffin at the Bankers' Club in that city. The sudden change from polite attention given to the perfunctory diplomatic compliments which inevitably precedes such discourses, to one of lively interest when he touched on the subject nearest his heart, encouraged him to proceed and expand his views. The roar of genuine and heartfelt applause which followed and the congratulations showered upon him by every Japanese present told him that his message had gone home. Ambassador Woods did not know at the time that his mission came as the end to a long drawn out and bitterly contested campaign on the part of these same Japanese business-men to bring about the very thing he so fervidly advocated.

These same group of Japanese business-men had long realized the strength of the bond which united America and Great Britain, and that the one obstacle to the attainment of the same close co-operation with their own country was the suspicion created in the minds of Americans by unreasoning propaganda that such co-operation might be employed to advance their special interests in China. It was due as much to the influence and pressure of this same group that the policy of their government towards China was radically modified in order that no barrier could stand in the way of a complete understanding and close friendship with the United States. Little could be done towards eliminating friction with America, however, while the agitation against Japan in China was at its height. When these points were cleared up at the Washington conference and American confidence restored in her sincerity, the road was open to an amicable adjustment of her differences with China. Japan's policy towards China is now fixed. She stands squarely on the terms of the Washington treaties, the champion of China's unimpaired sovereignty and administrative independence. There is every reason to believe that within the next year all past differences will disappear and trust and friendship supplant suspicion and ill-will.

With Japan adhering to this unalterable program and America willing to aid in the exploitation of her domestic resources and industries and extend this co-operation to the development of Manchuria and Korea the door is now open for a wider application of the new doctrine. The first step towards this end was taken in the approval by the state department to the National City Bank

loan to the Oriental Development Company for industrial and agricultural development in Korea and Manchuria. There are other schemes for the exploitation of these regions projected by Chinese and Japanese in which there is no good reason why American capital should not find safe and profitable investment. Manchuria is the Land of Opportunity, the Country of To-morrow, an empire in the making, the granary of Eastern Asia, the last frontier of the cattle man; a possible Klondyke. While the rest of China remains at a stand still, torn asunder by civil strife and overrun with bandits, vast schemes are being projected and carried out in Manchuria under the initiative and enterprise of the Japanese. The new iron ore reduction process invented by one of the engineers of the South Manchuria Railway Company will revolutionize the iron and steel industry and we now learn that a super-hydro-electric power plan has been prepared that will dam the Yalu and its mountain tributaries at various points and provide ample power to operate not only the industries established or projected in Manchuria but all the railways in that province and a large part of Korea. If these plans are carried out, Manchuria will become the manufacturing centre of the Far East. Surely, this is a brilliant opening for Sino-Japanese-American co-operation on a large scale, carrying as it does the essential guarantees for protection and stability not yet discernable in other parts of China.

The day of kicking Japan in order to curry favor with or extract subsidies from a group of Chinese politicians is past. The policy of Japan towards China coincides with that of the United States. The American government has declared for co-operation with Japan. The new policies of both countries will prove of great benefit to China, who enters the combination as a full partner when enterprises in Manchuria come within the scope of the doctrine. The application of this working agreement to Manchuria under the Washington treaties is the surest guarantee that China's sovereignty in those regions will be safeguarded and the road cleared for industrial development and a trade boom unprecedented in any part of the world. The development of Manchuria under such guarantees will parallel the winning of the American west.

# Japan, the Friend of China

IT does not require a keen insight into Chinese psychology to understand that in clamoring for intervention, strong action, reinforcement of military and naval forces, railway police, and the many other remedies, advocated from time to time as a panacea for China's domestic ills, Americans and Europeans are undermining their own position with the Chinese while the latter are more and more turning towards Japan for sympathy and diplomatic support. It is only a question of time, and not very far off at that, when Japan will once more regain the full confidence of China, while those who have enjoyed her friendship and trust will see their influence and prestige wane and faith in their sincerity turned into suspicion and ill-will. The over-harsh demands of temperamental Americans for drastic intervention, fortunately unheeded by Washington, were more or less supported by local British sentiment. A campaign was launched to bring about exclusive Anglo-American co-operation for the same purpose, followed by a petulant outburst from a very small but extremely vociferous coterie urging the United States to take immediate and independent action, in order, so they said, that America would maintain the lead in Far Eastern affairs gained at Washington. On the part of the French, there was no scramble to obtain a seat on the Anglo-American band-wagon, as in these matters they can well afford to remain quiescent and permit others to pull the chestnuts out of the fire. Those who advocated the creation of a foreign-directed railway police as a protection against bandit attacks upon the railways believed it would result in increased British and American prestige, overlooking that French capital far exceeds that of any other country or combination of countries in the construction of existing Chinese railways. The money for all the Russian lines, sixty five per cent. of the Belgian and forty to fifty per cent. of the British-built railways was raised in the French market and the bonds are still held by French investors. The claims of the French to control the new organization, if vigorously pushed, would have to be recognized by other interested powers or invite opposition and the selection of a neutral.

As a counter irritant to the Anglo-American co-operative movement staged in China, a group is forming in Paris for the purpose of extending the Anglo-French understanding to this country along lines diametrically opposed to the strong action of the Anglo-American program. The French, as well as the Japanese, have been quick to take advantage of the mistakes of Americans. M. Roger de Belleval, editor of *La Revue Pacifique*, uses this situation as the basis of a call for Franco-British co-operation in the Far East. "Intervention," he says "was nowhere more unpopular than in the United States, nowhere is it now more insistently demanded." The French incline to the view that intervention, if necessary, must naturally take a prudent form. M. de Belleval says :

" England and France cannot go on indefinitely allowing their nationals to be maltreated ; nevertheless, it is the duty of both powers to counsel moderation at Washington.

" The Chinese people are very jealous of their independence. It is vital that action by the powers should always remain within the bounds of true neutrality, which is, in fact, the only real safeguard. No matter at what cost, they must never take sides, or they will mobilize the whole Chinese nation against them.

"The psychological factor has always to be taken into consideration. Men's characters change. It may appear useful to lend support to a chief for a time, but afterwards it is regretted, and the policy embarked upon has in the end done more harm then good. And if individuals are unstable, how much more so is public opinion. A chief may be popular for a time, and his influence may appear great, but how soon does this popularity disappear, often without any apparent reason ! Moreover foreign support often causes a man to lose what influence he has in his own country. We may admire a chief for his capacity in keeping order, but if we give him assistance, that very fact ruins his authority with his own people, and chaos ensues.

" The policy that is needed must therefore combine energy and prudence, perhaps the most difficult procedure of all. Who will control this policy ? Clearly it cannot be one power only. The Chinese people would never brook such interference. Accordingly intervention must be undertaken by a combination of powers acting together, to the exclusion of all individual action. It is clearly indicated that this combination should consist of England and France. They have both an excellent title to it. They are not new-comers in China, like the United States, they are not deeply involved, as is the case with Japan. Both powers have great interests in China, not only commercial, but also moral and intellectual. France, in particular, can point to her missionary work, which entitles her to a hearing. Moreover, since the collapse of Austria, England and France are the only two old nations that remain which are able to carry on a foreign policy consistently without constant interruptions from criticism at home. They have been able to prove to the world that political crises can be handled coolly, and also shown the wisdom of suspending judgment until the opportune moment arrives. There are, therefore, many reasons why these two powers should combine to make their influence felt in China, but the most important is the need for Anglo-French co-operation in every possible field. It would serve to relegate the Ruhr problem to its proper position, as an exceptional episode in the relations of the two countries, rather than what it is regarded as now, a disquieting symptom of disagreement and estrangement. During the war the *entente* between the two nations was perfect, because it was directed to the same ends. In the future let us seek for work we can do in common, for through working together we shall also come to agree together."

Americans who believe that their country is called upon to be the savior of China by reason of their commercial, philanthropic, educational and religious activities will probably be surprised to learn that French writers base their right to leadership on old established moral and intellectual interests arising out of their missionary activities. It will also come as a surprise that any plan for foreign control based on the volume of capital invested might also swing this leadership to a nation, who, because of its pre-occupation with other more important questions, has had the least to say about what should or should not be done to restore stability to this country.

There is only one obstacle to perfect Anglo-French co-operation in the Far East, the same obstacle which influenced Great Britain to oppose French occupation of the Ruhr. When both nations realize that there is no profit and much loss in opposing each other in Near Eastern territories where neither are wanted and where both are being played off against each other, it is possible that a more harmonious understanding may be arrived at in regard to China.

As long as the French in Syria continue the intrigue which precipitated the downfall of British prestige at Constantinople and stir up the Beduoins and tribes in Inner Arabia against Hedjaz, Transjordania and Iraq, frustrating British imperial designs in this section of the world, there is little hope that these two nations will work together in other parts of Asia. An extension of the Anglo-French *entente* to the Far East must necessarily lead to an abrupt termination of the Anglo-American copartnership in this country and the drawing together of America and Japan.

As long as other foreigners continue to demand drastic action for the protection of their interests in China they are simply hastening the day when Japanese influence will once more predominate at Peking. The policy of the American government (as opposed to a minority of its nationals in this country) and that of the Japanese government is identical. Both are determined to live up to the full letter and spirit of the Washington treaties and permit China to work out her own salvation without outside interference or pressure, even if it takes years and injures their own commerce. Only on the express invitation of China herself, will these two powers consider any variation from this program. No amount of pressure can influence Japan to depart from the basic policy laid down originally by the Hara cabinet, and had it not been for the agitation and boycott over the Kwantung issue, by this time the two peoples would have solved their differences and resumed close relations. Every move made by other powers or their nationals to break down or impair the Washington treaties provides the opportunity for Japan to strengthen her position, and should independent action be taken that would contravene these treaties, the power or powers taking such action would face a united China supported morally and materially by every force that Japan can command.

Japan, to-day, is acting solely in accordance with its own interests and will not be led away from its policies by the actions of other powers. Japan has set out to gain the good-will of the Chinese. Never before in the history of the Japanese nation has the policy of its government and the opinion of its people with regard to China coincided as at present. The Japanese believe that with the solution of their internal troubles the Chinese will be able to settle all foreign complications and if left alone they have the ability to unify contending factions without foreign interference. They also believe that it is Japan's duty to protect China while she is passing through this crisis in her history. Japan will live up to her present determination to refrain from supporting any one faction or party and work for unification as the first step to bring peace and prosperity to her neighbor. The Japanese hold, and rightly, that Chinese affairs are for the Chinese themselves to consider and solve and not a matter for foreign intervention. The Japanese people persistently encouraged their government to oppose the plan for enforcing a foreign directed railway police on China and succeeded in having it modified. Japan will make no move that might in the most remote manner be construed as an aggression or an impairment of China's sovereignty or a wound to its pride. When the time arrives in the future, the one outstanding question that remains to irritate the Chinese, the Kwantung lease, will be dealt with in a manner that will take it out of the arena of international politics.

At the head of the gaimusho, or foreign office, stands a man known to the Chinese as their friend, a statesman who has played a prominent part in formulating the present policy of his government. Since the Paris peace conference he has taken the lead in working out a program for better relations with America and a complete revision of Japan's attitude towards China. His efforts have been crowned with success in the United States and Japan is now well on the road towards a *rapprochement* with China. Japan's policy is fixed and without her approval it will be difficult to put into operation any of the plans so freely advanced to place China on her feet through outside help and against her wishes. Every move, every resolution, every plan advanced that in the least impairs the provisions of the Washington treaties, will meet with the disapproval of the administration at Washington which stands or falls on its record in bringing about these guarantees to China's sovereignty. In like manner, every such move will be blocked by Japan, who will go to the extreme of aligning herself with China in case the latter's rights are further impaired. And as the nationals of other powers continue to demand further encroachments upon China's sovereignty, she will turn more and more towards Japan for aid and comfort, with the full assurance that it will be forthcoming.

# The Red Side of the Disaster

It is unfortunate at this time that further anti-Japanese feeling is being aroused in China over the reports that a number of Chinese were killed by the so-called vigilance commitees organized in Japan immediately after the earthquake for the protection of the towns and villages against Koreans and reds. There is no denying the fact that Japanese mobs in several outlying towns lost their heads and committed acts of violence on a large number of innocent refugees fleeing from the horrors of Tokyo, under the supposition that these unfortunates were the vanguard of Korean anarchists bent on burning, looting and wrecking vengeance on defenseless country communities. It is difficult to explain, more difficult to excuse and still more difficult to atone for the cruelties which blackened the story of the great catastrophe at a time when all the characteristic good qualities of the Japanese came to the surface and earned the applause of the entire world.

It is, however, easy enough to understand the state of mind of a people who have learned to look upon the Koreans somewhat in the same manner as a generation ago the English did the Fenians, the Russians the nihilists or Americans the I.W.W. Ever since Japan has occupied Korea, the Japanese people have repeatedly been horrified by tales of assassinations, bomb explosions and revolutionary plots in which Korean malcontents figure as principals, and the public mind intuitively associates them with every political murder, conspiracy against the state or other activities which keep the police in a constant state of alarm. The assassination of Prince Ito, the murder of Mr. Stevens, the recent attempt to shoot down General Tanaka at Shanghai (resulting in the death of an American bride touring the world with her husband on their honeymoon) the long line of bomb outrages and revolutionary uprisings in the Land of the Morning Calm have got on the nerves of the Japanese to a point where they are ready to believe the Koreans capable of committing any crime in order to register their hatred of Japan. It was only natural when the quake set free the prisoners from the Negishi prison at Yokohama at a time when all police restraints were removed that the hardened criminals would take full advantage of their liberty to murder and loot. It was also natural that the reds, and there are many in Japan, would seize the opportunity to forward their own plans to precipitate disorder and utilize the occasion to shift the responsibility to the shoulders of others. Many Koreans are used by the reds, to forward their propaganda in Japan, and it was easy for the latter to cover up their own activities by placing the blame on their misguided dupes. The cry against the Koreans, as far as can be ascertained, started at Yokohama and in the Yokosuku district where a large force of Korean laborers were employed in railway construction and the word was carried like a flash all over the empire that the Koreans had banded together to loot, murder and burn. The Japanese living outside the big centres knew the Koreans only by reputation and as the first truck loads of unfortunates fleeing from Tokyo passed through the towns of Saitama prefecture they were seized by the mob of self-constituted vigilance committees and young men's associations and despite the efforts of the police to protect them, were ruthlessly massacred. There may have been some Koreans amongst these victims of mob ferocity, there may also have been a few Chinese, with here and there a foreigner who was roughly handled, but the evidence which has come to light since those terrifying days immediately following the catastrophe, shows that the great majority killed by the terror-crazed mobs were their own countrymen.

It is a picture which no one cares to dwell upon, least of all the Japanese themselves. Those peaceful and inoffensive Koreans killed by the mobs paid the penalty of years of outrages perpetrated upon the Japanese by the worst elements of their own country. The criminals of Yokohama and the reds of Tokyo knew their own people and with devilish intent diverted popular rage from their own misdeeds to those the public were all too ready to accept as desperate characters. There is no other explanation to an episode which darkened the otherwise bright picture of supreme heroism, self-sacrifice and deeds of human kindness which characterized the Japanese people at a time when all law, order and government were at a standstill and self-preservation overpowered every other instinct.

There is ample evidence to support the charge that the reds instigated the movement against the Koreans and hailed the disaster

as a providential opportunity for furthering the revolutionary movement. A soviet propaganda ship, well named the *Lenin*, was fitted out hastily at Vladivostok and dispatched to Yokohama carrying physicians, nurses and supplies for the relief of the "Laboring classes only." In her hold was also safely stowed a few tons of revolutionary propaganda literature. The captain had the consummate nerve to convey this information to the Japanese officials who boarded the vessel on her arrival. Soviet Russia calmly calculated how the agony of a stricken people could be turned to political account and felt aggrieved when the Japanese very properly refused to permit their bloody propaganda to be concealed under the mantle of charity. The captain of the *Lenin* was directed to make all reasonable haste in removing himself, his boat, his supplies, his doctors and nurses from Japanese waters and a warship stood by to speed him on his return voyage. Bolshevist propagandists ordered by Moscow to hurry to Japan by other routes were detected and turned back by the police. People who will descend to such tricks and methods to incite revolution at such a time are fully capable of setting the mob on to innocent people in order to arouse the blood lust.

It may be true, as alleged, that some Chinese, unable to satisfy the vigilance organizations of their identity, were mistaken for Koreans, it is also entirely probable that others were murdered in Yokohama by criminals bent on looting, but it is equally certain that no one regrets such occurrences more than the Japanese people at large and their government. One of the outstanding features of the great catastrophe was the immediate reaction of the Japanese to the dispatch of stores, medicines, red cross units and money from China and the abrupt cessation of anti-Japanese activities on the part of the students and political agitators in this country. The feeling of profound gratitude on the part of the Japanese for the unexpected and spontaneous sympathy shown by China eliminated all bitter feelings engendered as the result of years of political misunderstanding. From the very first measures for general relief, even before they had heard about China's generous contributions, the Japanese government created a special bureau and organization to succor the Chinese sufferers residing in the devastated regions. It is within our personal knowledge that Mr. Debuchi, chief of the Asiatic bureau of the foreign office, left no stone unturned in order that immediate relief and protection be extended to the Chinese. Owing perhaps to the larger American and other foreign relief activities which monopolized publicity, adequate recognition was not given by the press to China's prompt response to Japan's mute appeal for help, or to Japan's equally prompt reciprocal steps to ameliorate the sufferings of Chinese victims of the disaster.

A special fund was set aside for this purpose. Several thousand Chinese were collected and cared for in specially prepared camps while over 3,000 were provided with free transportation on Japanese ships to their own country. They were clothed, fed and in some instances provided with money. In fact, every possible attention was shown them at a time when the Japanese homeless and destitute were crying for clothing and food and had the first claim on their own authorities. Mr. Debuchi took personal and active charge of these matters while the army, navy, police, red cross and steamship companies co-operated with him at all times to impress upon the Chinese refugees Japan's real friendship and solicitude for their comfort and well-being.

In the midst of their own sorrow and loss, the Japanese government officials and leaders of public opinion, even to the man-in-the-street, were as one in hailing the opportunity presented by the disaster to clear away misconceptions surrounding their attitude towards the Chinese. If the latter were subsequently shocked to learn that some of their countrymen had fallen victims to mob violence, the allegation brought consternation to the Japanese, and no time was lost by the government in expressing its sorrow and making proper apologies through its minister at Peking, at the same time starting an investigation to determine the truth of the charges and fix the responsibility. The new epoch in Sino-Japanese relations so fervently hoped for on the part of all classes in Japan is set back temporarily by this unhappy incident. Some Chinese, ignorant of true conditions during the days following the quake, are now advocating retaliation, using the incident to keep alive political strife and the boycott against Japanese goods. The Japanese government is conducting a searching inquiry and if the allegations are supported by the evidence, ample reparations will be cheerfully and spontaneously forthcoming.

The Japanese people as a whole are sternly demanding the facts and if the charges are proven, full satisfaction will be given the people of China, the families of the injured or killed compensated and the guilty properly punished. If such incidents occurred it was through no general anti-Chinese feeling on the part of the Japanese, but traceable solely to the extreme terror inspired in the hearts of the simple-minded credulous country people by stories scattered broadcast by the reds and criminals that the Koreans were coming to massacre them.

G. B. R.

# Technical Education in China

THE following contributed article to *The Engineer* is of special interest to Americans at a time when the China society of America is using its best endeavors to have young Chinese student graduates from American colleges supplement their training by practical experience in American industrial establishments and technical offices. While heartily approving any plan that will provide that practical training so essential to the efficiency of the technical graduate, we incline to the belief that until Americans carry their philanthrophy further and provide the capital for the creation of industries in China that will open the door for the employment of their protégés, they are simply adding to the already large number of unemployed and dissatisfied Chinese technical men who decline any work other than a comfortable desk job.

The contributor to *The Engineer* emphasizes this same condition, and maintains that the reason why more of the graduates of the Chinese engineering colleges have not followed technical careers is due to lack of development, or, over-production of engineers. "It is manifestly absurd" he continues "to expect any country to absorb yearly some one to two hundred engineers on a total track mileage of from four to five thousand miles with all the postal, telegraph and navigation services thrown in." Most of the old students of the Chinese official technical schools are looking for jobs. When the hundred or more yearly graduates from American colleges is added to the number of unemployed, the situation can only be improved by the immediate resumption of railway construction on a large scale accompanied by the creation of technical industries. Otherwise, the continued swamping of the Chinese engineering field by untrained graduates from technical colleges, can only make for a continuation of nepotism and political favoritism if these men are to find an outlet for their usefulness:—

"The more one reads about technical education in China from the pens of Chinese journalists and leader writers, the more one becomes convinced that China will never wake up to face realities, or cease to bow down and pay supreme homage to the god "Face." All that this means to China's millions cannot be expressed in a few short phrases. It permeates the whole of official and private life, with the result that a scheme with a high-sounding name will be assured of support, while any attempt to introduce reforms which aim at putting the fundamental principles right will be met with that passive resistance for which the Oriental is so justly famous. In no department is this tendency more marked than in that of technical education, and it is safe to predict that there are few technical students in China to-day who really believe that there is no royal road to a knowledge of engineering.

"The latest scheme is that put forward by Yeh Kung-cho, who was minister of communications prior to the downfall of his party in the civil war of the summer of 1922. Briefly, there is to be a reorganization and an amalgamation of the engineering department.

Peking University, the Nanyang College, Shanghai, and the Engineering College, Tangshan, to form the Chiao Tung (Communications) University.

"It may be of interest to recall that the Engineering College, Peking, is a combination of two separate schools, viz., railway administration, and telegraphs and posts, and that they came into being in 1917, following the decision to close the training institute of the ministry of communications. The Nanyang College was founded in 1897 by Sheng Kung-pao, then director-general of the China Merchants' Steam Navigation Company, and head of the Imperial Chinese Telegraphs, and was known as the Government Institute of Technology. In 1904 the control was transferred to the board of commerce, but after the revolution in 1911 it passed to the board of communications. Prior to this transfer the College received its funds from the Steam Navigation Company and the Imperial Telegraphs; afterwards it was maintained by an annual grant of some $130,000 (Mex.) from the board.

"The Tangshan College, considered by some writers to be the best technical institute in the country, was founded in 1905. It started as a railway school, and since that time it has been renamed out of all recognition, successively becoming the Engineering and Mining College, the Railway College, and in 1913 the Special Institute of Industrial Education. As stated above, it now becomes part of the Chiao Tung University. Since it was transferred to the board of communications in 1907, it has received its funds indirectly from the mother railway—the Peking-Mukden line. Tangshan, situated some 75 miles north-east of Tientsin, is the most important industrial centre in North China, and is the centre of the Kaiping coalfield, operated by the Kailan Mining Administration, the weekly output approximating to 80,000 tons. It also contains the Peking-Mukden Railway Works, giving employment to 5,000 men, a large cement works and a modern cotton mill.

"So far as the writer can ascertain, under the new order the Nanyang College will give courses in mechanical and electrical engineering, the Tangshan College will give courses in civil engineering only, and the Peking College will confine itself exculsively to wireless, telegraph and telephone engineering. In addition, a two years' preparatory school is to be established at Tangshan, and a middle school at Shanghai.

"It appears that the amalgamation scheme formed the subject of a memorandum which was submitted to the president, and that the arguments supporting the proposal were based on the necessity of improving the then existing conditions.

Briefly, the defects referred to were:

(1) The duplication of courses, and lack of economy of effort.

(2) The majority of the graduates of the three institutions had gone into various walks of life for which no technical training was required.

(3) The impracticability of the education as given owing to the absence of intimate relationships between the administrative heads of the colleges and the board of communications, the former making no endeavor to ascertain the wants of the latter and to regulate their courses accordinagly.

(4) The courses were believed to be not practical enough. The promoters of the scheme claim that the new arrangements will eliminate these defects for the following reasons:—

(1) The board is in a position to know the kind of technical training required.

(2) It will be in a position to give the graduates employment at the end of their technical training.

"A cursory glance at excuses given and proposals made, might lead one to think that the authorities concerned had at last been brought to see the true state of affairs. It is the writer's studied opinion, however, that there is no cause for optimism, and he proposes to analyse the statements made in the light of his engineering experiences in China extending over seven years, three of which were spent as head of an engineering department in one of the government colleges.

"The amalgamation of the colleges is, undoubtedly, correct in principle and may—indeed, should—give the economy of effort and co-ordination required; but to expect such a college reorganization to be the cure for wasted technical talent is to show an ignorance of the facts and a blind disregard of the conditions now obtaining in China. The writer does not believe that lack of co-ordination has ever deprived students of satisfactory theoretical training, or that the instruction given was so inadequate that students who were successful in passing out were not qualified to be offered work on a remunerative basis by the board. In fact, he is prepared to maintain that the reason why more of the graduates of the three colleges have not followed technical careers is simply due to lack of development or over-production of engineers, whichever way one cares to face the problem. It is manifestly absurd to expect any country to absorb yearly some one to two hundred engineers and experts on a total track mileage of from four to five thousand miles with all the postal, telegraph and navigation services thrown in. It is one thing for the minister of communications to promise employment, and another to find it, unless he is prepared to create sinecures. The real answer to such statements is simply this, that at the present time, old students of the Tangshan College, with four years' courses and the associateship of the college behind them and a further experience of two or three years on engineering works abroad, are looking for jobs. Statistics showing exactly the number of students who have kept to technical work and have found employment in the board of communications would make illuminating reading.

"As regards the lack of practical training, in theory, at least, the way is simple. A student attends technical courses in order to learn certain elementary principles so essential in the application of scientific knowledge to engineering problems. A knowledge of the processes and materials used can only be obtained in, or upon, engineering works, and it is to the shop he should go if he wishes to obtain such knowledge Unfortunately, it is difficult to get students to see the value of such training. Although it is unwise to dogmatise too freely, it is safe to say that the old *quasi-caste* distinction (not hereditary) of men into four classes—(1) Shih, the scholar; (2) Nung, the farmer; (3) Kung, the artisan, and (4) Shang, the dealer—is not wholly eradicated, and in China proper, at all events, it is almost impossible to get the scholar to play the part of an artisan, even for relatively short periods. The writer has seen the experiment tried with six fourth-year students in one of the largest railway works in China. In the first place, the scheme was sanctioned only after repeated representations had been made to the officials of the board of communications, and, in the second place, the students were lazy, objected to the time limits and general restraint imposed, and generally wasted their opportunities.

"It will be many years before technical education in China can be run on European lines. The apprentice or pupil at home takes his shop training as a matter of course, but in China the reverse holds, and the Chiao Tung University will fail, as its constituent colleges have failed, until such time as it refuses to grant engineering degrees and subsequent employment on purely theoretical training. Not 10 per cent. of the students who have graduated in Chinese colleges know the difference between a smooth cut and a bastard file, and men with less practical experience than that claimed by a third-year apprentice in England are given appointments as works managers. It is not for the really qualified man to grumble at this state of affairs. He is part of a system that encourages "Friend Pidgin," and that makes political feeling more important than engineering qualifications.

"There is a touch of irony in the situation as it exists to-day, and one wonders whether in all the welter of proposals, counter-proposals and paper reforms, the board of communications has realized its own shortcomings. In the writer's personal experience this same board has brought technical education to the point of ridicule by sending up "ploughed" students for three re-examinations in as many weeks, when such action could only be interpreted as an official order to pass these students.

"If the administrative authorities and the Chiao Tung Pu wish to co-operate for the good of students who, according to the claims of one Chinese writer, have the potentiality of developing into the best technical men, and really desire to give them a training suitable to the needs of their country, they must do something more than introduce paper reforms. They must slow up the process of turning out fully qualified technical men by making a three years' course in, or upon, engineering works an integral part of the curriculum. It is, perhaps, needless to emphasize the fact that there are many good places under the control of the board where such training could be obtained. In several, the student might eventually come to realize that many of his difficulties were due to the fact that his predecessors lacked the practical knowledge he was trying to acquire. Also, in time, he might realize that getting one's hands soiled was no disgrace, and that a country professing to strive for commercial prosperity must be prepared to eliminate these ideas of exclusiveness which hamper real progress."

# A Superfluous State Department

## Some Thoughts on American Policy in China

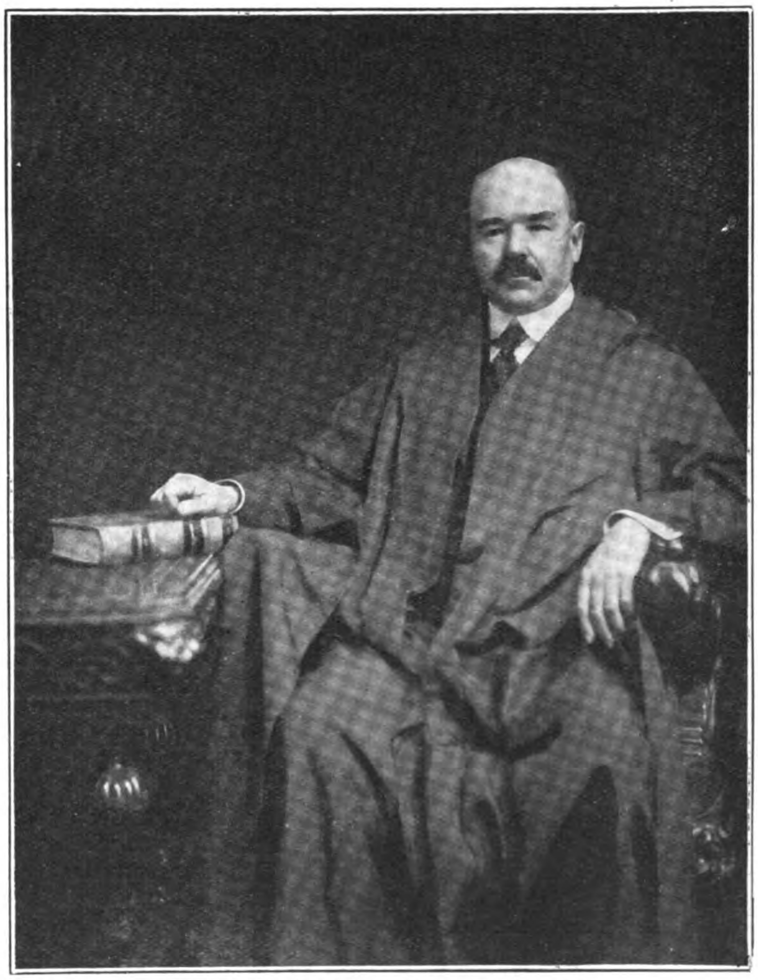
*By Geo. Bronson Rea*

THE resolutions of foreign chambers of commerce in China make interesting and instructive reading and when confined to purely trade matters are extremely helpful to their governments and newspapers in advocating and supporting measures for the protection and advancement of national interests. Unfortunately, however, there seems to be a tendency on the part of such organizations to depart from time-honored precedents and agitate delicate international questions to the point where their activities instead of being welcomed become a serious handicap to their governments in seeking and applying satisfactory and peaceful remedies. Only a few months ago, a set of resulutions were passed by a sub-committee of the American chamber of commerce, which, if acted upon by the American government, would have aroused intense anti-American sentiment throughout China and completely destroyed national prestige and the good-will that has taken years to build up.

The associated American chambers of commerce of China have now passed another set of resolutions for the guidance of their government in dealing with the many complex and perplexing problems arising out of the disturbed internal conditions prevailing in this country. On the whole they are sane, sensible and by far the most conservative coming from a body which to date has distinguished itself by its unreasonable attitude towards Far Eastern problems.

The resolutions fully covered the many needs of the American commercial community and with the exception of those dealing with political matters should have the full endorsement of everybody interested in the maintenance of national prestige and trade in China.

From the viewpoint of the American trader who sees his treaty rights flouted, his properties damaged or destroyed, his claims for reparations ignored, his bills for materials dishonored, in addition to being called upon to pay exorbitant and illegal taxes for the privilege of conducting business outside the treaty ports, the resolutions are far too conservative. On the other hand, when perused by Chinese and considered in connection with the previous set of resolutions, they will conclude that Americans are attempting to coerce their government to take more severe and aggressive action than did Japan in the 21 demands of 1915. Americans who read these resolutions will gather the impression that their government has been negligent in adequately protecting the lives and properties of its citizens and will strenghten their belief that a set campaign has been initiated to force the United States into some sort of intervention in the affairs of China that can lead only to most deplorable consequences.



HON. CHARLES SUMNER LOBINGER

**Justice of the United States Supreme Court for China**

A jurist of exceptional ability and probity, worthy of promotion to a higher court. His friends in China are conducting a vigorous campaign for his reappointment

We are not always in agreement with the policy of the American government in China believing that in many instances its attitude is influenced largely by our philanthropic, educational and religious interests and in the past by mischief-makers and embryo experts who knew only one side of the questions at issue, but we realize also that our officials have done all within their power and gone as far as public opinion will permit to protect national trade interests in this country. Any suggestion that the American government has been backward in co-operating with other powers to protect the lives and properties of foreigners in China will be resented in high official circles in Washington especially when such suggestions reach the stage of open accusation charging the minister at Peking with neglect of duty.

As a matter of fact, the American government has not only been most active in finding a suitable solution for the Chinese problem but has actually taken the lead in efforts to seek a feasible and practical method to restore stability. The difficulty of applying any constructive remedy is due not so much to the unwillingness of America or any other power to co-operate, but to the generally chaotic condition of China herself and the danger of uselessly arousing the latent anti-foreign sentiment throughout the country. Consideration for these conditions led the United States to reject a few months ago the suggestion of a great naval demontration off the coast of China mentioned by another power as one of the means which might prove efficacious in bringing China to her senses. The proposal was opposed by the American government on the ground that there is no channel to Tientsin for heavy warships and that ships lying outside the Taku bar would not be visible from Tientsin and could have no possible effect upon the *tuchuns*, who, safe in the interior, would laugh at a naval demonstration. The same argument holds good in other ports of China, where a show of naval force would have little, if any, effect.

To complicate the international situation, irresponsible elements such as the students, professional politicians and agitators, morally supported and encouraged by certain foreigners and defended by American publications, launched a deliberate campaign to renew the Japanese boycott, a campaign which at any time might have embroiled China with a power which has given convincing proofs of its sincerity and friendly disposition by the settlement of the Shantung question and adherance to the terms of the Washington treaties. The Japanese boycott might easily have led to developments which would have so complicated the international political situation that other powers could have done nothing to save China from the consequences of her folly. The sudden reinforcement of American troops in China and

an increase of naval strength in Asiatic waters at such a time might well have created the suspicion in Japan that we stood ready to defend China and uphold her demand for the cancellation of the treaty extending the Kwantung lease to 99 years.

Conditions have not materially changed and when Americans now call upon their government to increase its military forces in China to the full strength allowed by the treaties and augment the Asiatic fleet and Yangtze patrol squadron, the inference is that they are expected to compel adherance to the treaties by either a show of force or by actual armed intervention. This brings us back to the resolutions of a few months ago whose application would compel the United States to take the lead in a task wholly repugnant to public opinion at home, with the added certainty of arousing the resentment and hostility of the Chinese people. The recommendation to strengthen our military forces could only result in reinforcing the regiment at Tientsin by an additional 500 men, whose activities under the treaties are confined to keeping open the railway from Peking to the sea in the event of internal warfare in that region. The presence of an additional 500 men at Tientsin could have no moral effect on the *tuchuns* in the interior nor could they be employed for any purpose other than protecting the railway without violating the integrity of China and vitiating the Washington treaties. It is difficult to understand how the strengthening of this regiment could have any effect on present conditions or protect foreign lives and properties outside the American patrolled section of the Peking-Mukden railway zone.

There is considerable justification, however, in asking for additional craft for the present antiquated Yangtze patrol, all of which should have been scrapped ages ago. These boats should be built in Hongkong or Shanghai and placed in commission without delay. Here we are well within the treaties and until the Chinese determine to settle down and call a halt to internal squabbling and provide guarantees against piracy and interference with foreign navigation, they must expect to have their sovereignty further impaired by the presence of foreign war-ships on their inland waterways. The increase of the main Asiatic fleet entailing as it does extraordinary expenditures for the enlargement of the Manila naval base, may well be in contravention to the terms of the naval treaty. With Japan's power crippled for another generation, the present is no time to advocate any considerable increase in the American naval forces in Asiatic waters, and as pointed out, any such show of strength would fail to impress the Chinese warlords who dominate the interior. Increase of the army or the fleet would be justified only in the event of actual armed intervention for the protection of foreign lives and properties, and it is safe to say that American public opinion would never sanction such a step unless the menace reaches that point where international action becomes absolutely imperative. The Yangtze patrol is another matter and the chambers are fully justified in asking for this additional protection to their shipping.

Americans who shout the loudest for intervention and the strengthening of our armed forces in China are the same people who only a few years back loudly condemned Japan for applying similar measures for the protection of her subjects in Manchuria and elsewhere. They were foremost in denouncing the presence of a Japanese garrison at Hankow and tore their hair and yelled for war when Japan's position in Shantung was upheld at Paris. This element was fully informed that during the progress of the world war the allied ministers at Peking on two occasions requested Japan to send troops to protect foreign lives and properties in the north and as soon as the danger was past, they roused the Chinese against Japan, called upon the world to bear witness to her unwarranted aggressions and in general created an atmosphere that was only clarified by the Washington conference. Japan was ostracised, her prestige undermined and her trade killed by boycotts, simply because she attempted single-handed to protect and advance her vital interests in China. Yet with this lesson before them, we find the chambers advocating at this late date, the application of measures they so loudly condemned and were even willing to have their countrymen go to war over a few years ago. Are these Americans now willing to assume a leadership that will carry with it the same consequences ? For just so sure as their recommendations are carried out and America takes the lead in straightening out the tangled affairs of China against the will of the Chinese people, just so sure will other nationals turn on us in the same manner as they turned on Japan, just so sure will they arouse the Chinese against us and advocate reprisals and boycotts. Is it any wonder that sober-minded Americans cannot always endorse resolutions passed by their countrymen, when such inconsistencies and fatal remedies are proposed passed and broadcasted through the medium of the press ?

Another delicate question which received attention at the meeting of the chambers was the bill now under consideration by congress which amongst other things contains clauses providing for placing the U. S. court for China entirely under the supervision of the department of justice, instead of, as at present, the state department; extending the power of the U. S. commissioner and making him an assistant judge, and providing for a modified jury trial. The bill received the approval of the chambers. This raises certain points which seem to have been treated rather lightly in so far as general public opinion is concerned. For the past three years the American community in China has been divided into two camps over the question of the American court, while the past six months has provided ample evidence of a determined campaign to have the judge reappointed on the expiration of his term. The present incumbent, Judge Charles Summer Lobinger, is a jurist of exceptional ability and probity, who has proved his worth in the Philippines and in his present position. He is worthy of official recognition and promotion to a place on the bench where he will have a wider opportunity to display and exercise his profound knowledge of the law. Rightly or wrongly, the judge aroused considerable criticism over his decisions to an extent where many lawyers seemed to feel that they were not receiving equitable treatment, all of which led to an investigation in which the judge was exonerated by the department of justice and received a personal note of congratulation from the president. The aftermath of this incident, however, has been unfortunate, insomuch as the friends of the judge have engaged in open electioneering for his reappointment, employing methods which pass in ward politics at home but wholly undignified when applied for the appointment of a judge to the supreme bench.

We cannot subscribe to the questionable tactics to discredit the judge indulged in by his opponents nor can we endorse the activities of his friends in electioneering at every possible opportunity for his reappointment. The record of the judge is before the authorities at Washington. It is an honorable record and entitles him to promotion. The judge has served nearly ten years in China, and the time has now arrived for the application of a jury system to decide important cases which come before his court. Judge Lobinger is on record as being opposed to the jury system in the court over which he presides. There may be excellent legal reasons why the present system should be perpetuated, reasons which we are not familiar with, but whatever these reasons are, they are not strong enough to convince us that justice can be dispensed at all times with equity by any individual, no matter how profound his knowledge of the law or how impartial or unprejudiced his views. The right to trial by jury is fundamental, and to surrender this precious privilege only serves to strengthen the hands of reactionaries and invite charges of favoritism or prejudice against the dispenser of justice. Here, we believe the judge has erred, and invited suspicions which grew until they assumed the character of direct charges, which, happily, proved unfounded. The jury system was evolved only after centuries of sacrifices and struggles against absolutism for the protection of the accused ; it is also the one safeguard for the reputation of the judge. The inalienable rights of the American citizen to a trial by a jury of his peers should be extended to the United States Supreme Court for China, and if we have any cause for differing with Judge Lobinger, it is solely because we believe that his own position will be strengthened and further criticism against the court forestalled by the adoption of a basic principle which guarantees to bench and bar a decision precluding any suspicion of favoritism or prejudice. The recommendation of the American chamber of commerce for the appointment of assessors to sit with the judge does not go far enough. Americans in China will never be satisfied until a full or at least a partial jury is empanelled to render a verdict on important cases.

The transfer of the court to the jurisdiction of the department of justice may also be based on sufficiently good reasons to warrant such a revolution in the conduct of our foreign relations. We can readily understand and support the argument that the dispensation of justice under our government should come under the jurisdiction of the department of justice, on the other hand, we fail to see how this can be extended to China without complicating the already difficult problem involved in living up to the terms of the Washing-

ton and other treaties between America and this country. The most important question now before the Chinese is the abolition of extra-territoriality, and although action on this may be deferred for some years, when internal conditions are again stabilized, the Chinese will once more concentrate their diplomacy and propaganda upon the realization of this aspiration. The establishment of an extra-territorial court outside the jurisdiction of the state department can only tend to hamper the latter's liberty of diplomatic action when called upon to face this issue.

So long as the state department is charged with the conduct of foreign relations under the direction of the president, it would be most inappropriate to have officials of the extraterritorial court in China under the supervision of some other department of the government. To receive attention, all correspondence with Chinese officials must pass through the hands of the consular or diplomatic officials, and unless the utmost care is used in wording such communications, it would not be difficult to precipitate a situation that would nullify the work of the duly accredited officials of the state department and undermine their usefulness. A case in point arose some months ago when the U.S. district attorney sent a rather peremptory communication to the *tuchun* of Chekiang concerning the arrest of an American in Chinese territory charged with arms smuggling. This encroachment of the court on the duties of the consular service raised a tempest in a tea pot, the end of which is still to be heard from.

The United States supreme court for China was established for the express purpose of carrying out the provisions of our treaties conferring upon the American government jurisdiction over its citizens in this country. In the absence of the treaties the American government would be without authority to establish American courts in China. The enforcement of the treaties is vested in the state department and the officers of the courts should be under the direct control of the department which has to do with the enforcement of treaties. The United States court for China was also created to relieve the consular officials of some of the heavy work connected with the increasing number of disputes arising in this country and of taking over the more important cases coming before the minister and consuls, the general purpose being to carry out the treaty provisions. After the creation of the court the consuls retained jurisdiction in certain classes of cases. Under the act creating the court it can only function in buildings belonging to the various consulates, and it was intended that the court would constitute a part of the judicial machinery of the American government in China under the department having charge of carrying out the treaty provisions.

The court cannot function without the cordial co-operation of the consular service. It is frequently necessary that officials of the court, especially the district attorney, should assist the consuls in court matters, and that degree of co-operation which is absolutely essential in order to maintain national dignity in China can only be obtained between these two classes of officials when they are accountable to one department. If one is responsible to the state department and the other to another department of the government, friction and divided authority is bound to develop. The fact that the court functions in a foreign country and is consequently intimately connected with our foreign relations should be a sufficient reason why its officials should be solely answerable to the department of state. If we are seeking to complicate our relations with China by a further extension of American governmental powers and jurisdiction over its citizens in this country, all we have to do is to permit the various departments of our government to send their officials here to operate independently of the state department. Every department of the American government with the exception of the interior is now operating in China either in co-operation with or independently of the department having charge of our foreign relations. In fact, as we had occasion to point out some months ago, Americans in China have all the advantages of their own government except the right to exercise the suffrage and to trial by jury. The operation of these various departments in China under treaties which concede to our government extra-territorial rights over its citizens, can only tend to the growth of a system that will be difficult to uproot when the time arrives for a serious consideration of China's claims for the abolition of extraterritoriality. There may be good reasons why the department of justice should extend its jurisdiction to China by taking over control of the court and making it directly answerable to the attorney general; there are equally good reasons, why the commerce department should function in China independent of the state department; we have a separate army command answerable to the war department; the commander-in-chief of the Asiatic fleet is directly under the orders of the navy department; there is no good reason why the treasury department should not open an office for the collection of income and other taxes; the department of labor should have its own office to inspect and pass upon Chinese taking passage to the United States; the marine health service and shipping board representatives are on the ground; so there is every reason why the department of justice should also establish itself here independently of the state department. There is one solution to all this that evidently escaped the attention of the American chambers of commerce; that is, the complete withdrawal of the state department officials from China altogether. If all other departments of the American government are to function in China under the treaties and have jurisdiction over American citizens, the consular service becomes superfluous and should be eliminated as rapidly as possible. The minister at Peking might be retained as a messenger boy for the secretary of state or he might even be elected by the American community in China and receive instructions direct from his constituents. Once we bring in all other government departments to operate independently of the state department there is no valid reason why the latter, shorn of all power, should continue to function.

This being the situation, it causes no surprise to read that the American chambers have resolved to ignore prescribed methods in communicating with its government through the medium of consulate and legation by creating a special office in Washington through which congress and the departments will be approached direct on all matters connected with American interests in China. The chambers believe that more suitable action may be obtained in matters pertaining to China and the *Far East*, affecting American business and interests generally, if they were directly represented at the national capital, and it was resolved that arrangements be made at once to appoint such a representative who will be empowered to give publicity to all matters which may be referred to him from time to time, to enlist the aid of the chamber of commerce of the United States, government officials and departments and commercial and other organizations interested in the various subjects referred to him for attention. It is easy enough, therefore, to connect this resolution with the one which follows:

"Owing to the fact that foreign trade occupies such a small portion of the interest or activities of the American people generally, it is always difficult to induce the American government to adopt constructive and continuing policies in foreign affairs and especially in respect to American interests in this part of the world. The lack of familiarity on the part of many of the officials at Washington in respect to the protection of the lives and property of its own citizens not to mention the larger diplomatic and strategic interests of America in the Far East as made it necessary for American citizens both individually and through their organizations to frequently conduct publicity campaigns in the United States. Such publicity campaigns in the past, although largely unorganized, have nevertheless been of considerable benefit in concentrating the attention of the American people and through them of the government upon particular problems affecting the interests of Americans in this part of the world.

"In view of the serious situation now existing in China which constitute a menace to the lives and interests of American citizens residing in the Chinese republic, it is recommended that the associated American chambers of commerce of China give this subject special attention and that a special committee be appointed to work out in co-operation with other American organizations, a definite publicity campaign calculated to bring to the attention of the American people, members of congress and other officials of our government the necessity of a definite policy in respect to the present situation of China."

It is difficult for a publicity expert to understand just what subjects are so important as to call for the appointment of a super-representative and his maintenance at Washington at a large salary and entertainment expenses without which he cannot function with success. The American chambers of commerce can have all the free publicity required for legitimate propaganda from representatives of the American press now stationed in China. The state department daily gives out all important news that comes from its officials in China; the commerce department is on the job at all times to sell China to the American manufacturer and

merchant. Once a year at least, the commercial attaché at Peking is called home and instructed to swing around the circle and tell the people about trade opportunities in China. Every publicity dodge has been tried to interest Americans in this country, every argument that could excite interest has been advanced, yet Americans have not responded. The truth is that the American people are fed up with publicity about China. Our merchants responded in 1919 to the campaign of the China booster and swarmed into the field, only to get stung. It will be difficult to make them bite twice. They recall previous publicity campaigns directed from China which nearly precipitated war with Japan; they recall that nearly every publicity campaign sponsored by Americans in China has resulted in disaster. They recall that it was this element which opposed dissemination of the truth about China previous to the Washington conference, and that present conditions are largely traceable to the hullabaloo raised by these same Americans demanding full recognition of China's sovereignty. They will recall that the same element which so strenuously opposed intervention by other powers is now clamoring for America to go it alone, to increase our military and naval establishments and unaided assume responsibilities which would overturn our traditions and diplomacy and bring down on our heads the odium of every Asiatic people.

We have every sympathy with any move that will bring greater protection to the lives and properties of foreigners in China and with every legitimate proposition for the advance of national trade interests, but when a few men representing American business interests assert that Americans have to be educated to the larger diplomatic and strategic interests of their country in the *Far East*, and that such education is to be carried on through publicity campaigns directed by the representative of the chamber, we are forced to enter an emphatic note of warning. Much of the misunderstanding surrounding Chinese and Far Eastern problems is traceable to the misdirected activities of commercial organizations in going outside their legitimate sphere to meddle in international politics by sponsoring publicity campaigns directed by half-baked experts who used these organizations to further their own ends. The above resolution is evidence that the American people are to be once more aroused by a campaign obviously designed to coerce the state department and bring pressure to bear in other quarters to take action in China along lines repugnant to our conceptions of international ethics and opposed to our traditions. It is safe to affirm that that the larger diplomatic interests of the United States in the Far East are fully understood by the very capable and experienced diplomats who direct our foreign relations and it is equally certain that every strategical possibility that might be discovered by the director-general of the proposed publicity campaign has been studied, pigeon-holed and forgotten by the war and naval colleges many years ago. If Americans in China now feel that they must educate the people and government of their country on these purely technical and highly specialized subjects why not go a step further and resolve that the super-expert representing the Associated American chambers of commerce of China be appointed *ex-officio* a member of the army and navy general staff and confidential adviser to the president and secretary of state on Far Eastern problems. Why embarass the government by merely sending him to Washington to open a headquarters to educate the people through the newspapers ?

Just how far a publicity campaign as proposed by the American chambers in China will adhere strictly to its own sphere, is open to much speculation. Having in mind past incursions into the publicity field by the same element which still largely directs American activities in this country, it is highly probable that its experts who seem to have learned nothing or forgotten nothing in the past few years, will attempt once more to turn public opinion at home against Japan. There can be no other interpretation to the phrase that Americans have to be educated to the larger diplomatic and strategic interests of their country in China and the Far East. Why the Far East? Why should Americans in China meddle with the affairs of other countries and arrogate to themselves the sole right to interpret these interests? Why should not American business-men in Japan ignore their ambassador and consuls and appoint a resident high-commissioner and publicity expert to reside in Washington and educate the government and people to their one-sided conception of policies that benefit their trade? Why should not American chambers of commerce in all other foreign countries, kick over the traces and follow the lead of Shanghai and declare their independence of the state department and raise general hell in the newspapers about the indifference of the government to their claims for special treatment? We would then have a real circus performing all the time at the national capital. In this particular case, it is almost a certainty that if the resolution of Americans in China is carried into practice, Americans in Japan will be compelled in self-protection to appoint a similar delegate to offset the pernicious anti-Japanese activities of their China compatriots.

There are certain fundamental features connected with a publicity campaign to educate the American people on strategic and diplomatic matters that seem to have been ignored. It is not difficult to carry on such a propaganda in the United States when the object to be attained has the approval of the heads of the state and other government departments. It is hopeless on the other hand to make headway in such matters against the opposition of the government, and when a campaign is launched, which on its face suggests a slight to the state department or conceals an attempt to coerce it into modifying its foreign policy to suit the ideas of a minority, a word from the secretary to the Washington correspondents will close the columns of every reputable newspaper in the country to such publicity. It is hardly probable under existing political conditions in the United States with the results of the Washington conference still fresh in the minds of the people, that any progress can be made in reversing the basic principles then promulgated. Americans in China clamored long and loud for the concessions that guaranteed China's place amongst the nations. Their arguments were accepted by the government and people at home and incorporated into the Washington treaties. The administration at this early date cannot go before the country and confess that it was buncoed without losing political prestige and present the democrats with ammunition to use against them in the coming presidential campaign. The same people who urged these concessions to China now ask the government to reverse its policy. American commercial organizations in China called for the hand that was dealt them by the administration. If they now go before the country in a publicity campaign denouncing the policy so strenuously advocated two years ago, we see no good reason why the republican and independent members of the associated American chambers of commerce of China should be called upon to subscribe funds for defeating their own party. The expenses should very properly be paid out of the campaign fund of the democratic national committee, who, we are assured, would gladly contribute any sum to nullify or minimize the political prestige gained by the administration as a result of the Washington conference.

The political pot at home is beginning to boil. The progressives and democrats are looking for any good argument that will put a crimp in the administration. The resolutions and program of the associated American chambers of commerce of China present them with the heavy guns for a frontal attack, and the super-representative and director general of the campaign will be received with open arms when he arrives in Washington. Let the democrats pay the bill!

* * *

# Probst, Hanbury's Come-Back

It is extremely gratifying to learn that after the serious losses due to the slump of 1920, the old Kung Ping Hong with eighty years of experience behind it has weathered the storm and is once more well on the road to prosperity. Some months ago we had occasion to refer editorially to the misfortunes which befell this firm and now with the latest report for 1922 before us, we are glad to correct any erronous impressions which may have been created by our comments on the business situation which necessarily included some mention of their troubles. The last report shows that the old concern is still finding plenty of scope for its activities and has made considerable recovery from the ill-fortune that followed its conversion into a public company. The flotation of the company, says the *Financial Times*. took place in January, 1920, a period now associated with evil omen. It was a modest proposition, brought out under excellent auspices. The public was invited to subscribe for £67,000 in eight per cent. preference shares and £143,000 in ordinary shares, the vendors receiving £33,000 of the former and £67,000 of the latter in part satisfaction of the purchase

price. The profits of the business were shown to have been subject to sharp variation. A passage in the prosepectus to which subsequent events have given an ironic turn stated that the stock-in-trade and goods under contract for delivery had been "acquired on exceptionally favorable terms, and very satisfactory profits, for this company are anticipated from their realization."

For 1920, the first year of working in the new torm, the preference dividend was paid, but before the accounts for that year could be submitted came the intimation that the preference dividend due on 30th June, 1921, could not be met. The 1920 accounts were produced in August, and showed trading profits and other receipts totalling £242,800, subject to £74,900 of working expenses. The balance of £167,800 was turned into a debit of £134,000 by the necessity for writing £301,800 off stocks to bring them to current market values. Payment of the preference dividend raised the debit to £140,600. The next year added £166,000 to this figure, and in presenting the 1921 accounts the directors frankly said that the paid-up capital of £310,000 had been "practically all lost," mainly because the inland revenue refused, on account of the change of ownership of the business, to make any refund of £217,400 of excess profits duty. The 1921 accounts were not issued until March this year, by which time an approximate idea of the 1922 results had been obtained. These indicated a moderate profit, and the recuperative power of the business having been proved, the directors foreshadowed a scheme of reconstruction, involving the provision of some £50,000 of new working capital.

In the report for 1922 now presented the directors announce that the scheme for writing down the capital is in train, that of the £52,500 in preferred ordinary shares they propose to create to furnish working capital £15,000 has been promised by directors and their friends in England and £22,500 by directors and shareholders in Shanghai, and that the remaining £15,000 is expected to be subscribed by other shareholders or connections in Great Britain. The year's trading profit was £63,000, after £4,100 had been written off stocks, and it may be hoped that the latter is the last word in a dismal chapter. On the sale of part of the property in Shanghai a profit of £33,700 was made, but £14,000 was involved in winding up what the report describes as "the unfortunate machinery department." Allowing for these items, the actual trading profit is put at £30,600, which may be deemed quite good in the circumstances ruling in China, and as warranting the belief that, after two years of unprecedented strain, this old business (it has nearly 80 years of history behind it) will, with the aid of new capital, resume the thread of its former fortunes.

From all sources 1922 provided £50,300 with which to diminish the profit and loss debit, thus curtailed to £256,300. This points to the obliteration of the greater part of the paid-up capital. In March this year the directors estimated that, if 1922 produced a net trading profit of £24,000 the company would be left with intact capital of £48,500, exclusive of goodwill, which does not figure in the accounts, though the directors put a considerable value on it. The balance-sheet of 31st December last showed decreases of £59,400 under bank acceptances and loan secured on shipments, of £101,700 under bills payable and £16,200 under overdrafts in Shanghai, while sundry creditors stood for £11,700 more. Under current assets a decrease of £159,200 to £657,100 appears, the decline in stocks being £65,800 to £298,900, in joint shipments of merchandise £28,400 to £97,400, in advances on shipments £15,300 to £12,100, in sundry debtors £7,100 to £84,800, and in cash £31,000 to £27,500. There is evidence in these figures that the company was still finding plenty of scope for activity.

# Papermaking in China

## Description of a Hand-made Process

AN interesting review of papermaking in China now and in ancient days was given recently before a meeting of paper men at Watertown, N.Y., by Mr. Perry D. Taylor, who for 15 years has been engaged installing paper machinery in the Far Eastern republic.

That the business of papermaking should attract the Chinese is not only most natural, but there is a growing demand for paper to meet the needs of the modern education the Chinese students are bringing to China from many foreign countries. The Chinese were the inventors of making paper from artificial pulp. They made paper from pulp as early as the beginning of the Christian era. Besides inventing the article the Chinese excelled in the quality of the paper they produced. India proof engravings, which were so highly esteemed in the days when hand engravings flourished were obtained by pasting a piece of India paper on the face of the home-made printing surface. This particular variety of the article could not be produced by the papermakers in India, but it came from Canton, China, in the form of wrapping paper on Chinese silks.

The Japanese learned the art of papermaking from the Chinese but soon excelled them in many qualities, while the West went far ahead of either by the introduction of machinery to take the place of the simple hand appliances. But to this day the hand-made papers are the best, and they are produced by the old Chinese method of now over 2,000 years ago.

### Family Concerns

Owing to the fact that the Chinese seldom form companies for business purposes outside of their immediate families they have to learn of our rule that in union there is strength in the business world as well as in matters of state. To-day there are thousands of family paper mills in China employing only the members of their immediate families. Mr. Taylor lately made a business trip into the interior of Kiangai province, where there are over 300 such mills scattered about the bamboo section of the province.

Bamboo is made into pulp by first crushing the pole—they do not chip or cut—after which alternate layers of crushed bamboo and layers of unslaked pulverised lime are put into a trench in the ground, then the trench is flooded. Any small by who has watched at a mortar bed can form an idea of the heat and boiling therein. The mass is allowed to stand for three or four weeks before being sorted. At this time the white pulp, the cream pulp and the wrapping paper pulp are placed in separate bins while the uncooked stalks are returned to the next cook.

The beating or reducing of the fibres is accomplished in large mortars carved of solid rock and men with pestles or stones and a wooden handle refine the stock. The natives also use a small kollergang arrangement with water buffalo pulling on the outside to revolve the stones in the rock trench. The pulp is screened through bamboo woven screens by hand.

### The Process

Making sheets of paper is accomplished in the usual moulds on woven bamboo cloth and the sheets always have imprinted markings like dandy roll marks. In making coarser paper the operator dips his hand mould into the vat and scoops up an unmeasured amount, but in nicer qualities the mould is rested on cleats with the bottom of the vat submerged and a dipper is used to dip up a measured amount of milky pulp. The operator then keeps the mould bottom below the water until, by violent shaking, the sheet is well formed. The mould is then lifted out and set on a table and a pad with handle is pressed on the inside of the mould and the sheet sticks to the pad when lifted out. The pad is then pressed on to the pile of wet sheets and as it is lifted the sheet of paper remains on the pile. After an inch or less of sheets is accumulated a cloth is spread on the pile and more sheets placed on top. Later stone weights are put on the piles to remove more of the water.

The sheets are dried and calendered by sticking single sheets on to door-like panels of wood highly polished on one side. After a panel is full it is leaned outdoors facing the sun until dry and the side next to the panel is highly finished.

Very little sizing of paper is done in the native mills, as all the product is consumed in China, where printing on but one side and writing with brush is the custom.

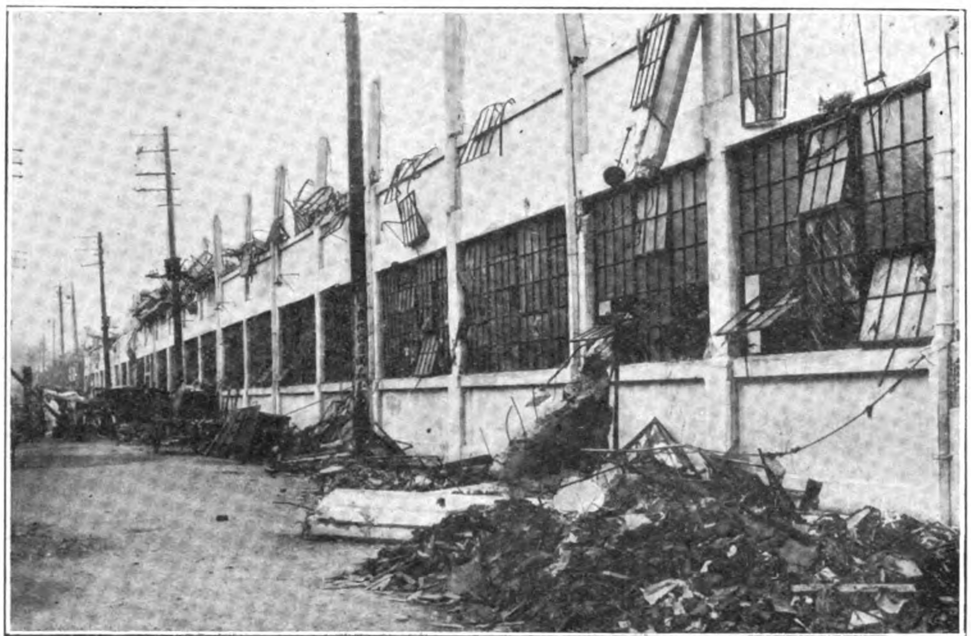
China is greatly handicapped for the want of raw material for the modern paper mills already there, but no doubt crops of raw material will soon be raised to fill the need, or wood will be obtained from Manchuria or Siberia. At present the following raw materials are used in China: Bamboo, rice and wheat straw, lung sea grass, goo tree bark and mulberry twigs saved from the food of the silk worm. The first ground wood mill was started in China last June.

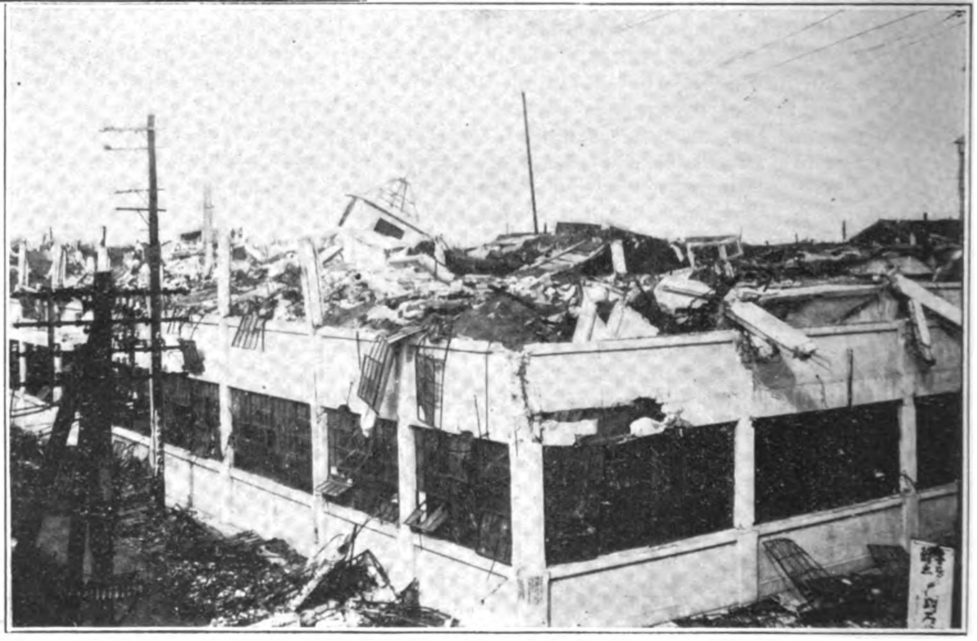
The most valuable paper stock Mr. Taylor ever used consisted of 80 tons of used paper money and new money thrown out of use at the time of the change from monarchy to republic.

There are now in China eight paper mills with modern machinery, 13 machines in all.

# Electric Reconstruction in the Tokyo-Yokohama District

OWING to the destruction of several of the foremost electrical equipment plants in the Tokyo region of Japan, a great proportion of the electrical supplies needed for replacing damaged installations will have to be imported from foreign countries. This is specially true of accessories and outside equipment. By far the most serious blow to the Japanese electrical industry was the destruction of the plant of the Shibaura Engineering Works, its forging shop alone being saved. Fortunately, work on the new plant outside of Tokyo had been commenced, but it will take at least a year to bring it to the producing stage. The next great loss was the Yokohama Wire and Cable Works of the Furukawa Company which produced over fifty per cent. of Japan's requirements. Both its Yokohama and Honjo plants are a total wreck. The fine new plant of the Nippon Electric Company specializing in the manufacture of telephone apparatus was demolished. The Tokyo Electric Company which supplied the larger part of the electric bulb demand, suffered not only serious damage to its plants but in the loss of a corps of specialists killed during the earthquake. The damage to the Oi works of this company was comparatively slight, only part of the brick side walls collapsing, with no damage to the machinery. The glass melting furnace and crucible collapsed but these have since been repaired, and as soon as gas is procurable will be in a position to resume work. The laboratory and research building of the great Kawasaki plant of this company collapsed causing the death of many workmen including the corps of experts. The Hatagaya works of the company were practically untouched by the quake and will resume operations at once.





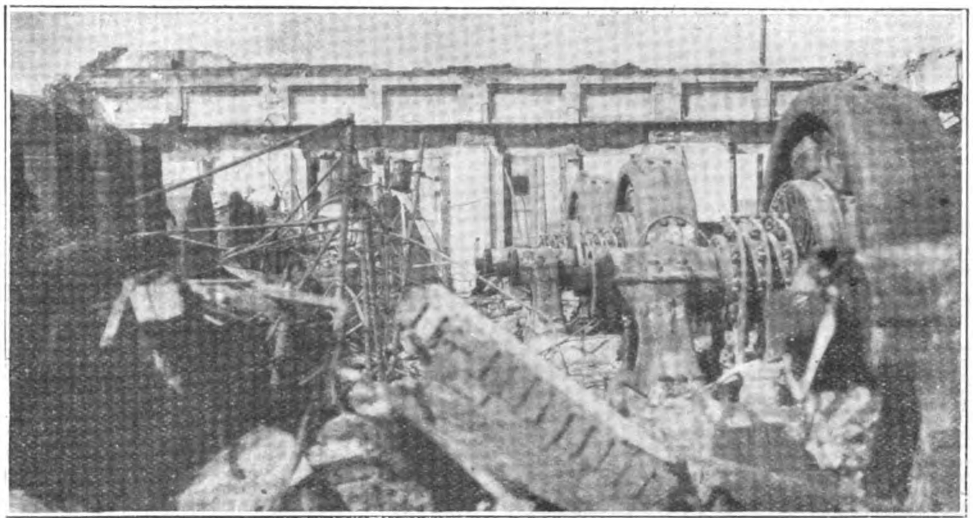
These two illustrations show how the new reinforced concrete buildings of the Nippon Electric Company failed during the earthquake. The two upper floors collapsed on the first concrete floor.

The Meidensha, one of the largest manufacturers of dynamos and motors, whose plant is located in Osaka-machi near Tokyo, escaped with only slight damage. This was largely confined to the large machine shop where several of the more important machines were thrown out of alignment by settling foundations. Its capacity for producing small type motors is practically unimpaired.

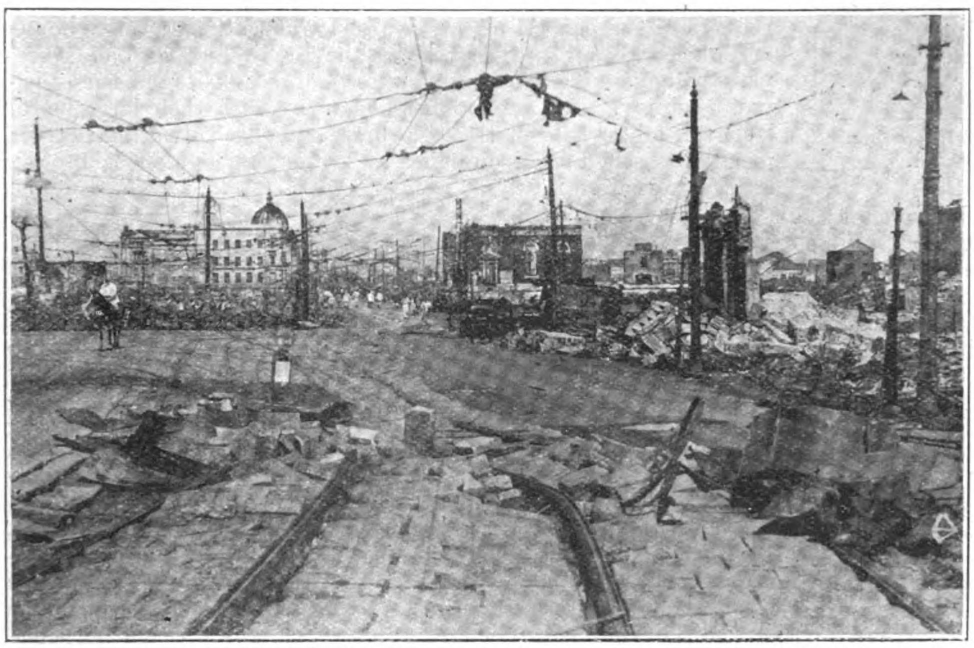
Besides these plants, a number of other small electrical factories in Tokyo and Yokohama were either demolished or consumed by fire. This throws the load of furnishing equipment for electrical reconstruction on the plants of the Osaka region, whose production capacity was only about forty per cent. of the plants in the Tokyo district. Aside from the Mitsubishi electrical plant at Nagoya, the Sumitomo Wire and Copper Works, the Okumura Electrical Works at Osaka, and the Hadachi Engineering Works, most of the manufacturing plants in the Kansai region are unimportant. Naturally, the Kansai manufacturers will reap the major benefits arising out of the necessity of rapidly replacing the requirements of the devastated areas. The Mitsubishi company in co-operation with the Kawakita Electrical Works of Osaka is preparing for an active sales campaign. However, even in normal times, electrical equipment has been imported from abroad to the extent of fifty million yen annually, and in the present crisis where time in delivery is the essential quality, many large orders are being placed in America and Europe.

The almost complete wiping out of the industrial life of Tokyo and Yokohama has resulted in an enormous surplus of power from the many hydro-electric plants supplying these districts and in the suspension of construction on new power houses. The demand for current in Tokyo and Yokohama before the disaster averaged 282,000 kilowatts, registering a steady increase of about fifteen per cent. annually. The Tokyo, Shinyetsu, Toshin and Hayakawa Electric companies had accordingly formulated their construction programs to increase the capacity of their plants by approximately 484,000 kilowatts, some of which were being carried out. The disaster, however, decreased the number of electric lights consumed by about 48 per cent. with a great decrease in the demand for power resulting from the destruction of factories.

The Daido Electric Power Company, for instance, calculated


Yurakucho Transformer Station of the Tokyo Electric Light Company, after the fire

to supply about 27,000 kilowatts to the Tokyo-Yokohama district from its new Momoyama power plant and in addition found it difficult to market its 282,000 kilowatts for power purposes in the district. This company expects to find a surplus of 80,000 kilowatts in its Tokyo-Yokohama market, and for the present will suspend its plans to increase its output confining itself to finishing the Momoyama and Yomihaki power plants. This company will divert its energies to finding a market for its in power in the Osaka and Nagoya districts, confident that its surplus will be readily taken up by the increased activity of and demand for more power on the part of industrial establishments in these centres.


The havoc wrought by the Quake to the Tracks of the Yokohama Electric Tramway

The excessive tightness of the money market has forced some of the larger power enterprises to seek new capital for construction by issuing debentures at home and abroad, and unless this financial assistance is forthcoming, many promising and profitable plans will have to be suspended or abandoned.

The copper industry is experiencing a boom. Before the disaster the mills had been working on a schedule of limited production, but due to the destruction of the copper and wire works of the Tokyo-Yokohama districts, the Osaka and other Kanto mills are now working to full capacity and in some instances planning to increase production. Some idea of the extent of the damage which must be repaired is seen in the losses of the department of communications which totals Y.300,000,000, of which Y.250,000,000 will be necessary for telegraph and telephone repairs alone. The Tokyo municipal authorities report that 7,112 factories of various kinds and their equipment of 9,752 motors were destroyed by the earthquake and fire. The destruction of factories engaged in the production of meters and measuring instruments affords another opportunity for foreign manufacturers to obtain a large share of the orders for replacement.

## Reconstruction Orders

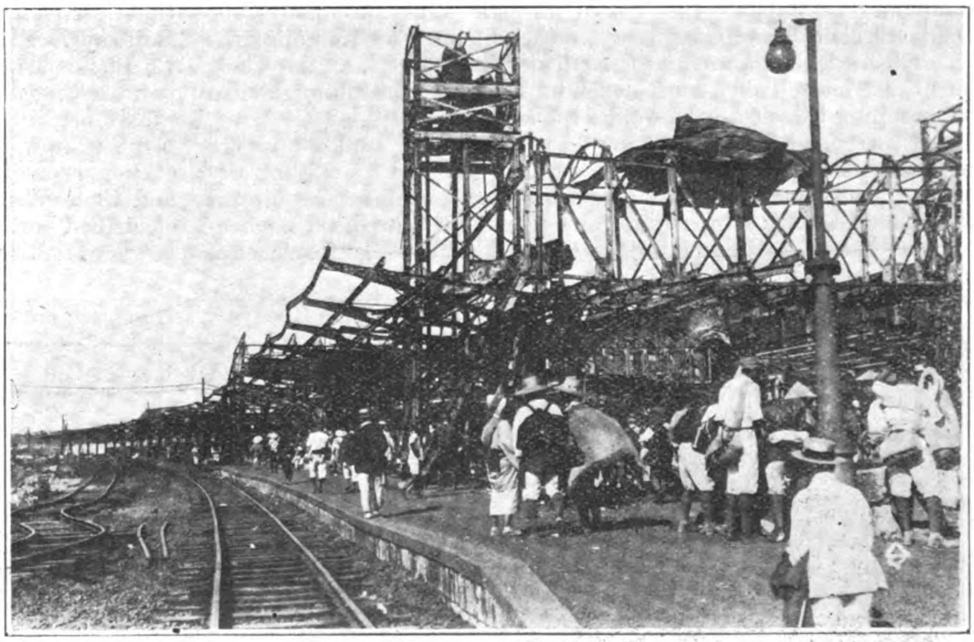
Before the ashes of Tokyo were cold, plans were being prepared to replace the ruined substations of the Tokyo Electric Light Company with their mass of transformers, switchgear and voltage regulator equipment. A total of 25,000 distributing transformers had been burned and a complete replacement was necessary.

The main office of the Tokyo Electric Light Company had disappeared, but temporary offices were established across the street from the Imperial Hotel, which became, temporarily, the centre of business activity in Tokyo. The office of the Westinghouse Electric International Company, with that of their agent, Takata & Company, had also been destroyed, but in a few days catalogues and price forms had been carried in on the backs of messengers from other offices, so that business has been going on as usual from September 5 in offices in the Imperial Hotel.

To supply the most immediate needs of Tokyo, the Westinghouse Company, were entrusted with various rush orders for quick shipment; among the more important are the following:

## 7,000-Kva, Type "S," Single Phase, 50 Cycle, 3,300 Volt Distributing Transformers for Pole Mounting

These transformers will be scattered throughout the burnt district of Tokyo, to step down the voltage for the 210 volt and 105 volt supply lines which will again enable the small factories as well as business houses and homes to enjoy the benefits of electric light and power. The transformers are of a new design, the cases and covers being of pressed steel,—making them light and easy to

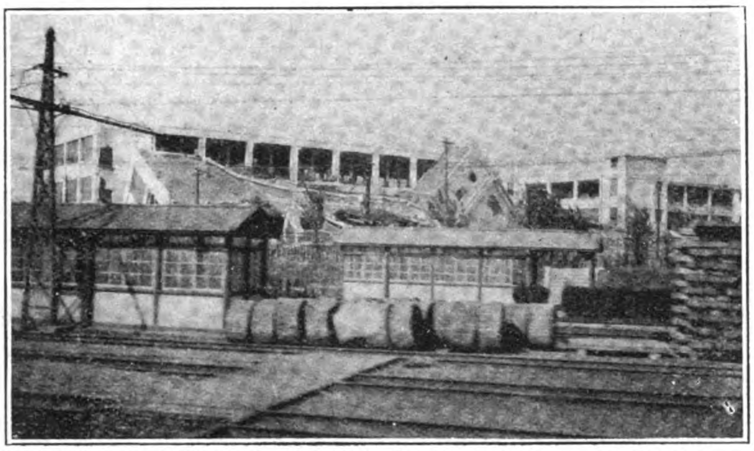

The Railway Station at Yokohama

install and being an insurance against breakage which is experienced with cast iron construction.

Work is being rushed on these transformers—a special department being devoted to their manufacture; and by shipping overland via Seattle they will be in Japan in a few months.

## 224 Automatic Single Phase, Feeder Induction Regulators 60 Kilo Volt Amperes, 3,450 Volt Primary

These regulators are very essential in a district where light and power are drawn from the same distributing system, as they automatically keep the voltage constant at all loads.



**The Works of the Tokyo Electric Company at Kawasaki, showing Research Building which collapsed during the Quake.**

The heart of the regulating system is a primary relay, or contact making volt meter which is very sensitive to fluctuation in voltage and which actuates a motor driven regulator at the least voltage variation.

This is the largest order for regulators ever placed for export, and it is a tribute to the designing engineers who have produced such an accurate and sensitive power regulator device for the largest cities in the United States. When it is recalled that a three (3%) per cent. reduction in the voltage on a system causes over ten 10% per cent. reduction in the light drawn from an electric bulb; and that a three (3%) per cent. increase in voltage would mean a short life for the bulb, the importance of accurate regulating equipment is apparent.

## 215 Large Heavy Duty Oil Circuit Breakers for Controlling the Power Circuits in Various Sub-Stations

These circuit breakers are of the same design as those supplied in quantities during the last three years, to the largest power companies in Japan,—the Tokyo Electric Light Company, the Daido Electric Power Company and the Nippon Electric Company.

This order is, however, of particular importance, as the whole burnt district in Tokyo must depend upon these controlling devices for handling the electric power in the future.

These breakers have heavy steel individual tanks, and are especially designed so that they can be installed quickly on delivery. One hundred of the largest breakers are, in fact, equipped with the necessary supporting frame work so that with the connection of cables to their terminals they will be ready for service. This is a great improvement over older types of construction, where it was necessary to construct expensive brickwork and concrete structures on which these breakers would have to be mounted before they could be used.

## Heating and Cooking Apparatus to Absorb about 7,000 Kilowatts 10,000 H.P. of Electrical Fnergy

This order for heating and cooking appliances represents a new era in the electrical history of Tokyo. Until the catastrophe of September 1, the power lines of Tokyo were overloaded and it was with difficulty that current could be supplied for light and electric power, especially during periods of minimum rain fall. Provision had already been made to tap the 200,000 k.w. power system of Daido at their pivot plant at Momoyama, and eventually 100,000 k.w. would have been drawn from that district. However, with the greater part of industrial Tokyo wiped out there was a severe contraction in the power demanded so that power will be exported to the Osaka district, rather than drawn from that territory.

Plans had already been laid for developing the use of heating apparatus but the time for their appliaction has now been advanced at least three years. These heating appliances will fit admirably at the present time as the many temporary office buildings and homes have not provided for any heating plant and much suffering will be avoided this winter by the general use of electric heating.

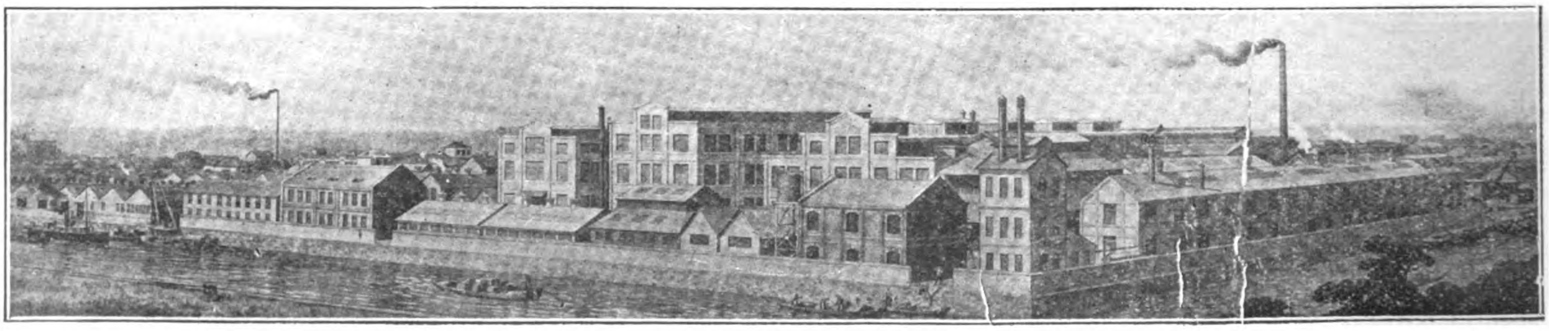
It is expected that these initial installations will be the forerunners of the general adoption of electric heating in Tokyo homes and offices so that in a year or two the Tokyo Electric Light Company will again be searching for ways and means of increasing their power supply. The rebuilding of factories with their large motor load will follow as a matter of course, and the Tokyo district will resume its schedule of doubling its power and light consumption every five years.

## Kobe Municipality Awards Contract for 6,000 K.W. Turbine to Westinghouse

The Kobe municipality have just placed an order for a new 6,000 k.w. Westinghouse Parsons reaction type turbine generator, to replace the impulse type machine of another make which exploded not long ago, causing injury and death to several operators. This machine is of a late design, being the same as has been supplied to a number of companies in Japan. It is very similar in construction to the 5,000 k.w. machine now operating at the Amanogawa plant of the Dairen Light & Power Company.

The 15,000 sq. ft. Westinghouse Le Blanc surface condenser, which had previously operated with the old 6,000 unit was uninjured, and consequently it will be used with the new Westinghouse unit. This equipment will operate in parallel with the 12,500 k.w. Westinghouse turbine generator which is now operating alone continuously, keeping Kobe supplied with light and power.

An order for another 6,000 k.w. turbine generator, similar to that ordered for Kobe, has been placed by the Imperial Government Railways. This will be complete with a 12,500 sq. ft. Westinghouse Le Blanc surface condenser, and will be an exact duplicate of the two existing units now in operation at the big Akabane station of the Imperial Government Railways, north of Tokyo. This power plant is now of exceptional importance, as the Yaguchi power station, such of Tokyo, has been badly damaged by the earthquake, and these Westinghouse units must carry the entire load of the electrified portion of the government railways, assisted only by such power as will be purchased from the Tokyo Electric Light Company.



**General view of the Shibaura Engineering Works at Tokyo, destroyed by the quake and fire. A new and larger works are under construction**

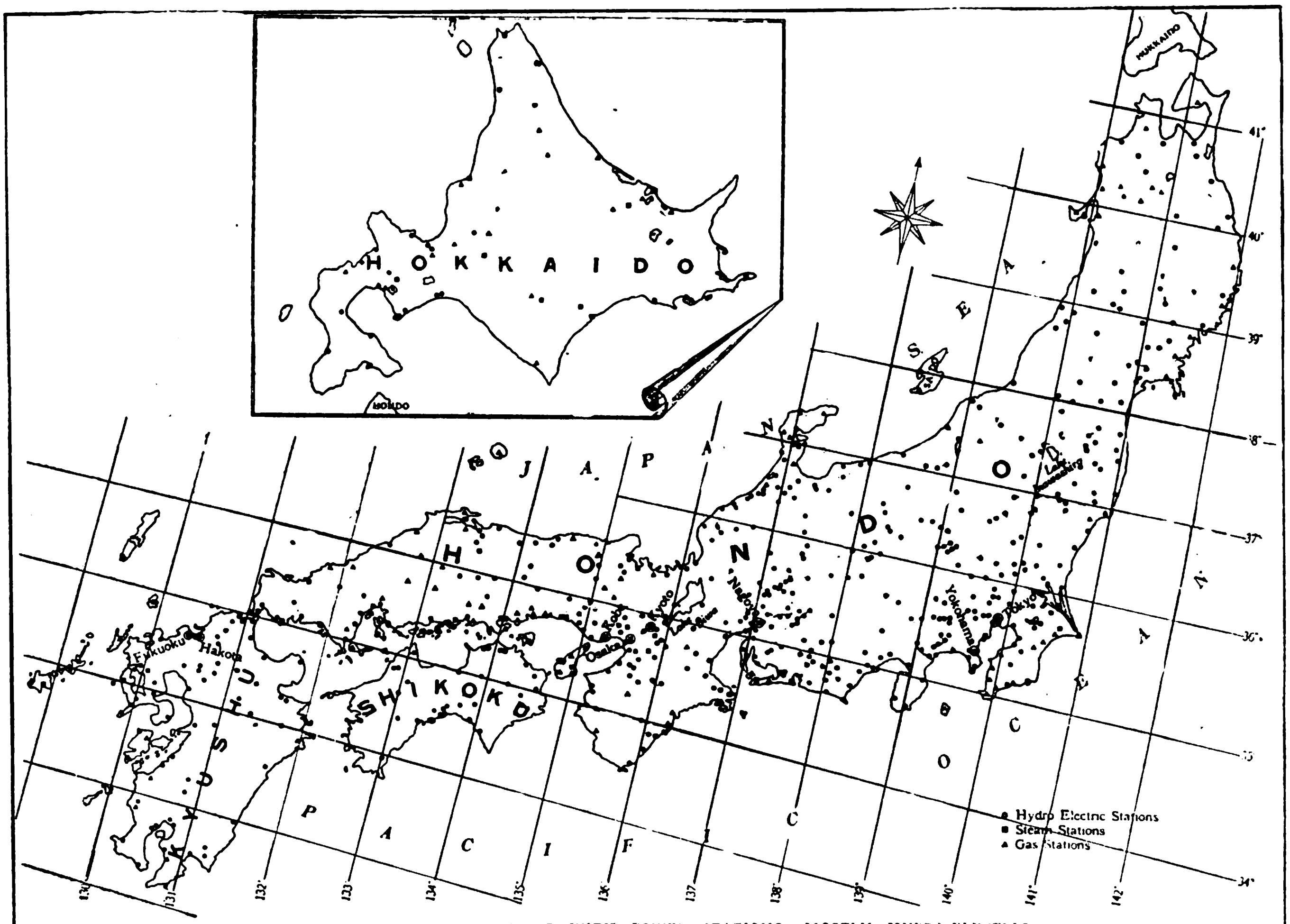



FIG. I—JAPAN IS THICKLY DOTTED WITH POWER STATIONS—MOSTLY HYDRO-ELECTRIC

# Japanese High Voltage Power Transmission Systems

*By S. Q. Hayes, General Engineer, Westinghouse Electric and Manufacturing Co.*

**In The "Electric" Journal**

**_Super-power_ systems in the eastern part of the United States and in California have been thoroughly discussed in the American technical press within the last few years, but little has been published about similar developments in other countries, so that Japan's progress in high-voltage power transmission should be of interest. In this article, it is the intention first to take up some of the more general features in connection with the larger power transmission systems and then to go into further details relative to certain interesting features of the generators, transformers, synchronous condensers, switching equipment or other important devices.**

THE Japanese empire consists of a long chain of islands in the Pacific extending between 21 degrees 45 minutes and 50 degrees 56 minutes north latitude in a general direction from S. W. to N. E. The principal islands of Japan are the groups comprising the main island of Hondo with Hokkaido near the northern tip of Hondo, Kyushu near the south-western tip and Shikoku south of the south-western part of Hondo. The Japanese empire also includes Taiwan or Formosa, Chosen (Korea) and Karafuto (the southern part of Saghalien) with many smaller islands comprising a total area of about 176,000 sq. miles and population of over 70,000,000.

From the electrical standpoint, Japan has been developed even more than the United States and has a graeater portion of houses illuminated electrically than any other country in the world. As the central portions of the main island are very mountainous and the rainfall in Japan is plentiful, hydro-electric developments are extremely numerous as shown in Fig. 1.

A very fair grade of coal is found in the island of Kyushu just off the southwestern tip of the main island of Hondo, and in parts of Hondo. Points on the main island, that can readily be reached by boat from Kyushu, have steam plants or gas lighting plants, while most of the interior towns and villages obtain their electrical current from hydraulic plants.

The principal electrical developments are on the main island centreing at Tokyo and Yokohama where 50 cycle current is employed and at Osaka, Kobe, Kyoto and Nagoya where 60 cycle current is used. The important load centres are near the southeastern coast between Tokyo and Osaka, these points being approximately 330 miles apart along the railroad.

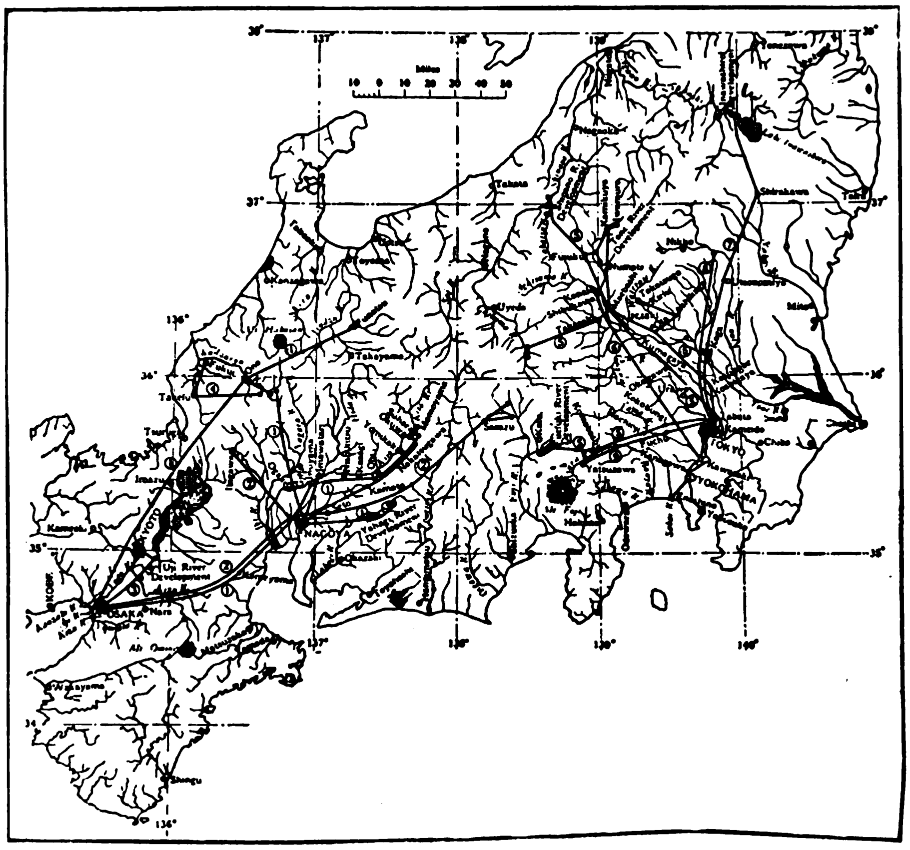


**Fig. 2—The Beginnings of a 154,000 volt Power System in Japan.**

This should be considered as a schematic diagram of some of the principal systems, superimposed on a map. Most of the systems shown are now operating at 66,000 or 77,000 volts, but this voltage will be increased in the near future. 1, Daido Electric Company; 2, Nippon Power Company; 3, Ujigawa Electric Company; 4. Hakusan Hydro-Electric Company; 5, Tokyo Electric Light Company; 6, Gumma Electric Power Company; 7, Inawashiro Hydro-Electric Company; 8, Kinugawa Electric Power Company; 9, Katsuragawa Electric Power Company.

For the transmission of large amounts of power and for tying together the scattered plants of the large systems such as the Daido, Tokyo, etc., 154,000 volts has been determined on as the voltage for the step-up transformers at the generating stations. For the main receiving stations at points like Osaka and Tokyo, the voltage on the main transmission lines will be maintained at approximately 140,000 by means of synchronous phase modifiers. The voltage regulators on the phase modifiers will be controlled by potential transformers on the secondary distribution bus—55,000 volts at Osaka, 11,000 or 22,000 volts at Tokyo and will tend to hold these voltages constant.

Most of the power in the Tokyo district is distributed by the Tokyo Electric Light Co., and is developed either under that name or under the name of one of the subsidiaries such as Shinyetsu, Kaihin, etc. Power is also received from the Inawashiro, Gumma and Kinugawa Companies. Most of the power delivered to Nagoya, Osaka, and Kyoto is developed under the name of Daido Company or one of its subsidiaries, or under the name of the Nippon Company or one of its affiliated companies such as the Ujigawa (Uji River) Power Co. Kobe has its own municipal electric plant. The western end of the island of Hondo between Kobe and Moji is known as the Sanyo and Sanin district, and contains the Sanyo Water Power Co. in the Hyogo prefecture, the Bisaku Electric Co. at Okayama, and the Hiroshima Electric Co. an amalgamation of the Hiroshima Kure Electric Co., the Hiroshima Electric Lighting Co. and the Shikoku Electric Power Company.

For the Daido system the total generating station output, including extensions contemplated within the next ten years, amounts to 640,000 kw. The receiving stations will have a total installed capacity of 560,000 kw. All of the Daido lines, transmitting power to Nagoya and Osaka, are for 60 cycle service, while those that are proposed to transmit power to Tokyo will be for 50 cycle service. Some of the proposed generating stations of the Daido Co. will be able to supply either 50 cycle or 60 cycle service.

The contemplated 154,000 volt lines of the Daido Electric Co. constitute a super-power system of very considerable magnitude, particularly in view of the fact that the 154,000 volt lines of the Tokyo Electric Lighting Co. and its various subsidiaries, tying in at Tokyo, will doubtless be connected with the 154,000 volt Daido lines, if they are extended to Tokyo. In a similar manner, a competing company, the Nippon Power Co. is transmitting power into Osaka at 154,000 volts and is arranging for a number of tie connections to the Daido and to other power systems.

The electrification of the Imperial Government Railways will also be carried out at 154,000 volts, power being transmitted from their proposed Shinanogawa (Shinano River) plant to a main receiving station at Kichijoji in the outskirts of Tokyo. When these various 154,000 volts systems reach their contemplated development, there will be 3,000 to 5,000 miles of circuits, all more or less tied together.

In the Osaka region, there are at present various 77,000 volt transmission systems that will be connected to the Daido and the Nippon systems, through suitable transformer stations. In a

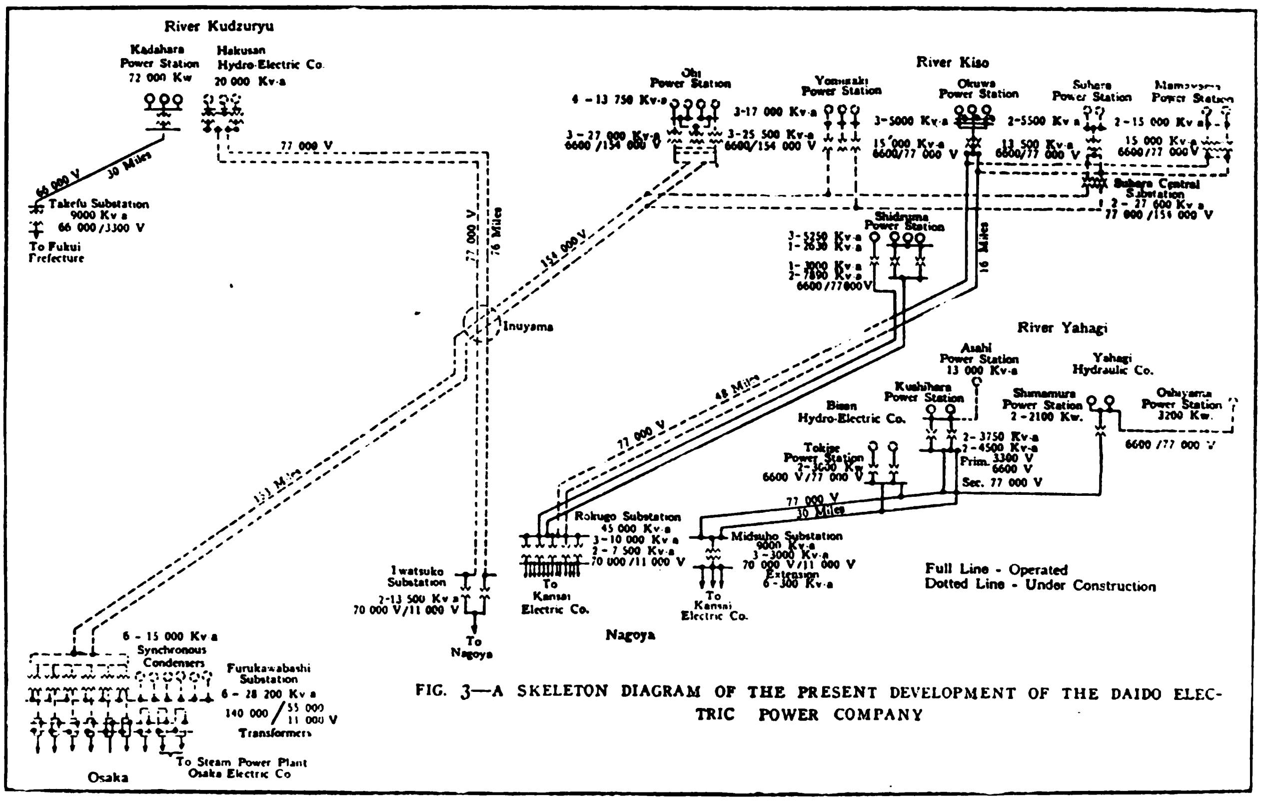



FIG. 3—A SKELETON DIAGRAM OF THE PRESENT DEVELOPMENT OF THE DAIDO ELECTRIC POWER COMPANY

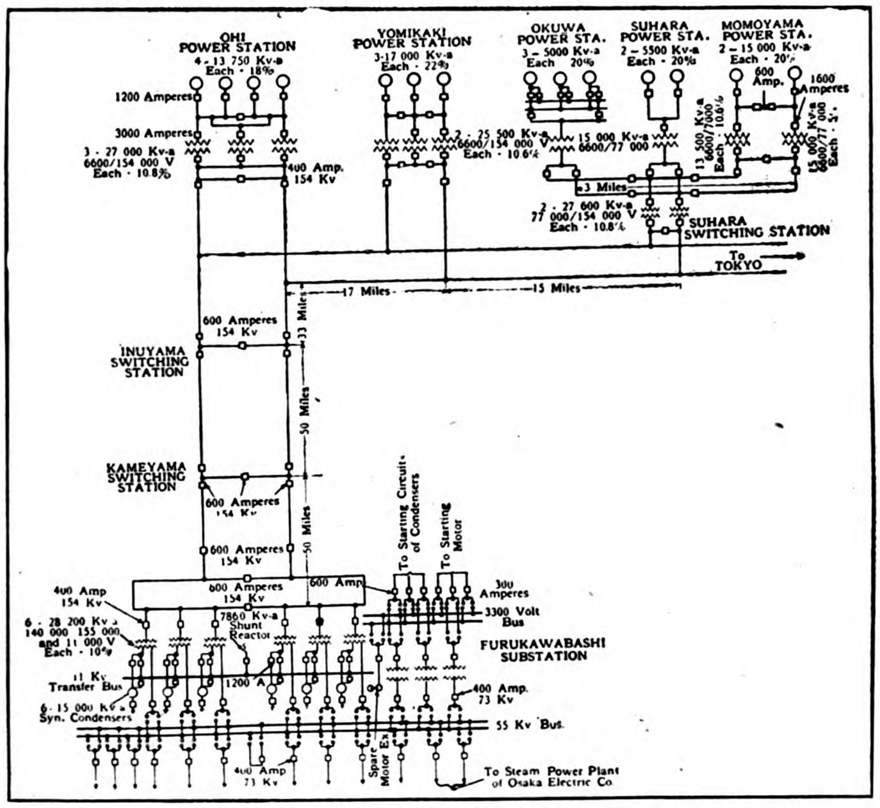



Fig 4.—Switching Scheme of the 154,000 volt lines of the Daido Electric Power Company

similar manner, in the neighborhood of Tokyo, there are various 66,000 volt transmission systems forming part of the present Tokyo system. The Tokyo Electric Light Company receives power transmitted at 115,000 volts from the Inawashiro Co., and provision will likely be made for tying in with the 115,000 volt system of the Gumma Power Co.

From the foregoing, it may be seen that 154,000 volts has been selected by the Japanese imperial government as the voltage for their super-power system and all of the principal power transmission systems. The secondary distribution of large amounts of power in the Tokyo district is at 66,000 volts, while at the Osaka neighborhood it is 55,000 volts. The local distribution around Tokyo and around Osaka is 11,000 volts with provision made for later changing to 22,000 volts. This 11,000-22,000 volt distribution feeds a large number of substations where the voltage is stepped down to 3,300 volts for general distribution.

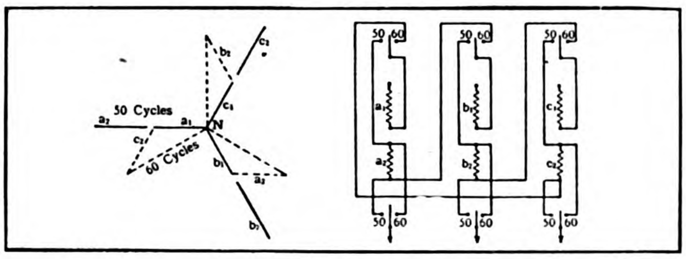



Fig. 6.—Scheme of Generator Connections to give 50 or 60 cycles at Momoyama

The city of Tokyo, the capital of Japan, has about two and a half million inhabitants and is growing rapidly. It has an excellent system of tram cars, an electrified belt line railway, and practically every house, even the smallest, is illuminated electrically.

Yokohama, eighteen miles away, is the port for Tokyo, and has about a quarter of a million inhabitants. The main railway line between Tokyo and Yokohama has four tracks, two for steam trains and two for electric trains operating on a twelve minute headway. Between Tokyo and Yokohama is a very busy industrial section with all of the factories electrified and most of them receiving power from the various hydro-electric transmission systems.

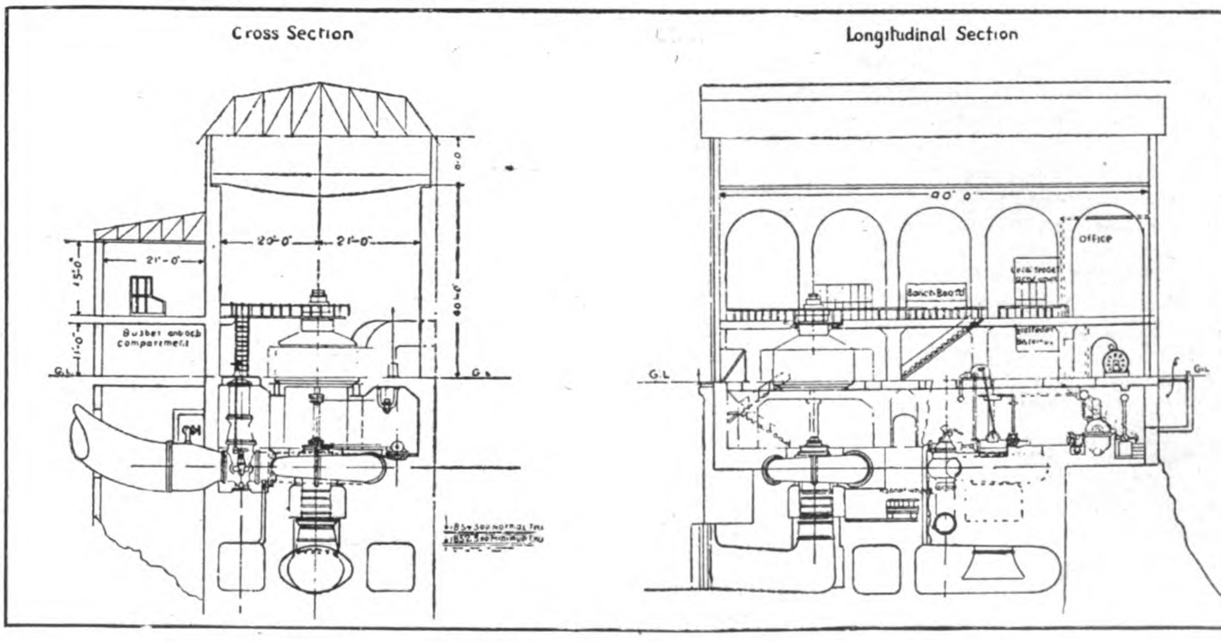
Osaka is a city of about one and a quarter million inhabitants and is the principal industrial city of Japan. Kobe, the chief port for Kyoto, is twenty miles from Osaka and has a population of five hundred and fifty thousand. Kyoto, the old capital of Japan, which has five hundred thousand inhabitants, is within an hour's ride of Osaka.

If all of the present plans are carried out, the power supply for the Tokyo district by the end of this decade, will be about 1,000,000 kv-a and the same amount will be installed for the Osaka district. The difference in frequency complicates the tying together of these systems. Up to the present, all of the 154,000 volt transformers switching equipment, and a large portion of the generators and lower voltage apparatus have been ordered from America so that the practice is essentially the same as in America.

## Daido Electric Power Co.

The Daido (consolidated) Power Co. is an amalgamation of a number of power companies, all controlled by a group of Japanese financiers headed by Mr. Fukuzawa. Under the name of the Kyushu Electric Light & Railway Company, control is exercised by Mr. Fukuzawa over the power and railway developments in the northern part of the island of Kyushu, centreing in Fukuoku and Hakota.

At present the Daido lines are used principally for furnishing power to Nagoya and Osaka, and most of the equipment now being built for the Daido Company will be used for the transmission to Osaka. To provide the two frequencies required for transmitting power to the Osaka, Nagoya and the Tokyo district, certain generating stations such as Momoyama are provided with waterwheels and generators suitable for operating at two speeds having a ratio of 5 to 6. It is very probable that from the Daido line connections will be made to the present system of the Tokyo Electric Light Company, and tie connections will be made to the Imperial Government Railways transmission system. At Osaka parallel connections are now made to steam




Section through Momoyama Station

plants of the Osaka Electric Light Company containing approximately 125,000 kv-a in turbo-generators.

The Nippon Power Company, now a rival transmission system into Osaka, may possibly be amalgamated later with the Daido system. This power company operates the power transmission system from the Ibigawa and Seto installations. In Osaka, the Nippon Company transmission line operates in parallel with the steam plant and the hydroelectric transmission line of the Ujigawa (Uji river) system.

Fig. 3 shows in skeleton form the main scheme of connections for the present water power developments of the Daido system on the Kiso, Kudzuryu, and Yahagi rivers for delivering power to Osaka and Nagoya. On this diagram, the full lines are now in operation at 77,000 volts supplying power to Nagoya and at 66,000 volts to Fukui prefecture (county). Lines are now under construction for 77,000 volts transmission to Nagoya and 154,000 volts transmission to Osaka. Fig. 4 shows more fully the main connections from the five important plants along the Kiso River used for the Osaka transmission.

The portion of the equipment now being built or which was installed for the Osaka transmission is that shown on Fig. 4 and comprises generating stations at Okuwa, Suhara, Yomikaki, Ohi and Momoyama, these being installed in this order with a step-up transforming station at Suhara, switching stations at Inuyama and Kameyama with main receiving station at Furukawabashi near Osaka.

At the Okuwa power station Fig. 5 there are three vertical shaft waterwheels, each driving a 5,000 kv-a, 60 cycle 6,600 volt generator. For use with these generators, excitors were furnished driven by horizontal shaft waterwheels. In this station there is a bank of three 5,000 kv-a 6,600-77,000 volt transformers. This Okuwa power station is approximately three miles from Suhara, where the main step-up transforming station will be located. The switching equipment at Okuwa is so arranged that the three generators, of which one is considered a spare, can operate on either of two sets of busbars. The transformer bank connects through suitable circuit breakers to the low-tension busbars and, on the high side, two circuit breakers are furnished for connecting to either of the two transmission circuits. At this station indoor apparatus is used, although there are some outdoor 77,000 volt disconnecting switches located just outside of the building.

At Suhara generating station there are two vertical shaft waterwheels each driving a 5,500 kv-a generator very similar to those supplied for Okuwa. In this plant are three 4,500 kv-a transformers stepping up from 6,600 to 77,000 volts. The distance from the Suhara generating station to the Suhara transforming and switching station is very short and they might almost be considered the same installation. The control desk equipment for the transformer station is the only indoor equipment at that plant as the transformers and switching equipment are all arranged for outdoor service.

At the Suhara transforming station there will be installed seven single-phase oil-insulated water-cooled transformers of the shell type construction for outdoor service. These will be used as two three-phase banks with one spare transformer for tying together, at this point, the 77,000 volt Nagoya transmission and the 154,000 volt Osaka lines. In the course of a few years provision will be made for 154,000 volt lines from Suhara to Tokyo and, as these will have to operate at the Tokyo frequency of 50 cycles, provision is made for operating the Suhara transformers, as well as the Momoyama generating station at either sixty cycles for the Osaka lines or 50 cycles for the Tokyo lines.

The transformers are rated for a maximum continuous output of 9,200 kv-a at 60 or 50 cycles and are designed for a voltage ratio, based on the turn ratio, of 77,000 to 89,000 volts, three transformers being connected in a three-phase bank with the primary in delta and the secondary in star to step up the voltage from 77,000 to 154,000 volts.

The switching equipment at this Suhara transforming station is arranged for the control of the following circuits :—

Two—10,000 kv-a—77,000 volt incoming linesf rom Suhara generating station

Two—15,000 kv-a—77,000 volt incoming lines from Okuwa generating station

Two—30,000 kv-a—77,000 volt incoming lines from Momoyama generating station

Two (later three) 27,600 kv-a transformer banks, 77,000-154,000 volts

Two—55,000 kv-a—154,000 outgoing lines.

In this station the two incoming lines from each of the generating station at Okuwa, Shuara and Momoyama connect through suitable circuit breakers and disconnecting switches to the 77,000 volt bus. Two transformer banks (with provision for a third one) connect through circuit breakers and disconnecting switches to this bus, and each transformer bank is provided with choke coils. The high-tension sides of these transformers connect to the 154,000 volt bus and supply power to the two outgoing lines.

At the Momoyama station there are two vertical shaft waterwheels each driving a 15,000 kv-a generator. These units operate at 250 r.p.m. for 50 cycle service, with their windings connected in star or operate at 60 cycles, 300 r.p.m. with their windings in interconnected star. The generators have twelve terminals brought out from the armature and the equivalent of a six pole double-throw switch connected as in Fig. 6 which takes care of the change from straight star for 50 cycle service to interconnected star for 60 cycle. As the ratio voltage for the two schemes of connections is 100-87 and the ratio of speed is 82.5-100, very little field adjustment is needed to insure the same voltage at either frequency.

The generators will be closed at the top, the air for ventilation being taken from underneath and discharged through openings in the stator frame into a housing. To avoid the heated air from the generators making the generator room unpleasantly warm, a sheet iron cover is to be put around each machine after installing, with suitable space between cover and frame connected to a duct in the foundation for carrying off the heated air. The upper bearing bracket, carrying the upper guide bearing, thrust bearing and exciter, has iron plate covers of ample thickness between the arms. The thrust bearing is of the Kingsbury type.

Each generator is provided with its own 320 kw direct-connected exciter, and there is a spare motor-driven exciter of the same capacity. The switchboard galley is at the height of the generator platform and contains the control desk, local service board, bus bars, etc., while the low-tension circuit breakers are located on the same level as the generator room.

The outdoor transformers for this station comprise seven 5,000 kv-a single-phase units arranged in two banks, with one spare, for stepping up from 6,600 to 77,000 volts, delta-delta.

Okuwa, Shuara and Momoyama generating stations on the Kiso River are normally operated together as a group supplying power at 77,000 volts 60 cycles to Nagoya, or through the Suhara transforming station supplying power at 154,000 volts to Osaka. When it is necessary to supply 50 cycle power to Tokyo the Momoyama generators will be run at 250 r.p.m. and one of the Suhara transformer banks will be fed at 50 cycles from Momoyama feeding to Tokyo and the other at 60 cycles from Okuwa and Suhara feeding to Osaka.

At the Yomikaki power plant, there are three vertical shaft waterwheels each driving a 17,000 kv-a, 60 cycle, 6,600 volt generator with exciter specially designed for line charging conditions. This plant contains two 25,000 kv-a, 6,600-154,000 volt transformer banks and complete switching equipment. Yomikaki is approximately 15 miles from Suhara and 17 miles from Ohi.

At the Ohi generating station there are four vertical shaft waterwheels each driving a 13,750 kv-a, 60 cycle, 6,600 volt generator, and two 675 kw waterwheel-driven exciters. At this station there are three banks of transformers stepping up from 6,600 volts delta to 154,000 volts star. Each bank comprises three-9,200 kv-a single phase units corresponding closely with the transformers for the Suhara station, except for the lower primary voltage. The switching equipment for the Ohi station comprises a nine section control desk and the separately mounted apparatus for the control of four generators, three transformer banks and two 154,000 volt lines. Normally the output of two generators will supply a transformer bank and each transformer bank will supply its own transmission line. The third transformer bank is a spare. Some of the important elements of the switching equipments are described later.

The Inuyama switching station, located 33 miles from Ohi, provides the necessary oil breakers with disconnecting switches for sectionalizing or joining the lines at this point. Hornbreak switches take care of the tie connections to the Hakusan lines. Fifty miles from Inuyama is located the Kameyama switching station with oil circuit breakers and disconnects for sectionalizing and tie connections.

The Furukawabashi substation in the outskirts of Osaka is fifty miles from Kameyama. Here provision is made for two 75,000 kv-a incoming lines each with an emergency capacity of 150,000 kv-a. These lines tie to a ring bus which in turn, feeds six 28,200 kv-a transformer banks, these banks being made up of three 9,400 kv-a transformers. These transformers are connected in star for 140,000 volts primary, in star for 55,000 volts secondary and in delta for 11,000 volts tertiary, this latter winding being used for supplying power to synchronous phase modifiers.

There are three 15,000 kv-a synchronous phase modifiers with 125 kw direct-connected exciters and one 125 kw motor-driven exciter. There are also three 15,000 kv-a synchronous phase modifiers provided with wound rotor motors that can be used either for the purpose of starting the phase modifier or actually driving it as a generator for a short period of time for the purpose of testing out a transmission line.

The main connections are so made that the two incoming lines connect to the two sections of a 140,000 volt ring bus and each section supplies three 28,200 kv-a transformer banks. The secondary, 55,000 volt, windings of the transformers connect through a circuit-breaker and two sets of disconnecting switches to either, or both of two 55,000 volt bushars that supply power to ten present feeders with provision for four more feeders. Fed also from these 55,000 volt busbars are two 825 kv-a three-phase transformers and a 2,500 kv-a three-phase transformer stepping down to 3,300 volts for local service, the starting of the phase modifiers, the operation of the driving motors and the motor-driven exciter.

The tertiary, 11,000 volt winding of the main transformers is used chiefly for the supply of current to its own phase modifier. The tertiary winding and the corresponding phase modifier have three oil circuit-breakers, one connecting the transformer directly to the phase modifier, the second connecting the transfer bus to the phase modifier and the third connecting the transfer bus to the transformer winding. With this arrangement of circuit-breakers, there are two alternative paths for the current from the transformer to the machine, one direct, independent of the bus, and the other by connection to the bus. Any one of the three circuit-breakers can be cut out for inspection, adjustment or repairs without shutting down the transformer or the phase modifier.

There are 18 three-winding transformers at Furukawabashi. Each transformer is rated for a maximum continuous output at 60 cycles of 9,400 kv-a on the primary winding, 9,400 kv-a on the secondary and 5,000 kv-a on the teritary. It is designed for a voltage ratio, based on the turn ratio, of 80,800 volts to 31,800 and 11,000 volts, three transformers being connected in a bank with the primary and secondary in star connection and the tertiary in delta to step-down the voltage from 140,000 to 55,000 and 11,000 volts. The transformers are equipped with a tap on the high voltage winding for 72-720. This permits temporary operation from some 77,000 volt lines to Osaka.

The 55,000 volt feeders from Furukawabashi connect in with the distribution of power from the steam stations of the Osaka Electric Light Co. where there are two 25,000 kv-a turbogenerators now being installed at the Kasugade No. 2 station : four 12,500 kv-a and two 6,250 units at other stations.

Among the old Daido stations, the Shidzumo plant contains three 5,250 kv-a 6,600 volt generators, one 3,000 kv-a, 6,600 volt generator, two banks of transformers fed from the 5,250 kv-a machines, each comprising three 2,630 kv-a units, 6,600/77,000 volts and one 3,000 kv-a, three-phase transformer, 6,600/77,000 volts used with the 3,000 kv-a machine.

For the Sango substation, switching equipment is being furnished for interconnecting the Furukawabashi station at Osaka, the Moriguchi substation, Keihan Electric Co. and the Kema steam power plant. In this station there will be installed three 5,000 kv-a 55,000-22,000 volt transformers.

For the Iwatsuki substation near Nagoya, there will be installed six 4,000 kv-a transformers, 77,000-11,000 volts now being built in America. Switching equipment for this installation is being furnished by local Japanese makers.

*(To be continued).*

# ELECTRICAL DEVELOPMENTS IN CHOSEN AND JAPAN

THE total capitalization of electrical enterprises in Chosen is Y.65,000,000 of which Y.24,000,000 is paid up. The total power generated is 49,000 kilowatts, supplying 505,000 electric lights, and 7,600 h.p. in industrial works.

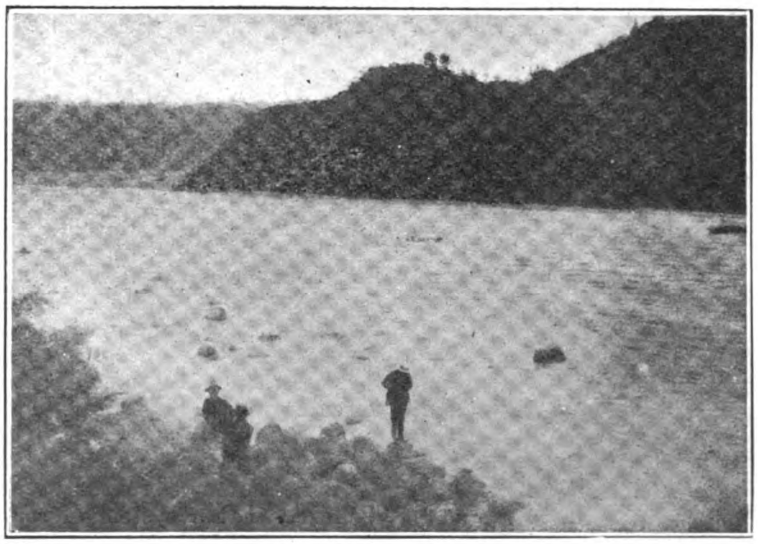
Compared with pre-annexation days the paid-up capital of the electric companies has increased eight times, and power generated, 45 times.

Electric development in Chosen includes many water power schemes, and applications for licenses are being favorably considered by the government general.

The Kongosan Suiryoku Denki Kabushiki Kaisha (Mr. Kongro Hydro-Electric Co., Ltd.) has obtained a license to distribute power in Seoul. This is the first long-distance transmission scheme in Korea, and its progress is being watched with great interest.

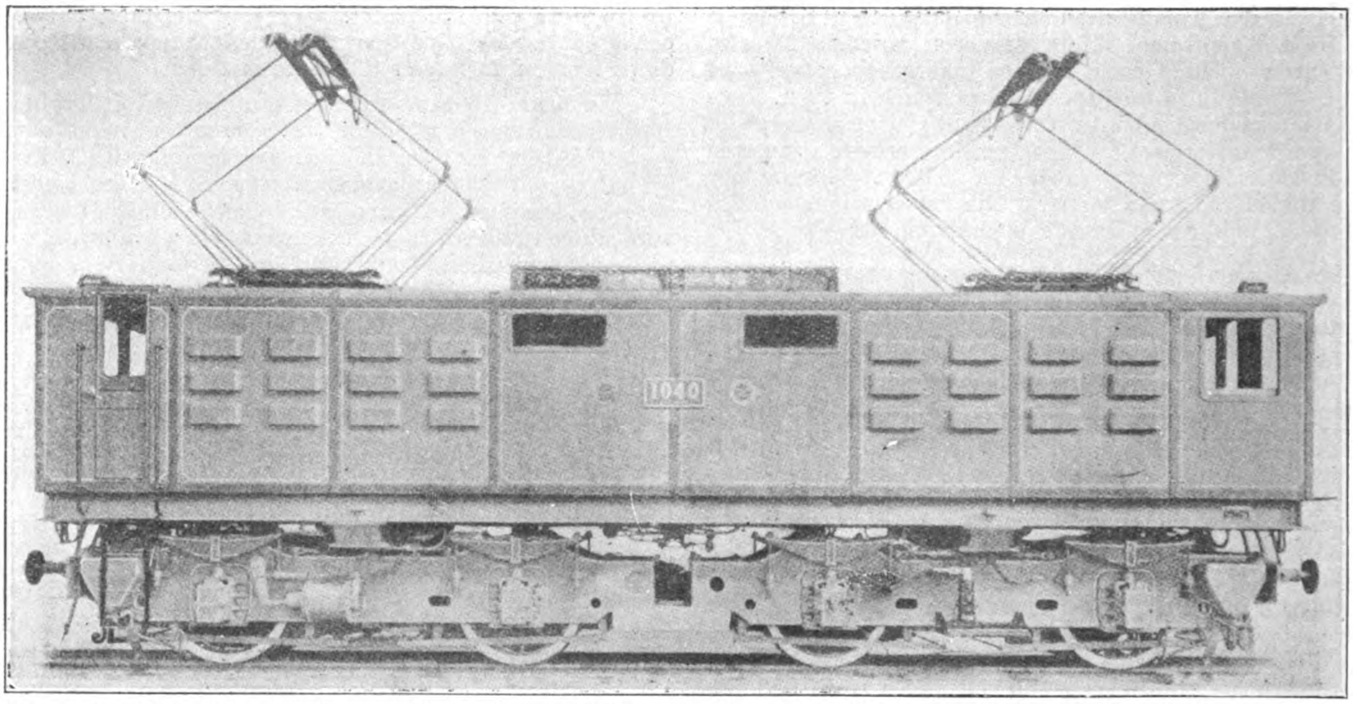
The Shinetsu Denryoku Kabushiki Kaisha (the Shinetsu Electric Power Co., Ltd.) has recently made application to the Sendai bureau of the department of communications for permission to construct a hydro-electric power plant on the Shinano River, at an estimated cost of Y.73,700,000. This is the much-talked-of Shinano River power project which is to supply power for the electrification of the Tokaido railway between Tokyo and Numadzu.

The Shinano River will be dammed in Nagano prefecture, from which point a canal will extend a distance of 6 *ri* (about 15 miles) to a point in Niigata prefecture, where the fall to the generating station will be 358 *shaku*, about 108.5 metres. Nine water turbines will be installed and fed through pipes 1,068 *shaku*, about 324 metres, long. Each turbine will have a capacity of 28,000 h.p., so that the total capacity of the plant will be 250,000 h.p.



**The Shinano River: showing exact site of dam under construction to store the water for operating the great 250,000 H.P. power house of the Shinetsu Electric Power Co., Ltd.**

The application states that construction will be completed in November, 1926. Power will be transmitted to Tokyo and the Kwanto district. This power plant will have four times the capacity of Inawashiro Suiryoku K.K., with 55,000 h.p. and is the largest single power plant ever contemplated in Japan. It has the same capacity as all the power plants in the six prefectures of northeastern Japan, including Niigata prefecture.



One of the 36 Electric Locomotives supplied to the Imperial Japanese Government Railways by the English Electric Company, Ltd.

## English Electric Locomotives for Japan

THE English Electric Company is making deliveries on its order for 34 electric locomotives from the Imperial Japanese Government Railways. The first of these locomotives was shipped in February and the remainder were completed by August.

Before deciding on their electrification program the Japanese government railways investigated the electric railway systems of the world and studied the designs of electrical equipment constructed by the principal manufacturers. As a result of this enquiry they determined to adopt a high tension direct current system, and in all future work direct current at 1,500 volts with a single overhead conductor will be employed. In 1921 the railway authorities ordered two 59-ton (ton equals 2,240-lb.) freight locomotives from each of four firms, two American, one Swiss and in England the English Electric Company. In June, 1922, a contract was placed with the English Electric Company for a further order of 34 electric locomotives, this being the whole number required to carry through the program of the Japanese government up to the end of 1923. The illustration shows one of the completed locomotives. This is the largest contract for electric locomotives whch has yet been carried out entirely by British manufacturers. The mechanical parts of the locomotives have been built by the North British Locomotive Company at their works in Glasgow, Scotland, and the electrical equipment at the Dick Kerr works of the English Electric Company, where each locomotive is erected for inspection and test before shipment.

The locomotive illustrated is one of 17 which will be used entirely for freight service; 9 others are being built for hauling local passenger trains, and 8 of a heavier type for the express passenger service. The freight and local passenger locomotives are similar throughout except in the gear ratio, which is so adjusted as to give for the former a maximum speed of 40 miles an hour and for the latter one of 53 miles an hour. These locomotives are of the 0-4-4-0 type and weight 59 long tons each. The weight is evenly distributed on the axles and comes just within the limit weight per axle of 15 metric tons enforced on the Japanese government railways. The aim which it has been sought to attain in the construction of the mechanical parts is to provide a sound and robust locomotive well-proportioned and of excellent finish, and generally to ensure that throughout the locomotives should represent the best British engineering practice. The locomotive trucks are articulated so that drawing and buffing stresses do not go through the superstructure. The monitor and part of the sides can be readily removed to allow erection and dismantling of motor generator sets and compressors, etc.

Each locomotive is equipped with four motors each of 306 h.p. arranged in groups of two in permanent series. The control is the "English Electric" electrically operated camshaft type, which provides series and parallel control and also two field shunting notches. The control is arranged for multiple unit operation so that two or more locomotives can, if necessary, be operated from one driving point.

The control voltage is 120 volts which is obtained by means of the motor generator set and this set also drives the fans employed in the forced ventilation of the motors.

The pantographs are raised by air and are so arranged that any one of them can be raised or lowered independently of the others and that all the pantogarphs on a train can be raised or lowered simultaneously from any driving point. The locomotives are arranged with a driver's cab at each end and the centre portion of the superstructure is occupied by the control equipment, air compressors and main resistances. All the high tension apparatus is in closed compartments and suitable interlocking is provided so that these compartments cannot be opened without the high tension apparatus being disconnected from the line. The locomotives are equipped with Westinghouse straight and automatic air brakes.

The eight express passenger locomotives are of the 4-6-6-4 type. The superstructure is mounted on two articulated trucks each with a swivelling bogie and three driving axles. The locomotive weighs 96 long tons, there being 12 tons on each driving axle and 12 tons on each swivelling bogie. The electrical equipment includes 6 motors each of 306 h.p., the same motor being used as on the freight and local passenger locomotives. These motors are also arranged in groups of two in permanent series. In other details the equipment of these express locomotives is also similar to that of the type already described.

## Wireless Telephones for Nagasaki Fishing Boats

THE chief of the Nagasaki prefectural marine products bureau, together with a committee of men interested in marine products, is reported to be investigating the possibilities of installing wireless telephone outfits on the larger-sized fishing boats which have their base at Nagasaki, to enable them to communicate with shore when in difficulties, and to report the catch in time for their owners to realize on it. The recent success of the Fukuoka-Fusan wireless-telephone tests has been the immediate cause of this interest in more practical applications of wireless telephony.

There are about 150 fishing boats on which wireless telephone equipment might be installed, and though they frequently go to distances from shore too great for direct communication, it is believed that a system of relays could be developed by which messages could be sent through to land. While wireless sets of Japanese manufacture will doubtless be favored where suitable equipment can be obtained locally, the owners of some of the larger boats ought to be interested in American-made sets.

# Steel Works Electrification

THE most important steel works reconstruction carried out in Great Britain for many years is now being undertaken by The Consett Iron Company who are modernizing their steel works and plate mills. The work on the coke ovens and steel furnaces is well advanced and the orders have now been placed for the new mill buildings, rolling mills and electrical drives.

This reconstruction involves four entirely new mills, consisting of :—

A 40″ Slabbing Mill,
A 42″ Plate Mill,
A 32″ Light Plate Mill, and
A Chequer Plate Mill.

As was to be anticipated, the whole of the plant will be electrically driven, and as the slabbing and plate mill are of the two-high reversing type the drives will be on the Ilgner system.

The main reversing motors direct coupled to the mills will be duplicates and will each consist of a double-armature motor designed for a maximum power of 14,000 h.p. between any speed of ± 50 to 100 r.p.m. A typical view of the mill motors is shown in Fig. 1.

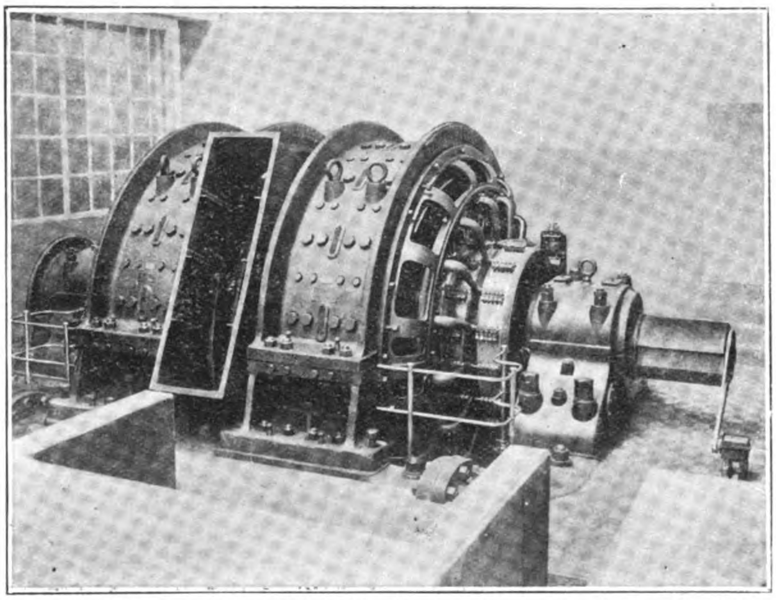


Fig. 1.—Typical view of the Mill Motors—illustration by the English Electric Company, Limited

The flywheel Ilgner sets supplying the mill motors will again be duplicates and will each consist of a 2,500 h.p., three-phase induction motor coupled to two variable voltage generators and a built-up steel flywheel, 48-tons in weight, 11-ft. 3-in. in diameter. The synchronous speed of the sets will be 600 r.p.m.

Under normal working conditions it is proposed to mechanically couple the two sets together, end to end, so that full use of the equalising effect of the two flywheels will be rendered available for steadying the load demand from the station. Fig. 2 shows a typical flywheel set in which the arrangement of the machines is clearly shown.

By introducing the flywheel between the two variable voltage generators the power transmitted from the flywheel passes in two directions, thus avoiding excessively heavy shafts. The length of the set is reduced to a minimum by the avoidance of any flexible couplings, the whole set being carried by five bearings.

The light plate mill is of the three-high type, and will be driven by a continuous running induction motor with a normal output of 2,500 h.p., 240 r.p.m. A flywheel of approximately 35 tons in weight, 15-ft. in diameter, will be coupled between the motor and the pinion, housing, this later acting, in addition, as a reduction gear to give a suitable speed on the mill.

The chequer mill will consist of a single two-high stand of rolls and will be driven by a three-phase induction motor of 750 h.p. running at 240 r.p.m., a flywheel 20 tons in weight, 8-ft. 6-in. in diameter, being interposed between the motor and the gearing.

The type of induction motor for the light plate mill and chequer mill, is shown in Fig. 3.

The new mills will be of Messrs. Davy Bros.' manufacture whilst the electrical plant will be supplied by Messrs. The English Electric Co., whose experience of rolling mill work is well known.

The two reversing drives now to be supplied will make the reversing mill equipments built by this firm 15 in number.

To provide the necessary power the Consett Co. have on order two 3,000 k.w. generator sets, of which the turbines and condensers will be built by Messrs. Belliss and Morcom, Ltd., and the alternators and condensing plant motors will be of The English Electric Co.'s manufacture. Power will be generated at 3,300 volts, 40 cycles, 3-phase, the periodicity being chosen so that additional power can be drawn from the mains of The Newcastle Electric Supply Co., and the County of Durham Electric Power Supply Co., Ltd., when desired, or conversely any surplus power can be delivered into the power company's mains.

The Consett Company have been well-known manufacturers of plates for many years, and this new plant will put them in an exceptional position to meet modern conditions.

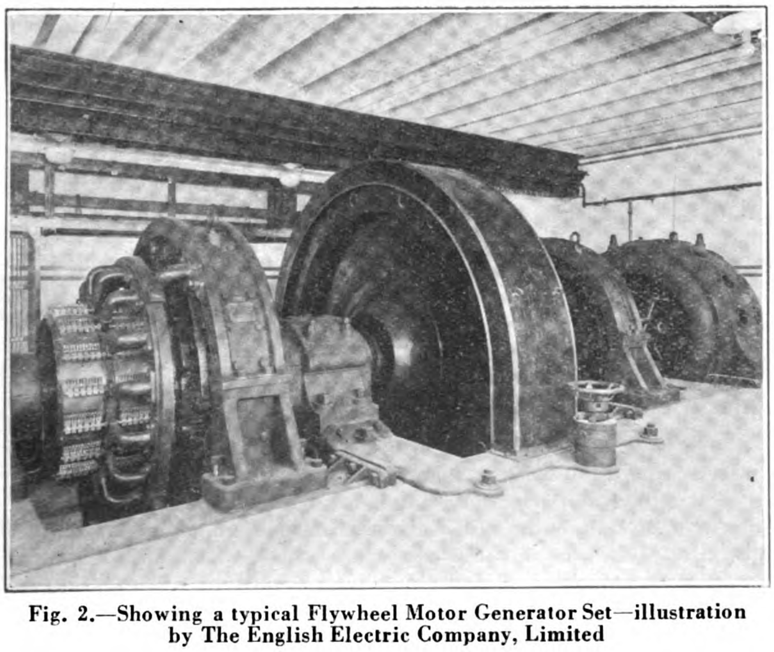


Fig. 2.—Showing a typical Flywheel Motor Generator Set—illustration by The English Electric Company, Limited

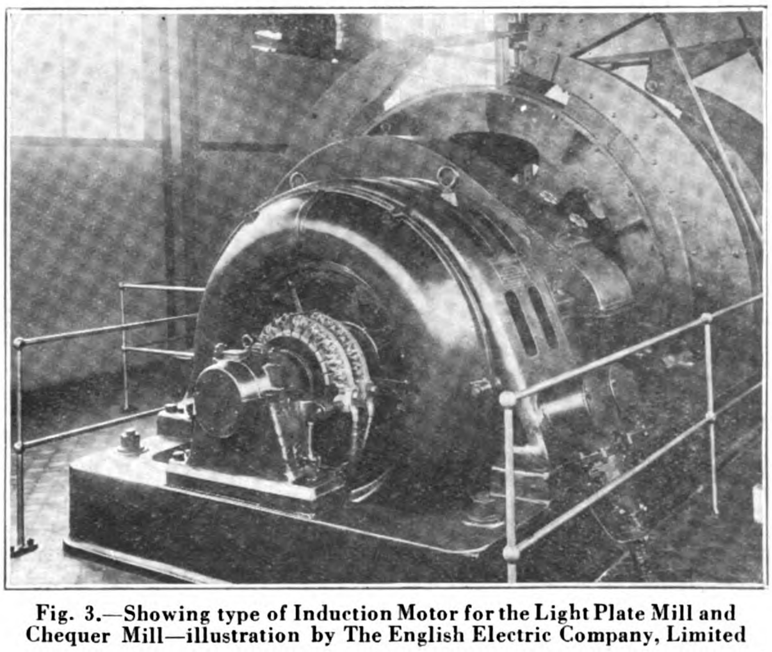
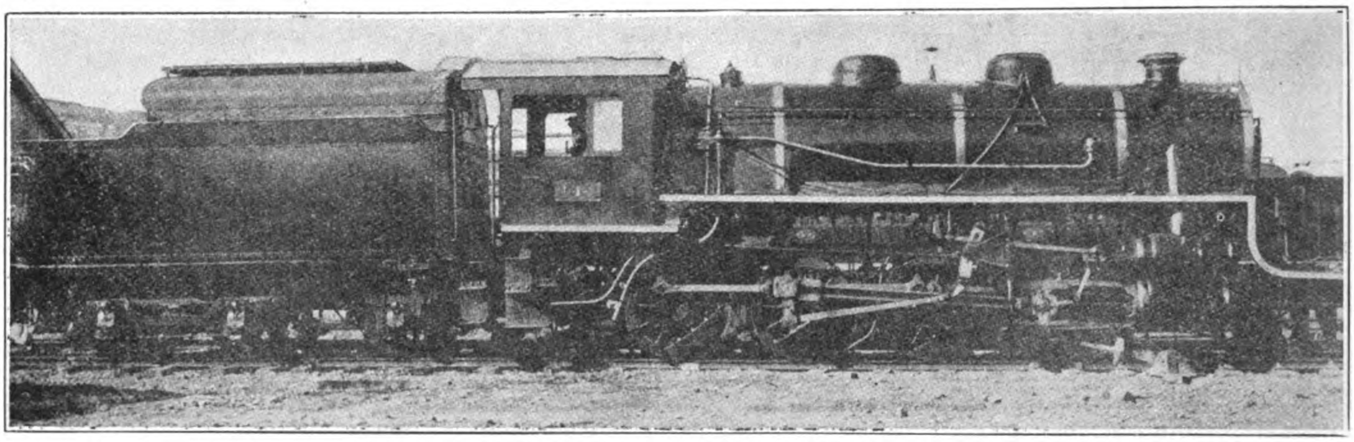


Fig. 3.—Showing type of Induction Motor for the Light Plate Mill and Chequer Mill—illustration by The English Electric Company, Limited



The First Locomotive in the Japanese Empire to Burn Pulverized Coal

# Pulverized Coal for Locomotives in Japan

TAIWAN (FORMOSA), the treasure island of Japan, which a few years ago was unexplored and inhabited by a fierce race of savage headhunters is now a progressive and prosperous country. The large tracts of virgin forest and mineral wealth have caused the name of Treasure Island to be bestowed upon it.

There are immense deposits of fairly good quality coal, but it has not been satisfactory for use on locomotive grates owing to its tendency to crumble, form clinkers and honeycomb on the flue sheets. These burning characteristics have prevented the use of anything but the best of the coal on locomotives. Native women sift the coal by hand, separating the lump from the screenings. The former is used for locomotives and the latter for small power plants and domestic purposes. Sifting has increased the cost of the coal.

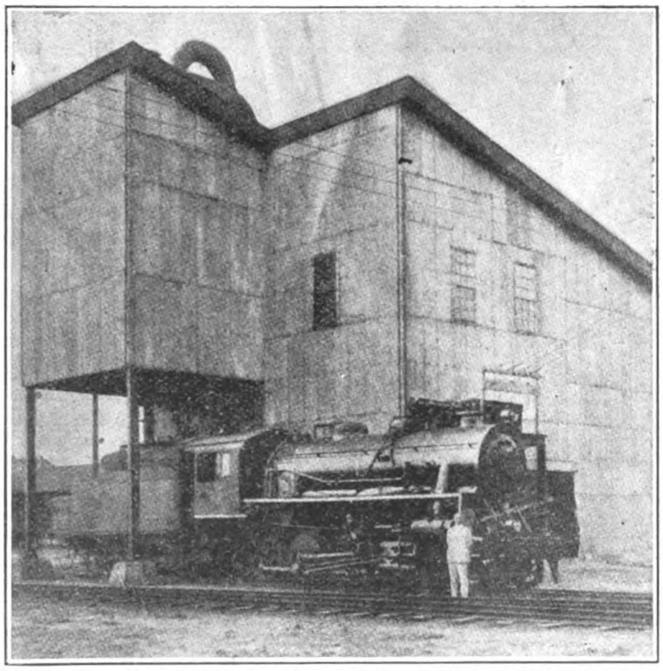
Although the best of the lump coal is now used on the hand-fired locomotives, the results are not satisfactory from several standpoints. In the first place, the coal crumbles and falls through the grates. The method of firing found to be most satisfactory necessitates the use of two firemen. Their instructions are "fire light and often and keep the holes covered." The fireman has to close the door after each shovelful and uses a coal shovel which holds only two pounds. Although this careful method of firing prevents slugging and some waste of coal, it does not lessen greatly the seriousness of the fuel problem and it increases the labor cost.

Another disadvantage was the emission of cinders, sparks, and smoke from the stack. This not only represents a loss of fuel, but is objectionable from the standpoint of the passengers. This is particularly serious in Japan because of the numerous tunnels necessitated by the mountainous character of the country.

The Imperial Taiwan Railroad is progressive and had its engineers carry on extensive investigations in an effort to find some more efficient method of firing locomotives. The question of electrification was also taken up. Taiwan is very mountainous; in fact, it has the highest peak in the Japanese empire. There is plenty of rainfall and the well-preserved forests prevent floods and cause a reserve of water supply throughout the year. Consequently, it was thought that one hydro-electric power plant located at about the centre of the island could supply the whole island with more power than it needed. However, the high first cost has eliminated this project for the present, or least until the screenings and low grades of coal have been utilized. The alternate plan was to find some method of burning the large amount of screenings and poor grade coal available. These investigations led to the consideration of burning this coal in pulverized form.

In the early part of 1921, three Lopulco equipments for locomotives and one complete set of equipment for the pulverizing plant were ordered from Mitsui Bussan Kaisha, Ltd., the foreign agents for the Combustion Engineering Corporation. The first locomotive was put into operation on October 15, 1922.

This locomotive was put in service between Taihoku and Keelung, a distance of 18 miles, over which the running time was 1 hr. 2 min., with six stops to switch out and pick up cars. Four round trips, or 144 miles a day, with switching at stops are considered a day's work over this division. Later the locomotive was put in service between Taihoku and Shinchiku, a distance of 45 miles. Here the running time is 2hr. 45 min., with 12 stops to switch out and pick up cars. Two round trips, or 180 miles, with switching at the stops are considered a day's work over this division.



Pulverizing Plant and Coaling Station at Taikoku, Formosa

After due trial, the pulverized fuel-equipped locomotive demonstrated that the screenings and low grades of coal could be efficiently used. As a direct result, two more Lopulco equipments were ordered by cable, and at the present time there are, either in operation or in the course of erection, seven locomotives in the Japanese empire equipped for burning pulverized coal—more than were ever used by the American railroads at any one time.

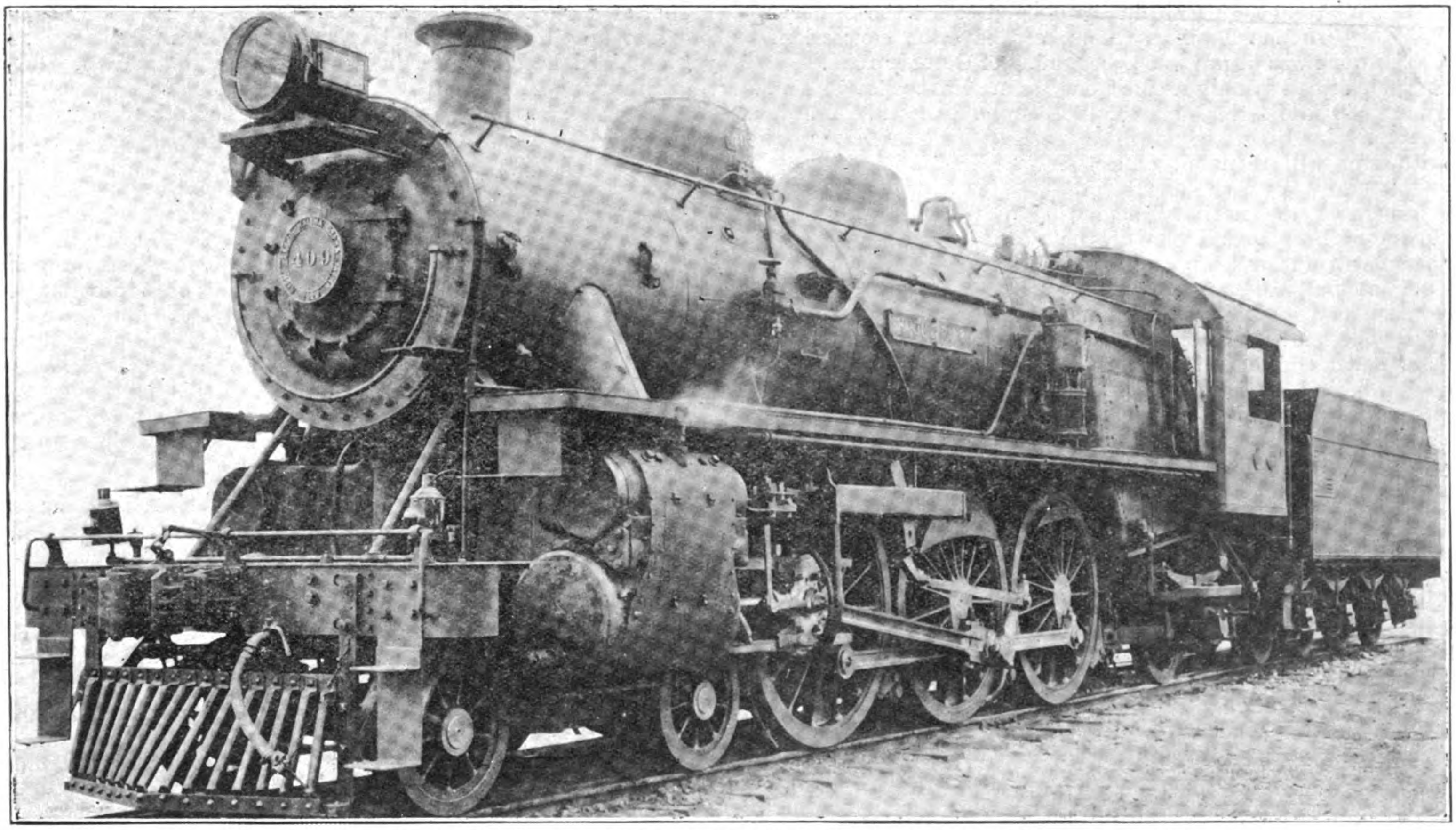
The locomotives operate on a track of 3-ft. 6-in. gauge and have a total weight of 133,900-lb., of which 117,400-lb. is on the drivers. The boilers carry a steam pressure of 180-lb. per sq. in. They have a total heating surface of 1,758 sq. ft., of which 345 sq. ft. is in the superheater, and there is a grate area of 33.9 sq. ft. The cylinders measure 20-in. by 24-in. and the drivers are 49-in. in diameter. The tenders have a water capacity of 2,700 gals. and five tons of coal.

The coal now used on the hand-fired locomotives costs in American money $6.65 a ton, while the screenings used on the pulverized fuel-fired locomotives costs $4 a ton. This means a saving at the outset of 40 per cent. in the coal bill. In addition to this, a saving of 50 per cent. is made in the coal used in firing up, the standby losses are reduced to a minimum and there is a 15

per cent. saving in coal burned when pulling the train. Another big saving is effected by the elimination of one fireman.

At present the hand-fired locomotives are coaled by coolies who carry the coal in baskets from the coal car to the tender. At first thought this might appear to be a very expensive method of handling the coal, but the wages of the men are about 8 sen (4) cents) an hour, so this is really not very expensive. When using pulverized coal, however, there is even a saving in this cheap labor as only three men are required to dump the coal car and look after the pulverizing plant while there are about 16 men required to handle the coal for the hand-fired locomotives.

The illustrations show the type of locomotive on which the equipment has been installed, the methods used in coaling the hand-fired locomotives and the pulverizing and coaling plant installed at Taihoku, which is situated between the 18-mile and 45-mile operating districts.—*Railway Age-Gazette.*



New Locomotive for the Shantung Railway built at Osaka Works of the Kisha Seizo Kaisha, Ltd.

# New Locomotive for the Shantung Railway

TYPICAL of the development of the rolling stock industry in Japan is the growth of the Kisha Seizo Kabushiki Kaisha, one of the first private enterprises to enter the field in competition with foreign manufacturers for the supply of the domestic railway requirements. This company was organized in 1896 after the termination of the Sino-Japanese war, and has since specialized in the manufacture of locomotives. Foreign engineers who have inspected the works and its products frankly state that these not only compare favorably with locomotives made in Europe and America, but in some particulars possess distinct advantages. Many of the finest and most powerful engines in operation on the imperial government railways have been turned out at the Osaka Works of this company. Recently this company built the standard gauge locomotive ordered by the Shantung railway administration and now are building six locomotives for the Chosen lines of the South Manchuria Railway.

In addition, passenger and freight cars of all types and sizes are manufactured for the domestic narrow gauge railways and electric tramways, while standard gauge cars have been built for the Korean and Manchurian lines. The shops are equipped to make cars for any gauge of line.

# Kowloon Tramways

PARTICULARS of the new Kowloon tramway service given out by the Hongkong public works department provide for tenders for the running and maintaining of the following service:—

Commencing at the Star Ferry pier, the lines will run up Salisbury Road, then turn off along Nathan Road and Coronation Road, turning to the left up to Sham Shui Po; the length approximately 2.8 miles.

Another route will be on through Salisbury Road and Chatham Road to a point beyond the junction with Gascoigne Road, where the reservoir is; a distance approximately of 1.6 miles.

A third route will commence just before the mortuary on Coronation Road, and branch off to the right along a new road running up to the Kowloon Tong foothills (distance 1.6 miles.) Route four will be along a new road at right angles to Coronation Road, from near its terminus, up to Kau Pai Shek (about 1.7 miles). A fifth route will be along Gascoigne Road, from Nathan to Chatham Road, approximately half a mile. The final route will run from the reservoir at Chatham Road along an extension of this road way up to Matau Wai village, about one mile in length.

The successful tenderer will pay the government an annual rent, being at least ten per cent. of the net revenue. The sum of $50,000 will have to be deposited on the signing of the agreement. The construction is to be completed by December 31, 1925. The term will be for twenty-five years, determinable at the option of the government at the end of the fifteenth or twentieth year, on six months' notice. The company is to operate a system and type of car approved by government, who will provide all land required for the service.

# Railway Construction in N.E.I.

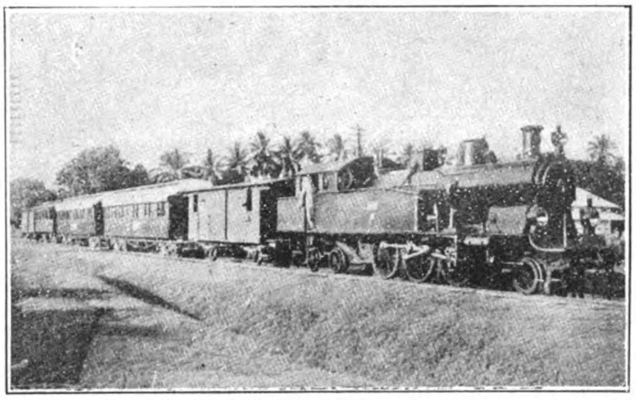
DUTCH Borneo is to have its first railway of the 3-ft. 6-in. gauge.

The Dutch government wanted to construct this railway, but the necessary funds were not forthcoming and they were finally obliged to let the Semarang-Joana Tramway Company have the concession.

The work was begun at the beginning of October 1921.

The railroad is only a short one, from Martapoera to Bandjermasin, 40 kilometres, but this will probably soon be followed by more. Bandjermasin which is reached from the sea on the Barito-river will then be connected by this railway with Martipoera, the centre of the native diamond-industry of Borneo and one of the richest parts of it.

A second railway may follow very soon as it is already studied and worked out, and in fact was much earlier under consideration than the one now begun. It is to connect the rich regions of Sambas on the west coast, *via* Singkawang, with the residency Pontianak, about 160 kilometres.



Medan-Tandjong Balei Express, Sumatra

### Celebes

On this island railway-construction was begun already at the end of 1919, and the line from Makassar, the principal town in the south, going south to Takalar, 45 kilometres along the coast. All earthworks and bridges have been completed.

Plans for a railway from Makassar to the north are well under way.

It will be continued to Pare-Pare and then cross the mountains to the east coast to return eventually to Makassar in a loop.

### Sumatra

Sumatra is the only island of Netherlands India where railway-building is still going on. The communication of Telok Betong, in the extreme south, with Palembang on the east coast, about 400 kilometres, has been established making it possible to trip from Batavia to Palembang in nearly two days.

The crossing from Java to Sumatra by the boats of the Koninklyke Paketvaart Maatschappy (K.P.M.) is the difficult part, and as long as present conditions do not change, six hours must be taken for the 100 kilometres that are separating the two islands.

Railway Construction in Sumatra

Another line of the government is built from Moeara Enim to Lahat by the Nederlandsche Maatschappy voor Havenwerjen (Netherlands harbor works) that got its name through its working in China at Shanghai, and later on by the construction of the harbor of Chefoo.

But up till now the Netherlands harbor works have not yet obtained harbor-works in Netherlands India, and they built this railway of 40 kilometres, from Moeara Enim to Lahat for the government, with 400 Chinese and nearly 1,000 other coolies.

Here steam-shovels are for the first time being used in Insulinde. This line is to be continued from Palembang on the east coast, *via* Praboemoelih (where the line from the south will bring the passengers from Java in the future), *via* Moeara Enim and Lahat to Benkoelen on the west coast. But a much bigger railway plan will probably be executed before this cross-railway to Benkoelen, and this is the central railway from south to north of the island Sumatra, that will open up the richest parts of it.

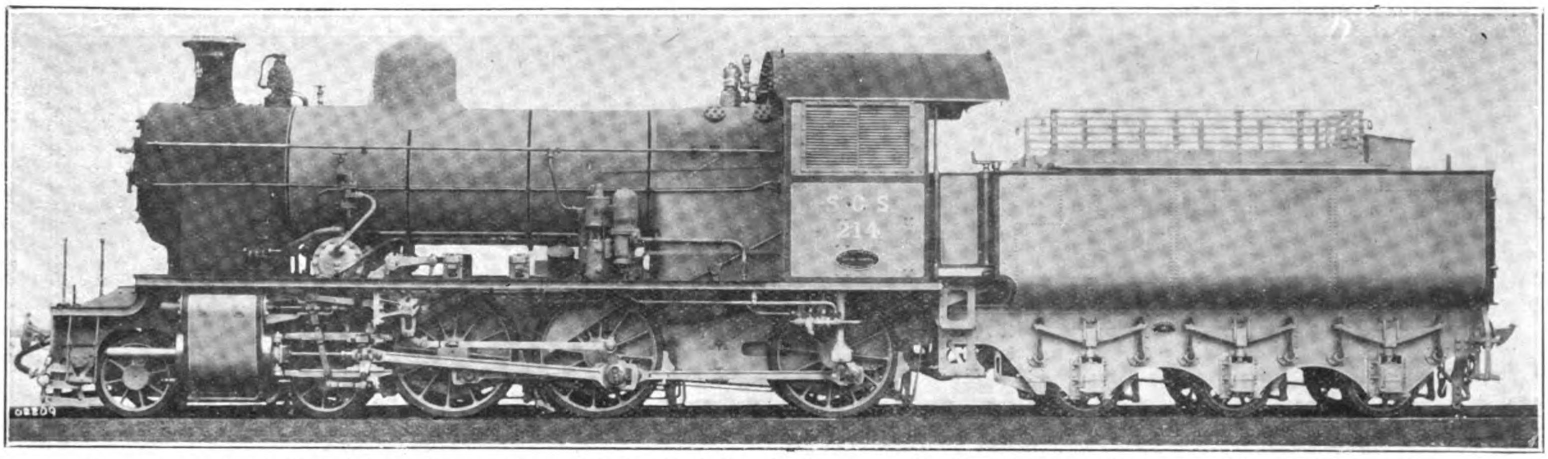
In the north the Atjeh-tramway is already connected with the Deli-railway-system, this will be connected with the railway at Padang on the west coast, where the Ombilien and other coal-fields are, and from there with the railways in the south at Lahat, where the locomotive from the south will arrive in 1923.

The communication between Java and Sumatra will probably be also of much importance for Singapore, as passengers will go by the quick route from Batavia to Palembang and from there to Singapore, saving quite a day on the present route.

## Plans for the Electrification of the Railway Lines on the Dairen Wharves

The South Manchuria Railway Co. is contemplating the electrification of the railway lines on the Dairen wharves, according to a report published in the *Ryoto Shimpo*. It has been ascertained that although this question has been discussed by the engineers of the company from the point of view of the great economy that would be effected—to say nothing of the abatement of the smoke nuisance—the discussion has not yet advanced to the stage of definite plans. There are about 45 miles of railway sidings on the wharves and 16 locomotives are employed in connection with cargo-shifting work at the wharves.

When the company reaches a decision in regard to the matter, even if no foreign aid is required for the work of installation, electric locomotives and material will have to be purchased from abroad. Manufacturers interested should send descriptive material, addressed to the director of the machinery division, South Manchuria Railway Co., Dairen. Very little business, however, can be expected to result from correspondence unless followed by personal appeal. It is, moreover, possible that a sales representative on the ground would be able to put the advantages of their equipment in such a light as to hasten the company's decision to act in the matter. The railway makes it a practice to buy material by inviting bids from firms having permanent offices here, and this fact might influence it to place the order with some Japanese firm which has offices in the United States or England as the case may be.



Passenger engine built by Messrs. Beyer, Peacock & Co., Ltd., for the Samarang-Cheribon Tramway Company. Fitted with superheater and all improvements, these locomotives are used for the express train services connecting with the trains of the State Railway

# Tramways in Java

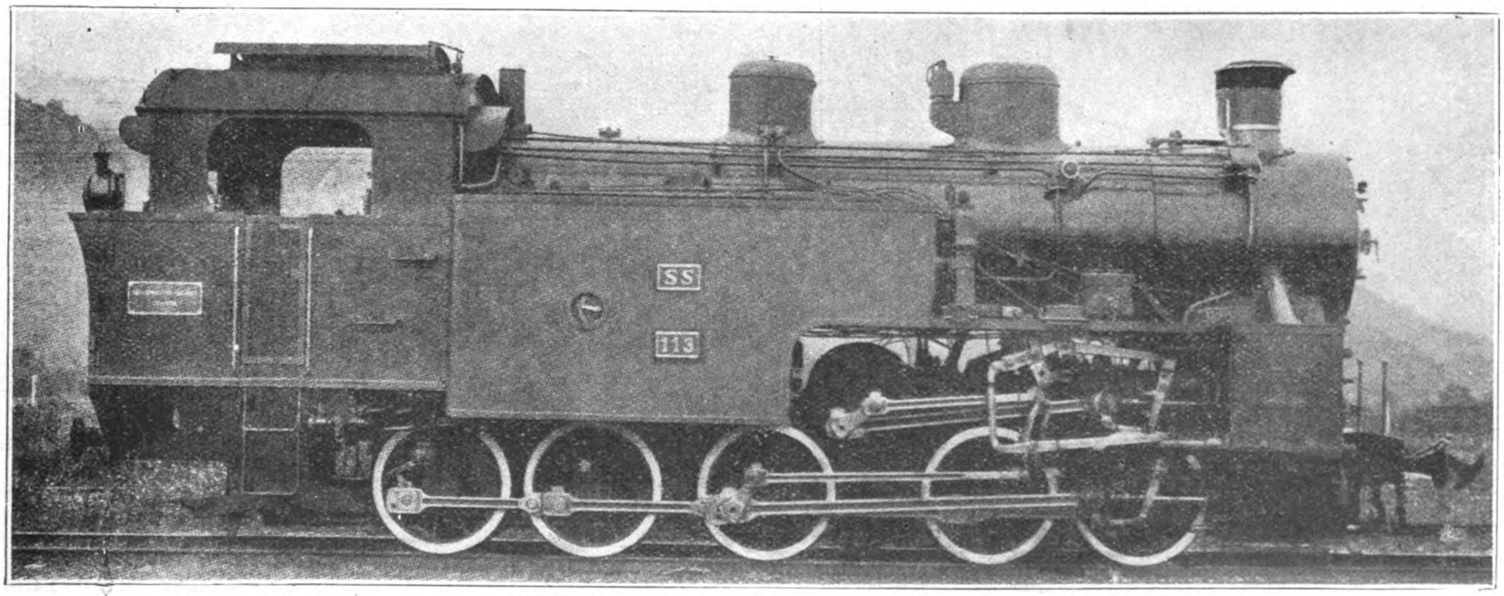
THE tramways in Java occupy a very distinctive place in the transport system of the Dutch East Indies. Not only in fact do they form in some districts the sole and very valuable means of local inter-communication, but their development has been of such a nature that they have come to fill an important place of their own in the wider sphere of through traffic facilities.

The first tramway concession dates back further than the earliest railway concession in the island. In 1867 in fact a concession was granted to certain private individuals for the construction and running of a tramway in the town of Batavia, on which animal motive power was to be employed. After heavy losses had been suffered this was converted in 1881 into a concession for a tramway with steam motive power, which, after being transferred to the Netherlands India Tramway Company, was developed into a financial success.

The first important application for a concession for the construction of tramways to run outside a town was that for a steam-tram in the district of Samarang, running from the town of Samarang to a place called Joana situated further eastwards, which application was submitted in the year 1880. In view of the proposed route and the existing plans to construct a state railway, running for the most part along the north coast of Java, from Batavia to Sourabaya via Samarang, the trace of which would therefore partly coincide with that of the projected tramway, the scheme gave rise to an extensive exchange of views regarding the matters of principle involved, which discussion finally led to a definite postulation of the principles adopted by the authorities, and this statement has since continued to govern the attitude taken up by the government on many points relating to tramways.

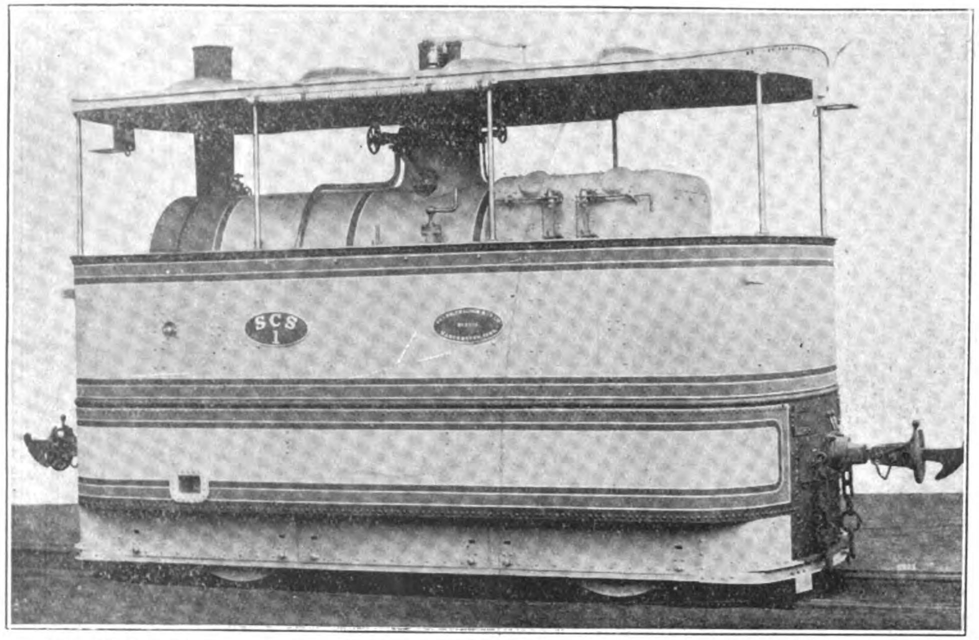
The chief conclusions enunciated in this statement were that a railway implied the construction of an entirely new connecting road, for which, as a rule, a whole continuous stretch of land had to be expropriated for the exclusive use of the railway contractor, which was closed to ordinary traffic and was used solely for the transport of large bodies of people and large quantities of goods at a time at the greatest speed that could be attained with steam motive power. On the other hand, a steam tramway was usually to be regarded merely as an improved means of conveyance along an existing road. There was no need for the ordinary traffic along the road to be hindered, nor was it actually hindered in practice, since the trams run at a moderate speed only, and the engines were so constructed as to permit them to stop immediately. The steam-trams were not intended for the transport of large bodies of people and large quantities of goods at a time and at the greatest possible speed. The existence of a steam-tram, therefore, could not debar the construction of a railway.

This clearly indicates that at first no such development of the tramways was anticipated as has since actually taken place. That the first tramways were considered to possess primarily a local importance is shown by the extent to which the head of the local district officers was entrusted in those days with the supervision of the tramways. This is also indicated by the concession conditions. The maximum speed was fixed at 15 kilometres per hour! As

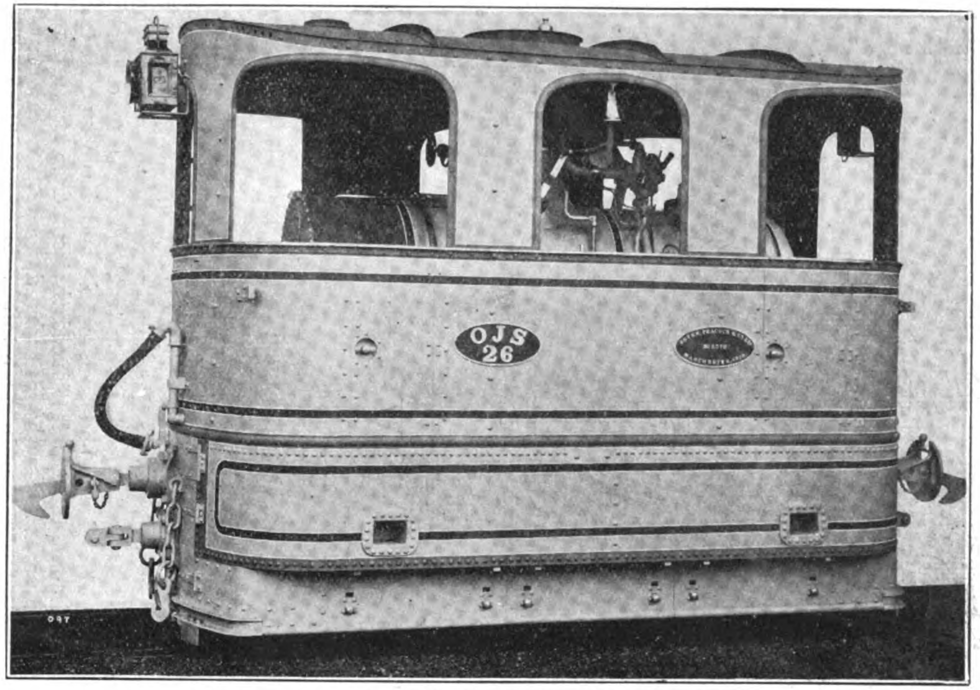



0.5.0 four cylinder compound combined adhesive rack engine with superheater, Sumatra West Coast State Railways

# BEYER, PEACOCK LOCOMOTIVES ON JAVA TRAMWAYS

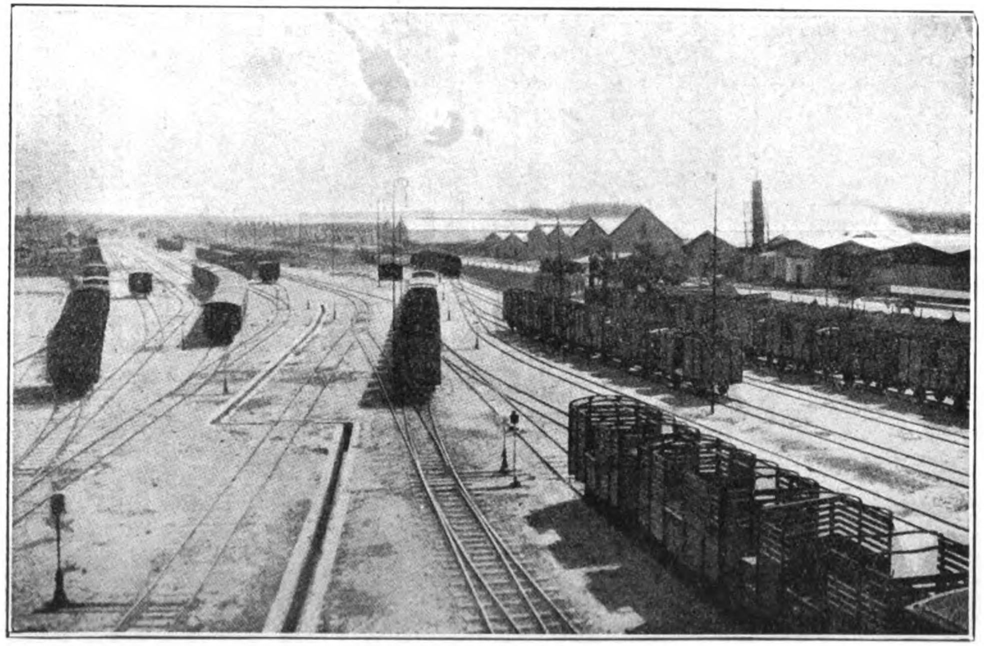



No. 8005. The capabilities of this engine are well known in Java, it being of the type used over the 384 kms. system of the Samarang-Cheribon Tramways, transporting goods and passengers at a speed restricted by statute to 45 kms. per hour




No. 097. Type of engine built for the Oost Java Tramway Company

Coal discharging yard at Tjilatjap Harbor (south Coast of Java)



General view of a portion of the new Harbor Yard at Kalimas, Soerabaja

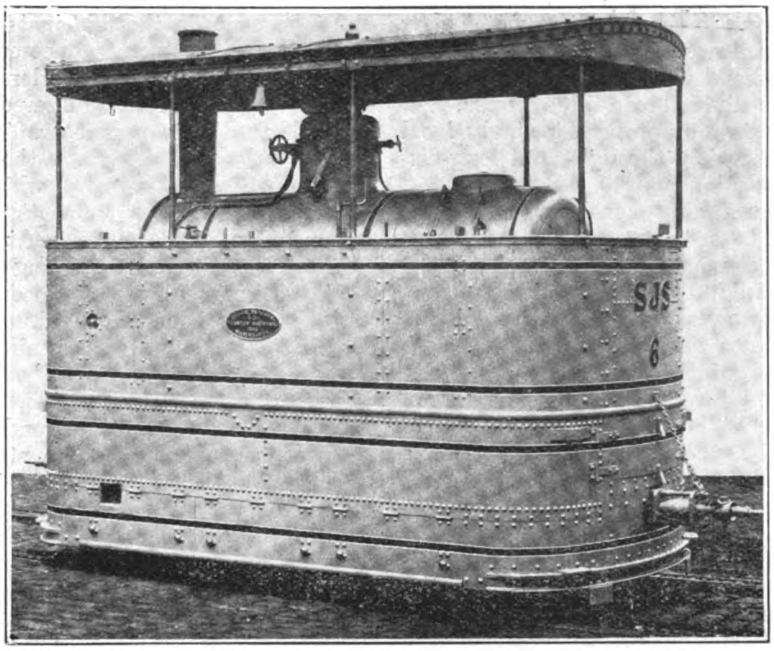
regards the tariffs the only stipulation was that they should be made public ; the concession made no stipulation whatever regarding either an obligation to carry, or the right of expropriation ; the length of the train was limited to 40 metres; nothing was stated regarding level crossings and junctions or running powers and working arrangements ; obligations to undertake through traffic were non-existent.

In the course of time, however, these conceptions became considerably modified ; the tramways came to be regarded more and more as railways of local importance, which, however, carry traffic of great extent and frequently for very long distances. The legal regulations were also gradually modified in sympathy, the length of the trains allowed was considerably increased, the maximum speed was gradually raised to 30 and 40 kilometres per hour, the latter speed, however, only being permissible where the trams do not run along the public roadways.

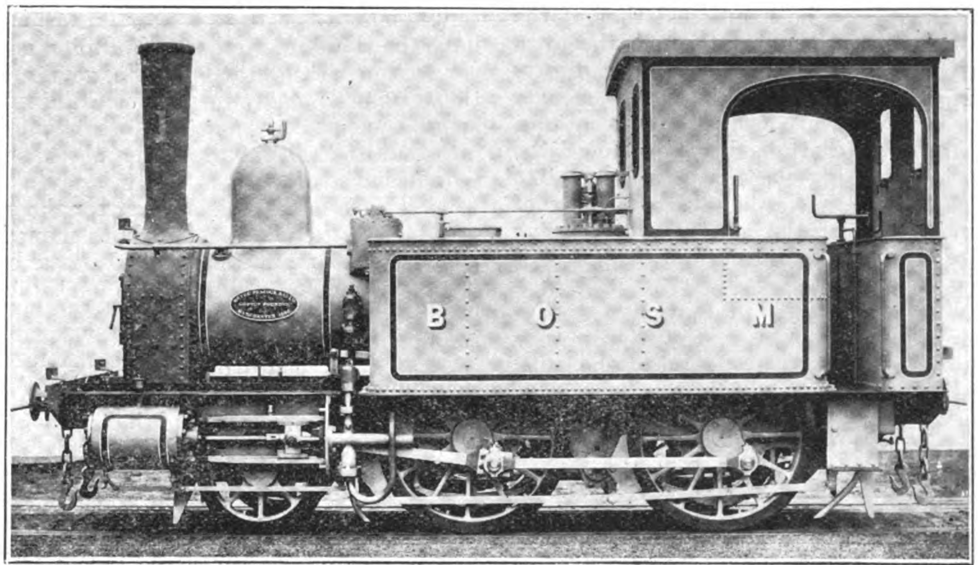
In recent years traffic with a speed of 45 kilometres per hour even has been allowed on sections where there could be no objection on account of the situation of the line from the point of view of public safety; further the representation of a deputation of competent parties resulted in a prompter management of tramway affairs being instituted ; the control on behalf of the government which was entrusted for many years to the chiefs of the local district authorities, is now placed in the same hands as the control of the railways ; the right of expropriation is now stipulated in the case of all new tramway concessions. In the meantime the steady development of tramway traffic and the continuously growing importance it has acquired—whereby the interests of the public have become more and more closely affected—have naturally revealed to an increasing extent the desirability of bringing the regulations governing this traffic more into line with its present character.

With that object in view a complete revision of the existing railway and tramway legislation has been taken in hand, regarding which it will be sufficient to state here that it is intended that the speed at which the traffic is run shall determine to which set of regulations a rail- or tramway is to be subject, a speed of 30 kilometres per hour making the dividing line between railways and tramways. Railways on which traffic is to be run at a speed of more than 45 kilometres per hour are classified among the original railways. The tramways are subdivided into two categories, the boundary line between which is a speed of 15 kilometres per hour. This subdivision according to speeds—which are naturally dependent on the extent of the traffic, and in connection with which, of course, the least elaborate regulations are designed to apply to the lowest speed—permits one to hope that further expansion of the transport system will be energetically proceeded with.

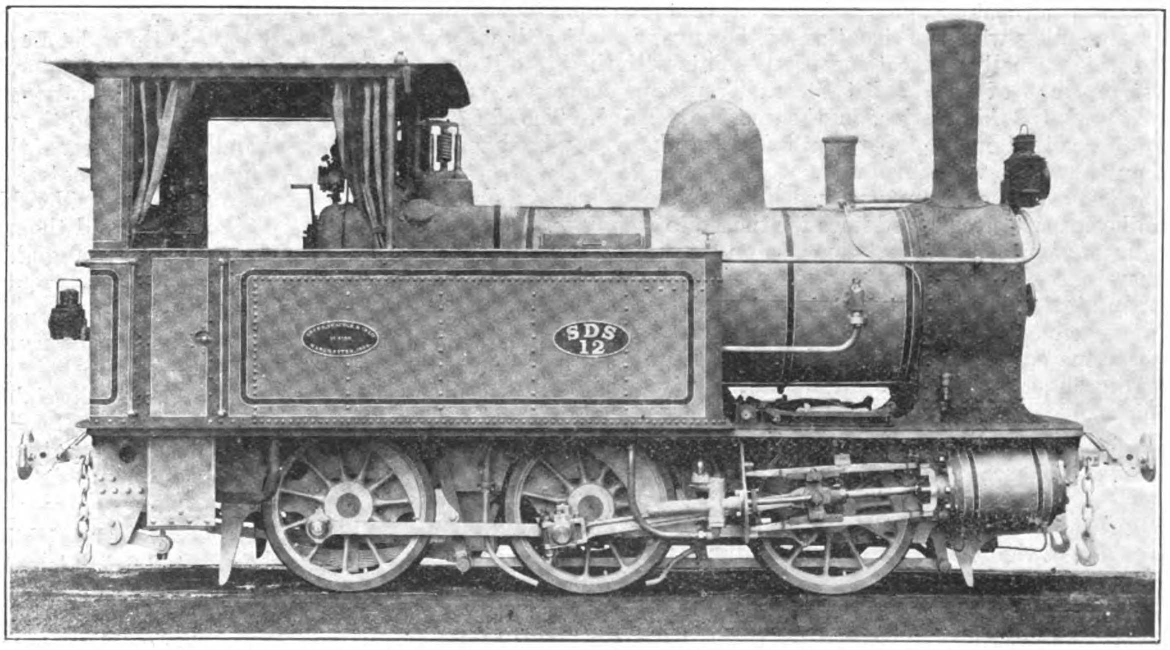
On the basis of the broad principles described above it has been possible for the tramways in Java to make rapid progress ; they have been constructed for considerable distances, and indeed, as already mentioned above, they now play an important rôle in connection with the through traffic in the island. In the last few years particular activity has again been noticeable in this sphere ; the construction of several new lines has been taken in hand—others




No. 6167. Beyer, Peacock engine Built in 1882, still in use by the Samarang-Joana Steam Tramway Company




No. 6716. Beyer, Peacock engine used by the Batavia Ooster Railway for freight and passenger traffic




Type of Beyer, Peacock o-6-o locomotive used on the lines of the Serajoedal Steam Tramway Company in Java (3′6″ gauge)

have gradually been compelled, owing to the extent to which they have grown, to join the ranks of railways, and have made a start with the requisite further constructional work involved.

The tramways in Java may be divided into three groups, viz.: (*a*) Actual town trams; (*b*) tramways of preponderatingly local importance, and (*c*) tramways on which through- and long-distance traffic plays a preponderating rôle.

Only some three tramway undertakings can be considered as falling under the category of actual town-trams, which term is here applied to trams in the larger cities connecting the business quarter with the residential suburbs and linking up the various suburbs with each other. Of these town tramways mention may be made in the first place of that in the town of Batavia, which besides linking up the town proper with the suburb Weltevreden, provides a connection with Meester-Cornelis, lying several kilometres more to the south. In 1922 there were 14 kilometres open to traffic. Up till now steam has been retained as the motive power, but plans have been prepared on the one hand to adopt electric traction, and on the other hand to extend the system by constructing a number of short lines.

As the second town tramway, which likewise runs within the township of Batavia, may be mentioned that belonging to the Batavia Electric Tramway. This also serves traffic from the town of Batavia proper to the outlying suburbs, but runs along an entirely different route to the steam tramway referred to above. This tramway system has been considerably extended during the last decade.

As the third town tramway is to be mentioned that of the East Java Steam Tramway Company, running through the town of Sourabaya to Sepandjang. As in the case of the tramways referred to above, this line is also only permitted to carry passenger traffic. Steam is used as the motive power; the dimensions, however, which the traffic has already attained, have induced the company in question to decide on using electricity as the motive power in future. At the same time a considerable extension of track has been taken in hand, involving the construction of a line partly encircling the town of Sourabaya, and also an extension of the track within the town itself.

In conclusion it will be of interest to mention that plans are also under consideration for constructing a system of electric tramways within the third chief town of Java—Samarang—and at the same time for electrifying the existing town portion of the line Samarang-Joana.

On investigating the tramways on which the traffic is of preponderating local importance, it will be found that these have developed most in the sugar-growing portion of East Java, where they serve to convey the products of the sugar factories either directly to a neighboring export shipping centre, or to the State Railway line for further transport to Sourabaya harbor. Several companies in that part of the island have in the course of time constructed a more or less extensive tramway system. Of these tramway lines and systems, many of which have spread in curious fashion corresponding with the situation of the sugar factories they serve, and which usually connect at various points with the State Railway system, that of the Kediri Steam Tramway Company, with a length of 123 kilometres, is the most extensive. The financial results realized on the tramways referred to here may be described as on the whole very favorable.

Several other tramways are met with elsewhere in Java of similar importance as feed lines for the State Railways. The sugar traffic is of primary importance also on a couple of these lines; the others carry a not inconsiderable passenger traffic besides transporting agricultural products, principally rice, for the native market. The revenue obtained from these lines also fully meets the expectations entertained at the time they were constructed. Some of these lines consist of ordinary railway track, and thus form a valuable portion of the general railway system.

One of the lines referred to here (from Babat to Jombang) though the area traversed by it displays a certain measure of prosperity, possesses special importance as forming a link between the main line of the State Railways and the parallel Gundih-Sourabaya line of the Netherlands India Railway Company.

Of the tramways of preponderating importance for through traffic, which, as already indicated above, owing to the nature and extent of the traffic subserved by them, have gradually acquired the importance of railways and are more or less run as such, mention must be made in the first instance of the Samarang-Cheribon line belonging to the steamtram company of that name, and the Gundih-Sourabaya line of the Netherlands India Railway Company. Both lines, owing to the routes followed, are destined to play a predominating rôle in the transport traffic between Samarang and Batavia and Sourabaya, and between the two latter towns. The Samarang-Cheribon Steam Tramway, which has a length of 334 kilometres of track, provides a connection along the north coast of Java between the towns mentioned; along its route are lying the important coastal centres of Tegal and Pecalongan. The extent of the traffic, which was not inconsiderable even when the line was first opened, rendered this line a very remunerative undertaking. In 1912, as a result of the opening of the State Railway line between Tjikapek and Cheribon, that traffic further acquired the importance described above. A commencement had already been made before that time with the work of rendering the line suitable by means of lengthening the track and constructing short cuts, for considerably faster traffic than that for which it was originally constructed. By running a service of express trains (from January 1, 1913) connecting with the trains of the State Railways, it was rendered possible to reach Samarang from Batavia, and *vice versâ*, along this line in the course of a single day.

The second line mentioned above (gauge 1.067 metre) connects at its terminus Gundih with the railway line Samarang-Vorstenlanden (gauge 1.435 metre), thus connecting Samarang with Sourabaya, although it is necessary to change trains at Gundih. The continuous increase in the traffic induced the company to apply for a concession to construct a new line from Gundih to Samarang to have the standard Netherlands Indian gauge of 1.067 metre. This connection was granted by the government. On the portion of the tramline already in existence the running speed has been increased since a conversion of the system of tramway administration into that of a railway has taken place some years ago. This could be effected all the more easily because the tramway runs for its whole length of 245 kilometres over the company's own track.

In addition to the two lines named there are several other tramways, expecially in Central Java, belonging to various companies, which are of importance for through traffic. Mention may be made in this connection of the Samarang-Joana Steam Tramway, running from the former town eastwards in the direction of the coast, with a length of 395 kilometres, and connecting with the Gundih-Sourabaya line.

While the importance of the transport facilities provided by the various tramlines in Java varies a great deal in accordance with the nature of the traffic, there are also considerable differences in the nature of their construction. Most of the tramways have been constructed with the standard gauge of 1.067 metre (equivalent to 3-ft. 6-in.). On the whole it can be said that this gauge has served very well. Its applicability rendered it generally possible to keep the cost of construction proportionate to the extent of traffic to be dealt with. The movement that has been manifested several years ago for making use of a gauge of 0.60 metre may be attributed to a desire to let blessings of improved transport facilities be shared also by districts where only a very spare traffic may be looked for, without involving any heavy financial sacrifice.

While on the one hand the nature of the traffic carried, and on the other hand the character of the territory traversed by the various tramways in Java differ materially, the cost of construction of the lines has also varied considerably; the maximum cost is 201,000 guilders per kilometre and the minimum 19,557 guilders, while the average amounts to 64,700 guilders.

The weight of rails used on the various lines differs also considerably; on tramways having a gauge of 0.60 metre, rails weighing 12 kilos per metre have been utilized. Railweights of 16 and 20 kilos per metre have also been used, but on the whole preference has been given to the railweight formerly used on the main lines of the State Railways, i.e., 25.67 kilos per metre. It may be mentioned in this connection that rails weighing over 42 kilos per metre are in use on the reconstructed Gundih-Sourabaya line.

As regards the extent of the tramway systems in Java, at the end of 1921 there were 2,411 kilometres of tramway track open to traffic, as against 2,965 kilometres of railway; this fact is a convincing testimony to the great importance of the tramways. The capital sunk in the construction of the tramways amounted at that date to 155 million guilders, as against 427 million guilders invested in the railways.

The extent of the traffic on the various tramways, just as in the case of the railways, differs very considerably. The densest passenger traffic is met with, of course, on the town trams. Thus the number of passengers on the lines of the Netherlands Indian Tramway Company (14 kilometres) amounted in 1921 to 12.3 millions, on the lines of the Batavia Electric Tramway Company 7.6 millions, and on the town lines of the East Java Tramway Company (95 kilometers) 13.9 millions.

As regards the goods traffic, this is heaveist on the line of the Samarang-Cheribon Steam Tramway Company (381 kilometres), with a quantity of 1.1 million tons of goods for the year 1921, and on the line of the Samarang-Joana St. Tr. Co. with 0.6 million tons for the same year.

With regard to the total extent of the traffic and its development during the last few years, the following further particulars may be mentioned. The total number of passengers on all private tramways, which in 1912 amounted to 48.5 millions, and in 1917 to 67.0 millions, rose in 1921 to 84.0 millions, representing an increase within 10 years of nearly 80 per cent. The goods traffic showed an advance of from 3.4 million tons to 5.3 millions, or nearly 60 per cent. in the same decade. The total revenue from all private tramways increased during this period from 14 million guilders to 34.5 millions, or nearly 150 per cent.

These figures may be considered amply convincing evidence of the fact that the tramway systems in Java form a very valuable complement to the general scheme of transport facilities, and that as regards both the traffic they are capable of handling and the financial results already achieved, they give every ground for satisfaction.

On persual of the above brief review, it will not have escaped the notice of the attentive reader that the course of development described above differs in many respects from what has taken place in other countries. The most conspicuous point of difference is the importance of the tramway system for general traffic, which approximates in several districts to that of the railways. This is to be explained quite logically by the special local circumstances. In the first place the familiar phenomenon which is met with in connection with most colonial enterprises, that money is only readily obtainable if the proposed employment of the capital promises to yield an especially favorable return, applies particularly to Java, where the shape and development of the country were of such a nature that no very large revenue was to be anticipated from railways.

As a result of this circumstance, but little private capital has been devoted to railway construction ; what has been accomplished in this direction has been almost entirely the result of direct state intervention. The tramways, however, which were so much less costly, both to construct and to run, provided the means for attaining the desired co-operation of private capitals, and the inducement so provided has proved to be of a lasting and stable nature. In cases where the tramways have gradually developed their own traffic to such an extent that a railway may be considered likely to be a paying alternative proposition, the conversion into a railway can proceed on the spot without the proprietors being exposed to any serious risks. The transport facilities provided continue in this way to meet exactly the demand that is made of them.

## THE BRITISH EMPIRE EXHIBITION

(*Continued from page 717*)

per cent. are potential regular customers who will consume a pound of butter every week. Butter has been taken as an easy example, but the same principle applies to meat, fruit, dried fruit and canned fruit, and to some extent the same principle will apply to sugar, coffee, tea, rice, and a hundred other things drawn from every part of the world. Too much attention has been concentrated on the estimated consumption of these things at the exhibition. That is really negligible except for publicity purposes. It may reasonably be assumed that during 1924 there will be a predilection on the part of the British public to give preference to dominion products, but there is no use disguising the fact that there is an equal predilection on the part of any public to purchase products which are obtainable easily and at reasonably competitive prices. The exhibition would do more harm than good if the public, having learned to appreciate meat, dairy products, wine, fruit and tea from within the empire, found that they could not obtain these products from their local sources of supply or could only obtain them at prohibitive prices.

When it comes to the investment of capital, the exhibition should bring prominently to the attention of British capitalists the attractions which the dominions offer for financial investment. The near future will certainly see a big expansion in the development of the natural resources of the overseas empire, and if British capital stands aloof, such development will be secured by means of capital from other sources. It may be true that finance is cosmopolitan, and that blood is thicker than water, but it is assuredly in the interests of a strong, united empire that British capital should continue to predominate in the economic development of the dominions and colonies.

Looked at, therefore, in its broadest aspect, the British empire exhibition means a great publicity campaign in which there are three equal partners—the dominions and colonies, the public, and the exhibition. The dominions and colonies have attractions to offer ; it is their business to present those attractions in the most convincing form. It is the business of the exhibition to co-operate with them in every possible way in achieving their object. And, finally, it is the duty of the public to give everyone a fair run for his money. Let the public realize that on the one hand the dominions and colonies and on the other hand the exhibition authorities are striving to realize a great ideal. Its attainment rests very much in the hands of the public, who by helping the final purpose of the exhibition will be helping themselves, just because they are helping the whole empire.

### Clearing House for Scientific Research

There is one other aspect of the exhibition which must not be lost sight of. Scientific research is often termed, vern inappropriately, a non-revenue producing section of an exhibition, when, as a matter of fact, the whole future of commerce and industry is bound up with research. Fortunately this axiom is appreciated in the dominions, and in certain directions, more especially relating to agriculture, the volume of support and the financial backing accorded to scientific research overseas are quite striking. There is needed, however, a clearing house for this work. Problems of stock and plant diseases are of common interest to the whole empire, and it would be a lamentable instance of lost opportunity if the British empire exhibition failed to give adequate attention to the results which have been achieved in different dominions —results which in too many cases are not sufficiently widely known. The original plans of the exhibition in this connection were on a very extensive scale, but there is some fear that financial considerations will prevent their being carried out. Surely within the empire there must be a sufficiency of public-spirited and wealthy men who will not allow this side of the exhibition purpose to languish.

Sometimes, in some quarters, there seems to be a disposition to regard the exhibition authorities as cockshies. No doubt, being human, they are open to criticism. But it cannot be too strongly urged that the exhibition itself is not a venture on the part of any group of individuals or of any particular party. It is a great imperial enterprise, designed to serve the interests of the whole empire by promoting mutual knowledge among all its components and by stimulating economic relations between them. So long as these main objects are kept in view the exhibition will, it may be hoped, play no unworthy part in helping to usher in the industrial and commercial renaissance which lies before the British commonwealth of nations.

## THE JAPANESE TRAGEDY

(*Continued from page 712*)

that when full reports come in it will develop that the earthquake itself did comparatively little damage, but that fire was responsible for the greatest loss, as was true in San Francisco in 1906, the tsunami greatly increasing the destruction at places near the shore. As the San Francisco earthquake originated along the San Andreas fault in the solid land, there was, of course, no disastrous sea wave connected with it.

Nor is there any reason for thinking that the Tokio earthquake was caused in any way by volcanic eruptions, which is in general popularly believed of all earthquakes, but which is in most cases an erroneous conception.

# The Japanese Tragedy

### Views of Expert Seismologists on the Origin of the Earthquake

***From "The New York Times"***

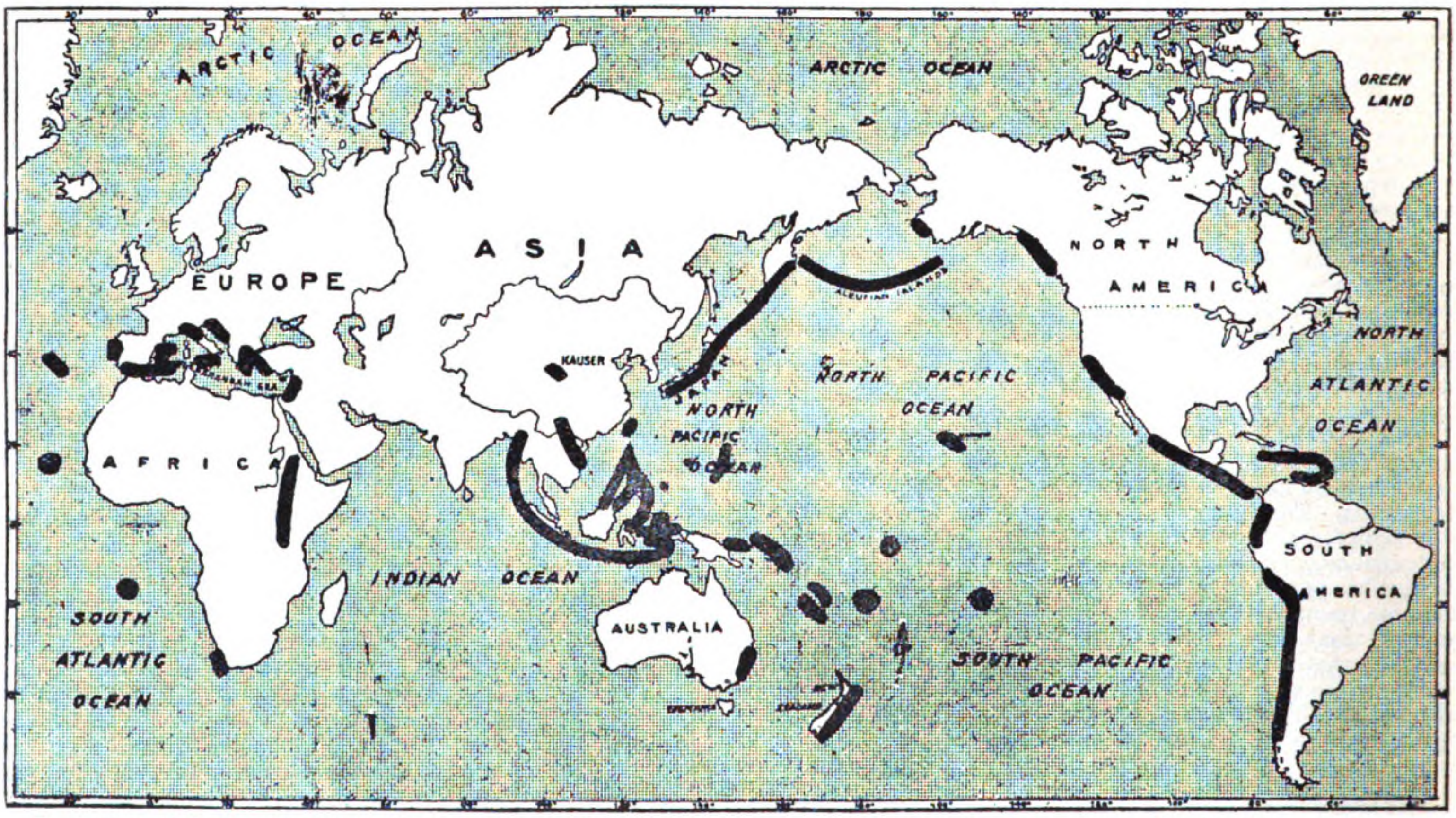
THE Japanese tragedy came as the spectacular culmination of disturbances that have rocked the Pacific since last November, spreading death along the South American coast and destruction throughout the storied isles of the South Seas.

Never in the known history of humanity has there been such widespread desolation as that visited upon Japan at one stroke. The classic tragedy of Pompeii in 79 A.D. seems slight compared to the fate of Tokio and Yokohama. Pompeii had a population of only 20,000 and the loss of life was about 2,000. In Herculaneum, destroyed at the same time, there probably was not more than a thousand dead. Tokio had more than 2,000,000 citizens and Yokohama in excess of 400,000.

centre about the middle of the earth, and those nearest the equator are much more active than the zones further away.

In describing the causes of the Japanese earthquake, Dr. Chester A. Reeds, seismograph expert at the American museum of natural history in New York, says, if we take a map of Japan and select a spot in the Pacific 1,000 miles distant, we find that the depth there is 4,206 metres, in 160 East longitude. Now let us travel to a point 250 miles from the coast. There the depth is 7,254 metres, something like five miles, one of the deepest spots in the world. In 160 East longitude, and extending both ways in a kind of arc, an undersea range runs for hundreds of miles. This is in a formative state, probably rising steadily mearer the surface, just as the islands which make up Japan rose in earlier times. They

## EARTHQUAKE ZONES THROUGHOUT THE WORLD




The Regions of Greatest Earthquake Movements Are Indicated by the Heavy Lines on the Map, Which Was Prepared by the Geological Bureau of the Department of the Interior. The Most Important of These Are the East Indies, the Pacific Basjn and the Greco-Italian Region

As indicated by the accompanying map of earthquake zones, these disturbances generally are confined for the most part to well-defined areas. The map is based on a composite record of shocks over a period of years.

Now and for a long time to come the earthquake centres of the world, in the opinion of eminent seismologists, will be along the shores of the Pacific, in the region of the Aegean Islands, and Messina, Italy.

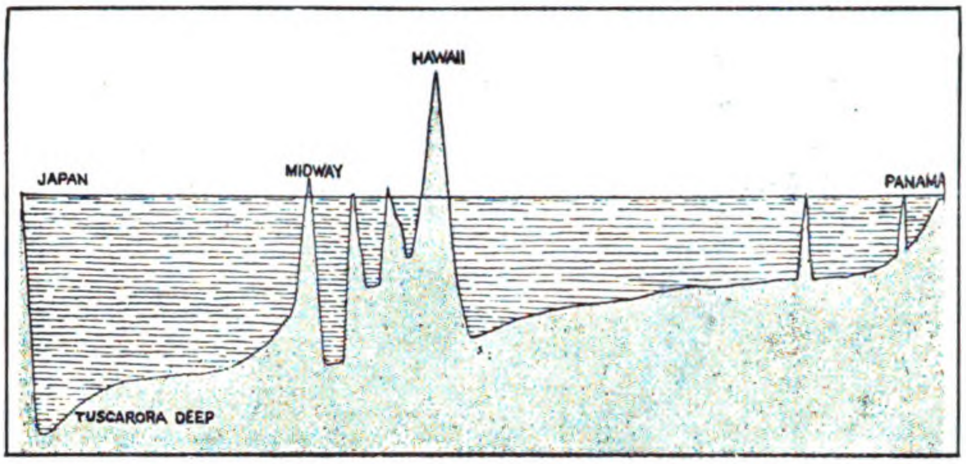
A study of earthquake zones indicates that most of them are confined to islands and coastal regions. Only occasionally do they extend inland any distance, which would seem to establish that the big masses of land away from the seacoasts are by far the safest. This may be understood on the theory that these inland masses are thicker and more solidified than along the edges or in the case of islands. It also is to be noted that the earthquake zones largely

are what we call new ground geologically, dating from the Tertiary Period, 1,000,000 to 3,000,000 years ago.

"Leaving the point 250 miles from the Japanese coast, the floor of the sea gradually slopes upward until it emerges in the crest of this second range, Mount Fujiyama, not far from Tokio, has a height of 3,780 metres, the highest point on the islands. Compare this with the depth of 7,254 metres 250 miles offshore and we get an idea of the tremendous difference in such a relatively small area. But 1,000 miles out to sea there is that second range, 4,206 metres. Nature has a way of matching one mass against another, particularly in the case of mountain ranges, and these exert pressure upon each other. The undersea range has that relation to Japan and there also is a difference in the gravity. Well, this pressure is the immediate cause of the shocks, as one mass is adjusted to the other. How long that process will go on nobody can say, and neither is

there any way of predicting in which direction it will next crop out. But, broadly speaking, the danger points are in the known earthquake zones. And in the case of severe disturbances it is not usual for these to be repeated under intervals of at least ten or twenty years."

The Rev. Father Francis A. Tondorf, director of the Georgetown University Seismic Observatory, says that the maps of zones along which earthquakes are liable to occur are quite as dependable as any of our geographical maps of the world. An inspection of such maps shows that the most earthquake-shaken regions of the globe mark the boundaries of the Pacific Ocean. They likewise show that many, if not the greater number, of quakes have their origin in the ocean's bed. Study these maps and one would naturally wonder if the coastal distribution of earth movements paralleled a like volcanic distribution along the Pacific border. Modern seismology indicates that the greater number of earth shocks are dependent upon fractures in the earth's crust, fractures that are either new or displaced upon those already existing.



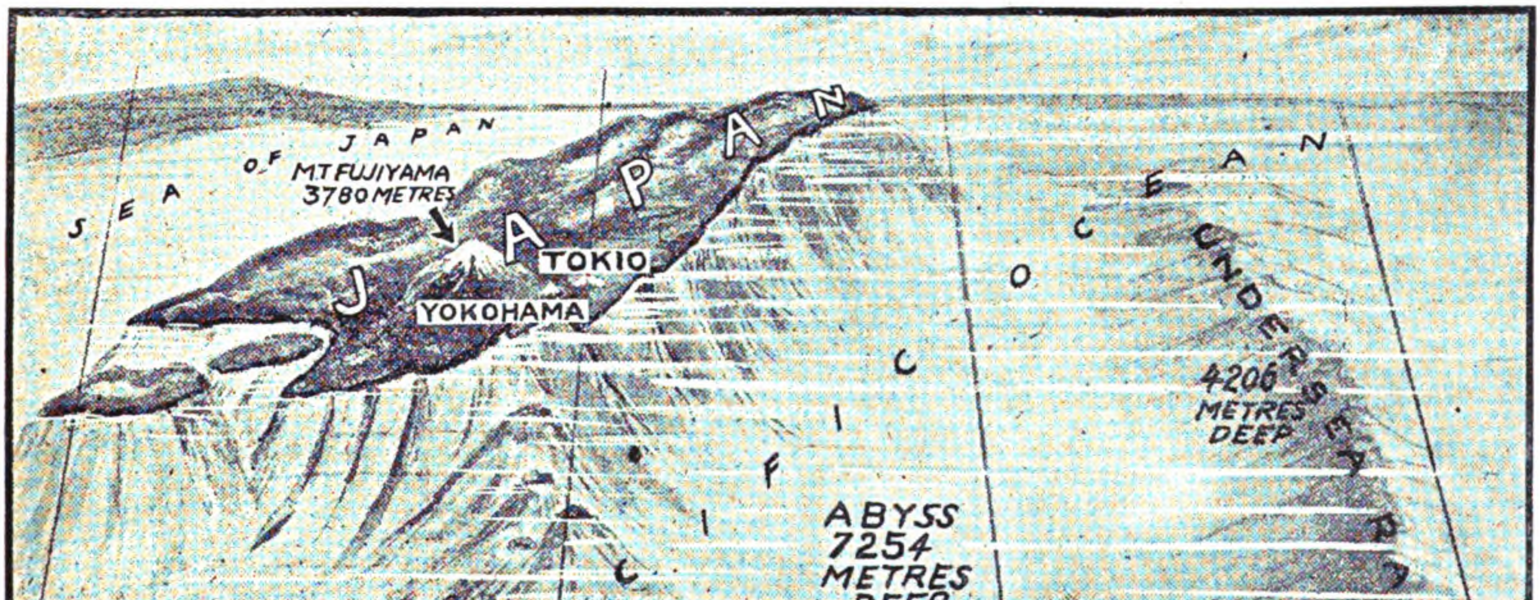

*From the New York "Times"*

**Profile of the Ocean-bed from Panama to Japan**

What might these causes be? Necessarily, some stress or stresses, in excess of the resistive strength of the rock, at the line of weakness. Just as a bar of steel at any point, because of a flaw in the steel, will only break at the point of weakness when pressure greater than the resisting power at the point of weakness, is applied, so with the earth's crust. Such stresses are brought about by displacement of the abutting portions of the rock.

Dr. Omori, a member of Japan's imperial earthquake investigation committee, suggests as a contributing cause for the stresses in Japan the heavy precipitations in the northwest portion of the island, and likewise suggests that variations in the barometric pressure, the weight of the atmosphere, is no negligible factor. This latter assertion will appeal the more to us when we recall that a variation of one inch in the mercury column, which is not an unlikely condition, means a change of pressure of one-half pound per square inch, or 3 1-3 per cent. of the total atmospheric pressure. From instrumental observation, it has been ascertained that the

## FLOOR OF PACIFIC WHERE DISASTER ORIGINATED




**Between the Coast of Japan and the Submerged Mountains in the Foreground, 1,000 Miles Distant, Lies the Tuscarora Deep, an Abyss Nearly Five Miles to the Bottom. It Was in This Abyss That the Disturbances Arose Which Caused the Earthquake**

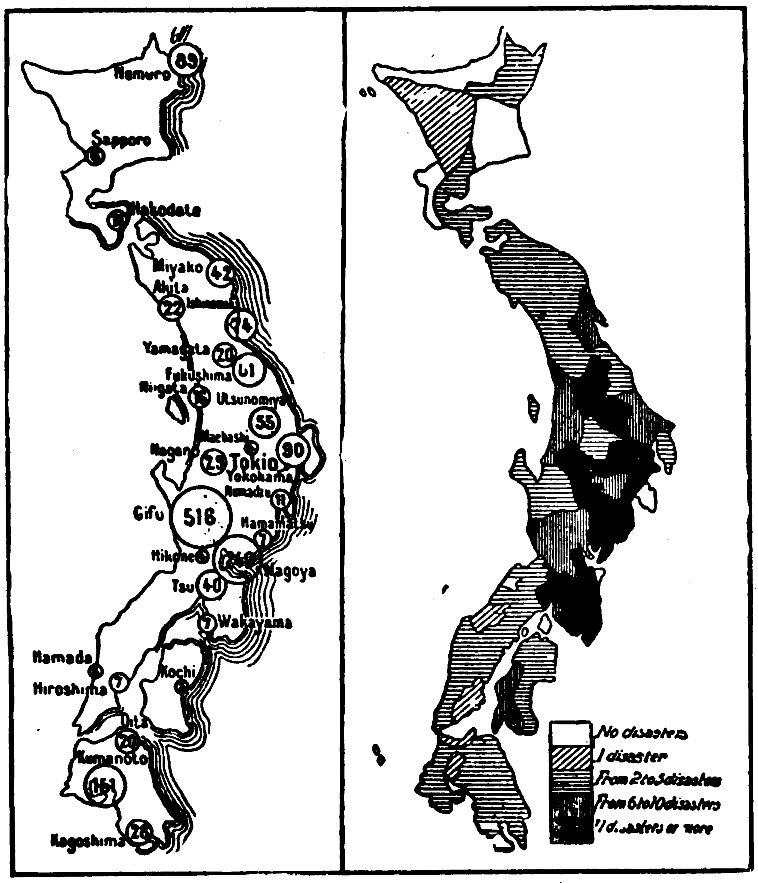
It is not hard to associate the notion of weakness with these fractures, and so it readily might be said that earthquakes are caused by slippings along these seams of weakness, such slippings being known to the geologists as faults.

"Dr. Nauman, in 1850, first suggested the name "tectonic," by which such quakes are now known, and it is therefore evident that these seams of weakness as the causes of the quakes, for without this weakness no earthquake would be likely. But, admitting such lines of weakness, no fracture could obtain without contributing causes.

passage of a cyclonic storm has occasioned a measurable titling of the earth.

As an example of slips which occur along fault lines, it might be mentioned that there occurred thirty-two years ago along an old fault plane in Japan a slip which produced an earth rent for sixty miles, with a twenty-foot repression of the land on one side and on the other a horizontal shift of thirteen feet in the direction of the fault.

It is, of course, quite reasonable to expect that such a shift will be accompanied by a tremendous output of energy. We can




From *L'Illustration (Paris)*

AVERAGE ANNUAL SHOCKS GREAT DISASTERS SINCE FIFTH CENTURY

### JAPAN'S EARTHQUAKE RECORD

The left-hand map shows the average annual number of earthquake shocks in Japan in different districts, and on the east coast, the relative frequency of tidal waves (indicated by wavy lines of shading). The right-hand map shows (by shading of graduated intensity, according to the table at the foot) the comparative incidence of seismic disasters in various parts since the fifth century, based on "Seismological Geography," by Montessus de Ballore.

appreciate this fact when it is recalled that Mendenhall calculated that the energy expended in the Charleston, S. C., earthquake of August 31, 1886, was 1,300,000,000 horsepower, and that was mild when compared to the great Japanese shocks of last week.

Dr. Henry S. Washington, of the Carnegie Institution, says that the recent earthquake which brought devastation upon Japan and which appears to have been one of the most destructive that ever happened, even in that land of earthquakes, naturally arouses curiosity as to the cause or causes that brought it about. It is too early, as yet, before more than the most meagre details are known, to discuss these at all adequately ; but it may be of interest to explain briefly what appear to be the causes of the quake and its probable place of origin, judging from what is known of Japanese earthquakes in the past and what few details have come to us.

To obtain a just idea of the cause one must have some idea of the general structure of the east coast of Asia and of the sea floor of the Western Pacific Ocean. The Japanese islands form one of a series of island " festoons " that fringe the Asiatic continent. The first " festoon " is the Aleutian Islands, followed by that of Kamchatka and the Kuriles, then the Japanese islands, followed by the Riu Kiu Islands, which run into the Philippine festoon, and thence into the transverse festoon of the Dutch East Indies—Sumatra, Java, etc.

Outside of these festoons and not far from them are long narrow troughs in the sea floor, like deep narrow valleys on the land, which run parallel to the trend of the island groups. The deepest portion of these troughs, in which the bottom is more than 3,000 fathoms (about three miles and a half) below the surface, are known as " deeps." That which is nearest to Japan, from 100 to 250 miles away, is known as the Tuscarora deep, and was discovered by the United States warship *Tuscarora* in 1874. This extends from the Tropic of Cancer to the Aleutian Islands, has an area of about 900,000 square miles, and a maximum depth of about 4,600 fathoms, or more than five miles, with very steep sides. The Tuscarora, however, is not the deepest " deep," others being known in the Pacific in which soundings exceeding 5,000 fathoms, or about six miles, have been obtained.

This structure of fringing island festoons and apparently related " deeps " is supposed by most geologists to be caused by wrinkling of the crust during the slow cooling and contraction of the globe, the " deeps " being the downward and the island festoons the upward parts of the combined fold. That this wrinkling movement is still in progress in the Japanese area is evident by many observations in Japan, such as becoming shallow harbors, posts at which fishermen formerly tied their boats being now hundreds of yards inland, and many other such facts. These show that the eastern coast of Japan, and especially of the main island Hondo, is gradually rising, while parts of the western coast are sinking.

Thus the Japanese islands are slowly tilting toward the West. This tilting movement is caused apparently by a thrust or pressure from the ocean side, although the exact cause is somewhat obscure. It may be said, incidentally, that a Dutch geologist has found evidence to show that such a thrust exists and to such an extent that it appears that the islands of the Dutch East Indies—Sumatra and Java—with others, are being gradually shoved back on themselves away from the ocean. As the Tuscarora deep forms an integral part of the Japanese wrinkle, this " deep " must be continuously getting deeper and probably narrower, as we may judge from similarly formed but much more ancient folds in the crust that have been exposed to our study by the erosion of old land surfaces. Also, it is practically certain, again to judge from such analagous occurrences, that the bottom of the narrow trench is cracked.

In accordance with what is known elsewhere of such crystal movements, this continuous pressure which produces the wrinkling also will "accumulate stress," as the phrase is, until something has to give way somewhere. The accumulated pressure is thus relieved by slipping along the fault-crack or system of cracks. As one consequence of this the sides, which are, of course, very rough and irregular, rub together and set up vibrations in the solid rocks of the crust, which are propagated in all directions and form the earthquake. If we may judge from what little is known of the Tokio earthquake, the recent slip must have been one of great magnitude, both in length and depth.

At the same time that these vibrations are being set up in the solid crust, the sudden slipping (which is generally downward on the side of the crack) of part of the ocean bed, imparts motion to the overlying mass of water. At the surface this takes the form of a wave which sweeps forward with ever increasing height as it passes over the gradually shoaling water near the land, until its height becomes 50, 60 or more feet when it strikes the shore. Thus originate the gigantic sea-waves or " *tsunami*," as the Japanese call them, which have done so much damage in many earthquakes on both sides of the Pacific as well as, but less often, of the Atlantic.

Such, in brief, is what is supposed to be the cause of the Japanese disaster—mechanically a very simple cause ; perhaps to many persons apparently too simple to account for such tremendous effects. Many examples might be given of similar earthquakes, similarly caused and accompanied by disastrous *tsunami* —such as that of Lisbon, in 1755, when 60,000 persons perished, or that of Arica, Peru, in 1868, when the United States steamship *Wateree* was carried half a mile inland.

Tsunami do not accompany all seaquakes, but they are frequent and sometimes occur when no serious earthquake is felt. That the down-slip is sudden and rapid is shown by the wave that is generated and its size, inasmuch as no sensible wave would be produced if the movement of the bottom were slow. It may be pointed out, by the way, that the term " tidal wave " for these tsunami is a misnomer, as they have nothing to do with the tides, the true tidal wave being of a different character.

There is no ground for the belief that in this recent earthquake there was any " leakage " of sea-water through the cracks or the solid crust into the " hot lava beneath." This appears to have happened in very deep water occasionally but, so far as known, the effects of such an event differ in several respects from what little is known of the Tokio earthquake. This appears to have been of the most frequent type of Japanese earthquake, and it is probable

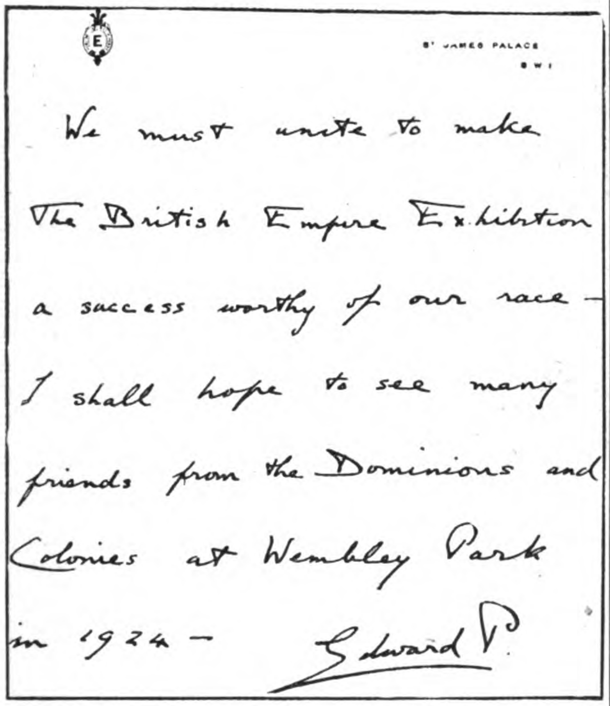
*(Continued on page 709)*

# The British Empire Exhibition (1924)

### *By Major E. A. Belcher, C.B.E.*

**The writer of the following article was the head of the British Delegation which visited the Dominions last year to enlist their support for the great Imperial Exhibition which is to be opened at Wembley next year. He is the Assistant General Manager of the Exhibition, and writes with intimate knowledge of what is being done and planned.**

WHEN Offa, king of Mercia, paid his traditional visit to the Eternal City, the great *Amphitheatrum Flavianum* completed by the Emperor Titus in A.D. 80 had for seven centuries remained an abiding memorial of the greatest days of the Roman empire. Offa's kingdom stretched from the Brent to the Trent, and Wembley Park—so called after an ancient British tribe, "The Men of the Meadow"—lay at the extreme south-eastern end of Mercia. Wembley Hill occupies a commanding position in the valley of the Brent, and it is no great stretch of imagination to think of Offa, already designated by Charles the Great as *Rex Anglorum*, wandering over the very spot where twelve centuries later the achievements of a greater empire than even he, as one of its progenitors, could dream of were to be enshrined in a great imperial exhibition.

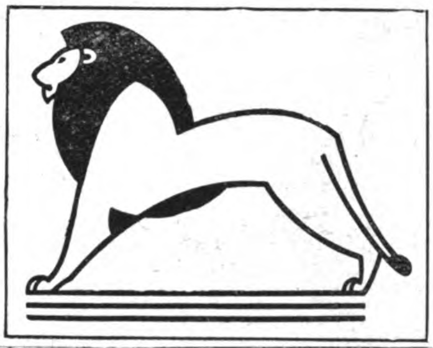

St. James Palace S.W.1

We must unite to make The British Empire Exhibition a success worthy of our race — I shall hope to see many friends from the Dominions and Colonies at Wembley Park in 1924 — Edward P.

Facsimile of Prince of Wales letter to the Exhibition Authorities

At the coming of the Friars in the thirteenth century, Wembley Park became the home of a religious foundation—a daughter convent to Kilburn Priory; and at the dissolution of the monasteries this home became an old English manor, known as the White House, which remained in the hands of the same family for over 200 years, till the close of the eighteenth century. The house itself stood on the site of the present stadium, and from there stretching down to the chain of lakes which will be the central feature of the exhibition was a famous old English garden, the glories of which will be revived almost precisely on the same spot.

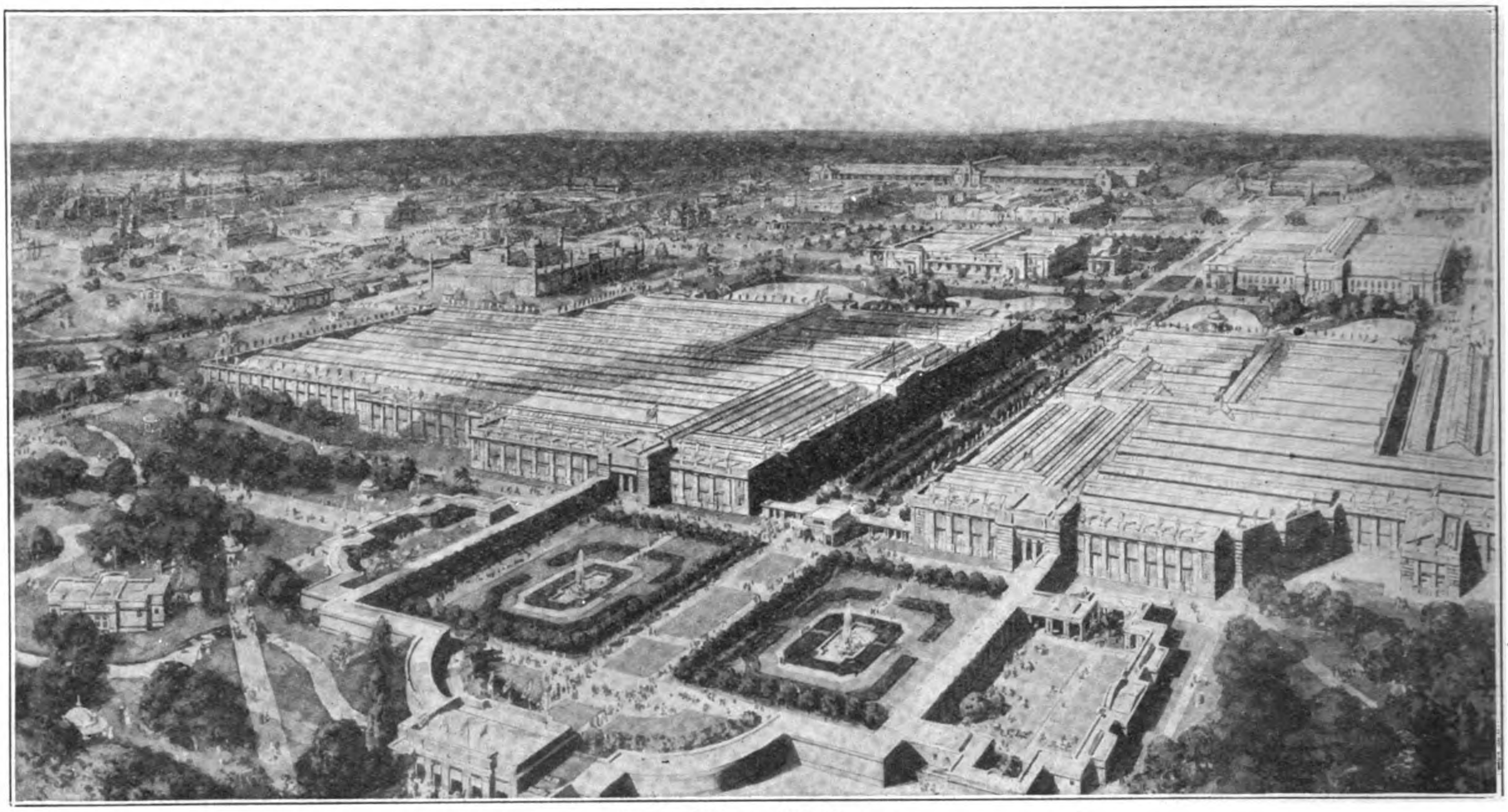
Some day the full story of the exhibition will be told. It is not without romantic interest. Everyone knows that the late Lord Strathcona conceived the idea of a great empire exhibition before the war, and that since the war the Prince of Wales has galvanised it into life, not only by his appeal to British industry and commerce, but equally by his steady and practical interest in every stage of its development. In that respect the Prince of Wales is following in the footsteps of his great-grandfather, with whom the great exhibition of 1851 will always be specially associated. There is a long list of others, at home and overseas, who have borne, are bearing or will bear some share in the great enterprise. It is not, for example, generally known that at a critical stage in the negotiations for the purchase of Wembley Park, when the executive council had more faith than money, Mr. Fred Hiam, the well-known East Anglian agriculturist, paid the deposit of £6,000 on the purchase price to seal the bargain, or that the council of the football association—and especially that doyen of football officials, Mr. F. J. Wall—at a time when everyone else was casting ridicule on the plans for an empire stadium, had the courage to enter into serious negotiations to occupy a building which did not exist on a piece of land which had not been purchased. The original freehold area purchased was 120 acres. Since then, owing to the expansion of the exhibition and particularly to the very large participation of the overseas dominions, an additional area of 106 acres has been acquired on lease.



H.R.H. THE PRINCE OF WALES,
President of the Exhibition

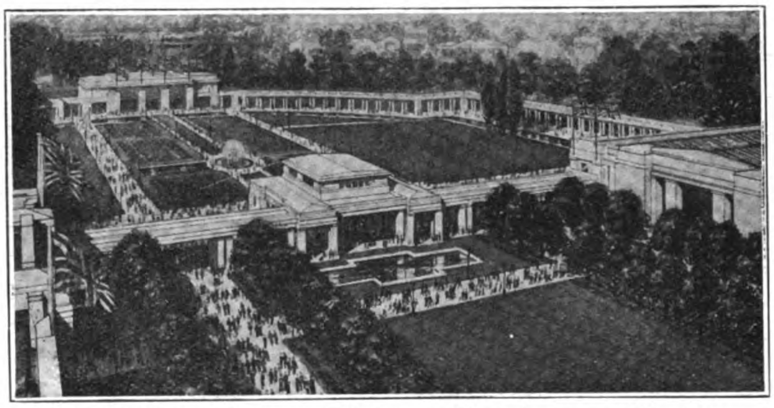
## The Stadium

The first million of the guarantee fund was completed on January 3rd, 1922. Seventy-two hours later the Duke of York turned the first turf in the centre of what is now the royal archway into the stadium, and so inaugurated the building of the exhibition. An inscription carved on the side of the archway commemorates this fact. The stadium is the first portion of the exhibition buildings to be completed. Its construction was specially expedited in order that the structure might be available for the 1923 cup final, and the actual building operations occupied 306 days. As the capacity of the stadium is approximately twice that of the Roman colosseum and three times that of the stadium at Athens, its completion in less than twelve months is a very remarkable achievement. Before any construction was started, the levelling of the site demanded the removal of about 120,000 cubic yards of yellow clay from the west end, most of which was required for filling-in purposes. The interior of the stadium provides an oblong of grass, nearly 500-ft. long and 260-ft. broad. Surrounding the grass is a cinder track precisely 440-yds. round, and by the ingenious use of a tunnel at the west end a perfectly straight 220-yds. has been



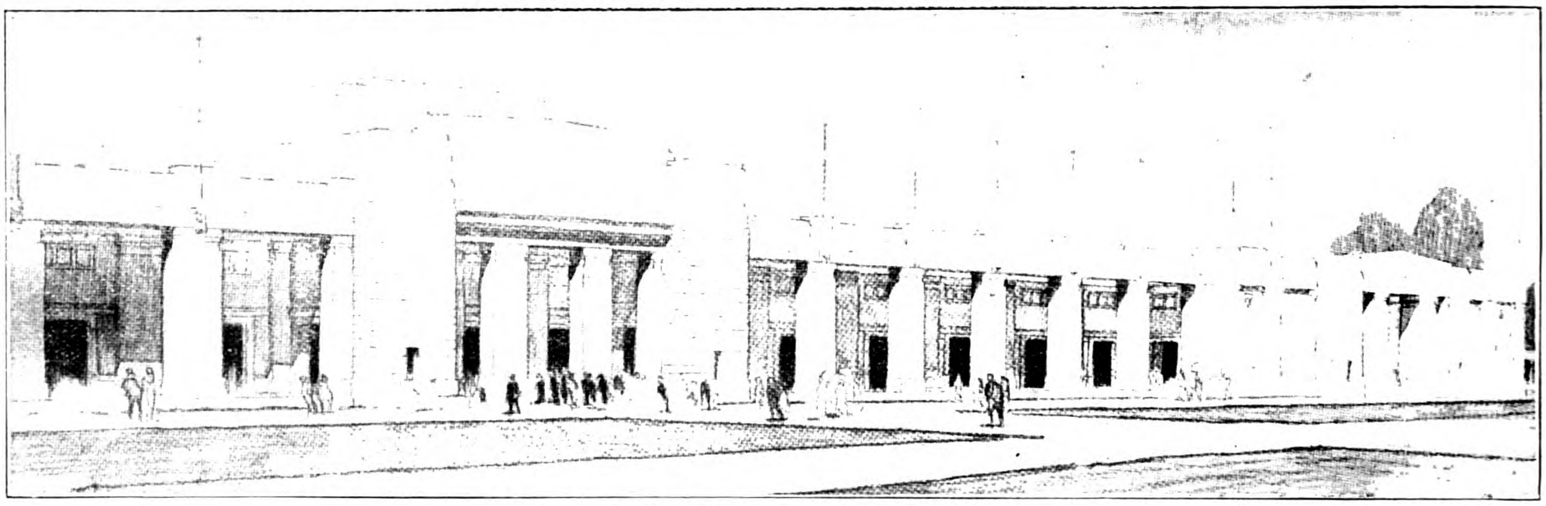
General View of Exhibition

constructed—the only one of its kind in the country. Apart from the use of the stadium for the cup final, the British legion will occupy it for a great athletic meeting on July 14th of this year, and on the following Saturday, July 21st, it has been selected for the Oxford and Cambridge *v* Harvard and Yale fixture. The question of using it for a series of inter-imperial fixtures during the summer of 1924, when many dominion teams will be in Europe to compete in the Olympic games, is now being examined with the athletic bodies concerned.



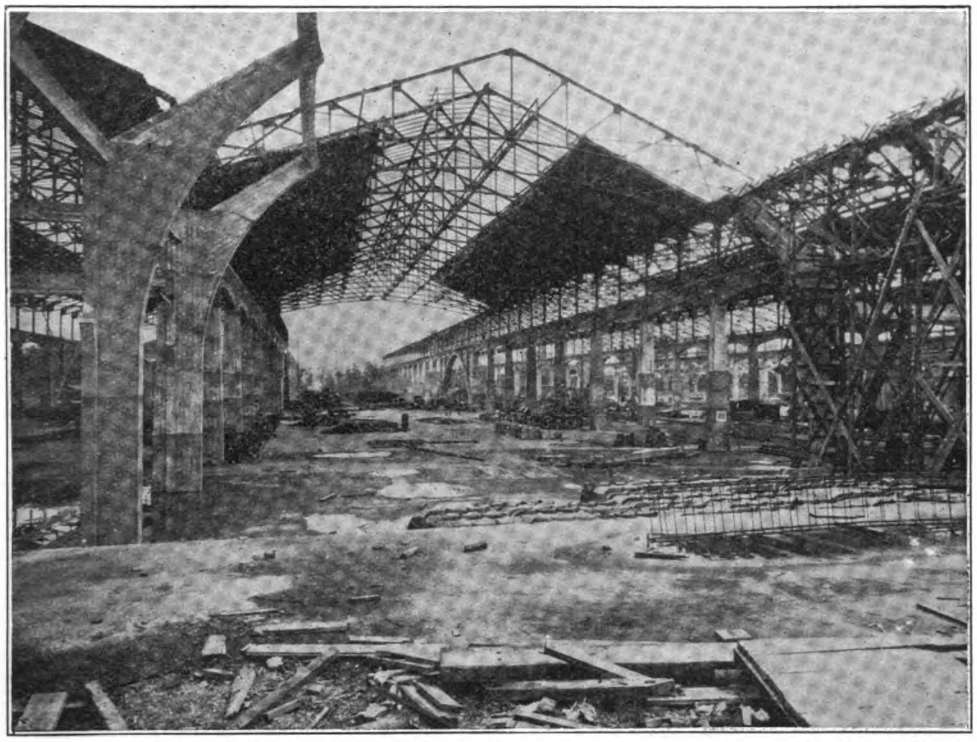
View of North Entrance to Exhibition: Main Avenue and Gardens

On the northern and southern sides of the stadium are the two great covered stands, both constructed of steel and reinforced concrete with an asbestos roofing. Each stand provides seating accommodation for 12,500 spectators, on a series of 31 terraces of concrete steps, rising 13-in. each time. The same terraces are prolonged without seats or cover round the eastern and western ends to complete the



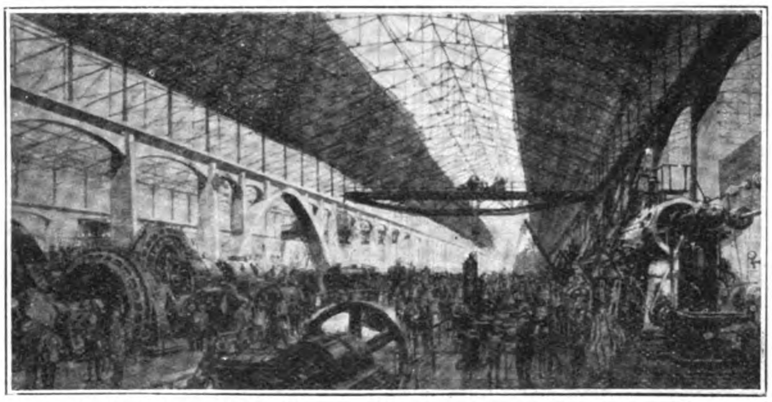
One of the Main Entrances to the Industrial Hall

The above illustration is of one of the seven main entrances to the Industrial Hall, which, together with the complementary Machinery building, will contain the principal British exhibits. The two buildings together cover an area equal to about four and a half times that of Trafalgar Square. They are constructed of cement concrete blocks and reinforced concrete. Mural decorations of a symbolic character will fill the long panel above the Cornice, and heraldic panels will be painted in the spaces above the Entrance Doors in the inner wall of the Portico. These doors lead into a spacious octagonal Entrance Hall measuring 46-ft. by 9-ft., with a domed and coffered ceiling 35-ft. high. The motive of the design is that of solidity: an endeavor has been made to illustrate the size and grandeur of the Empire by buildings of a simple and dignified character.



View of Palace of Machinery as it appeared in course of construction on May 25, 1923

oval. The uncovered concrete terraces and a lower oval between them and the cinder track —mostly cut out of solid ground —together provide standing room for over 90,000, and this, with the ring seats and the two covered stands, brings the total capacity of the stadium to over 125,000. Running round the whole building is an interior corridor 60-ft. wide, which gives access to the terraces by means of 49 tunnels and a series of staircases to the covered stands. At one point the corridor narrows to give room for the great banqueting hall, which has been designed to seat 1,000 guests at dinner. Above this again is a tea room, flanked on the exterior by a concrete terrace from which there is a fine view, stretching away beyond the Welsh harp to the north-east and Harrow School to the north-west. At the western end of the stadium are the players' quarters, including changing rooms, baths and gymnasium, and above these is a whole series of offices, surmounted by a control tower, whence there is a perfect view of the ground. The royal box is in the centre of the north covered stand, and beneath it is the royal retiring room. A press gallery running nearly the length of the northern stand is approached by a separate staircase, and has adjoining it a suite of rooms with telegraphic and telephonic facilities.



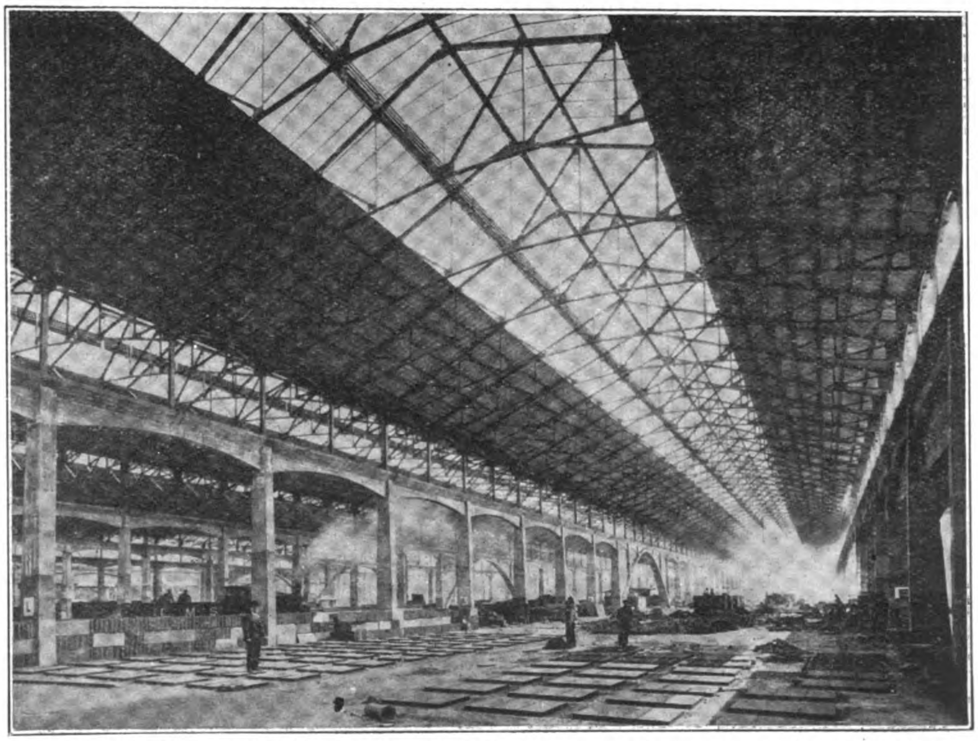
As the Palace of Machinery will appear on completion in 1924

It is not merely its size that renders the stadium a remarkable achievement. The elevation gives one the impression of simplicity, dignity, and strength, and the clever fluted shuttering on the walls breaks the monotony of the concrete. Viewed from the central avenue of the exhibition, the broad northern terrace flanked by twin towers is a dominating feature, and gives the keynote to the whole architectural design of the exhibition. Some 25,000 tons of concrete and 1,400 tons of structural steel work were employed in the work of construction, while the steel rods for reinforcing the concrete numbered over a quarter-of-a-million, and if laid out in a row would have stretched from London to Aberdeen. One curious feature of the stadium is its remarkable acoustic properties. These are so remarkable that a man speaking from the royal box on one side can be heard quite distinctly at the back of the stand on the other side of the arena. This quality will be put to good use during the exhibition, when Dr. Charles Harris, the director of the imperial choir and a Canadian by adoption, will conduct a series of open-air concerts with a choir of 10,000 voices.

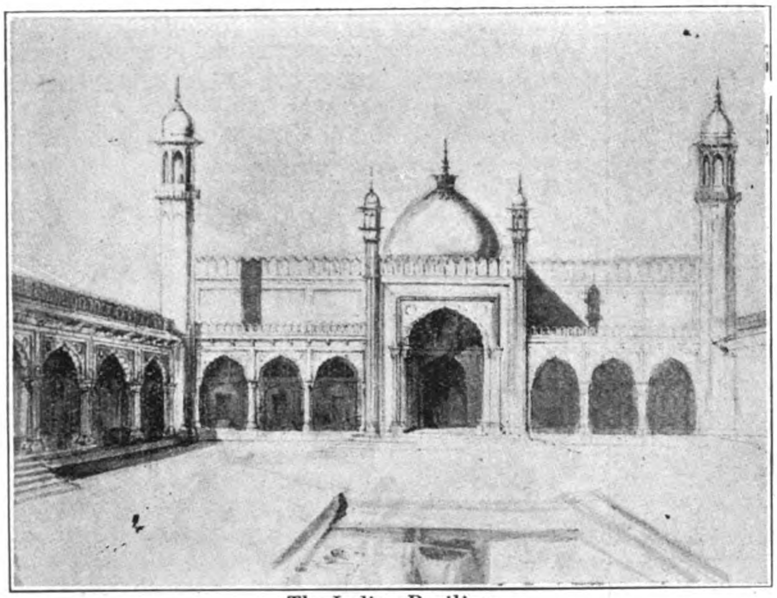
While from the nature of the layout as well as from its architectural treatment the stadium dominates the whole park, the use of concrete on such a large scale architecturally throughout the exhibition marks a very important advance in construction and design. Hitherto reinforced concrete has been regarded almost entirely as a purely engineering process and material. The buildings of the exhibition have offered such a wide scope for variety in design and manipulation that they may be expected to give a very great impetus to the use of concrete in the future. They will show how extraordinarily adaptable concrete is, and how, if treated upon its own merits and not as imitation stone, it will lend itself to the production of really monumental and classic buildings.

## Brid's-eye View of the Exhibition

From the centre of the stadium terrace the ground falls rapidly towards the chain of lakes running east and west for a distance of nearly half-a-mile. Fronting the lakes on the northern side are the two main United Kingdom buildings, each of them with a floor space of half-a-million square feet (over



Another View of the Palace of Machinery in course of construction on June 29, 1923



The Indian Pavilion

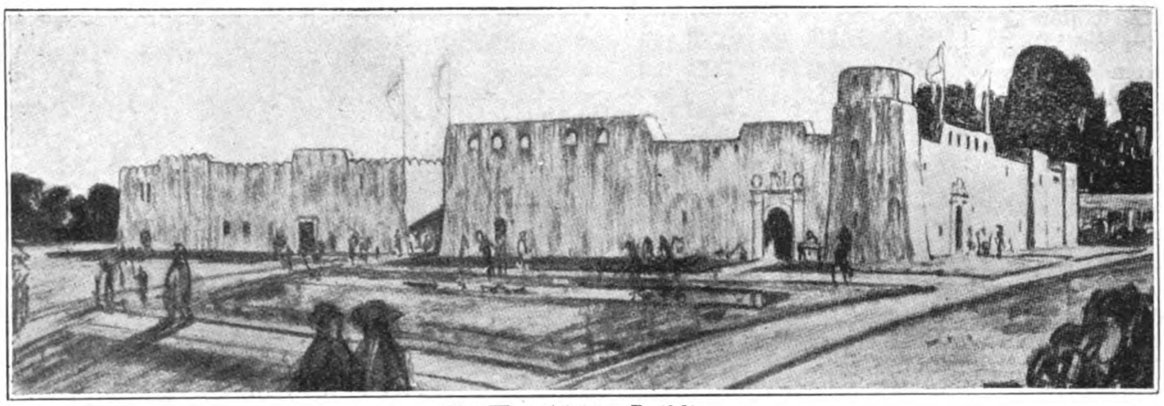
*(Suggested Design)*

The design of the Indian Pavilion is representative of Indian architecture as a whole. Portions have been reproduced from as large a number of different buildings as possible, due care being taken to avoid incongruities. The Taj Mahal and the Fort at Agra, the Jamna Masjid and the Pearl Mosque at Delhi, and Benares and Udaipur have all contributed

Entrance to the Burmese Village

*(Suggested Design)*

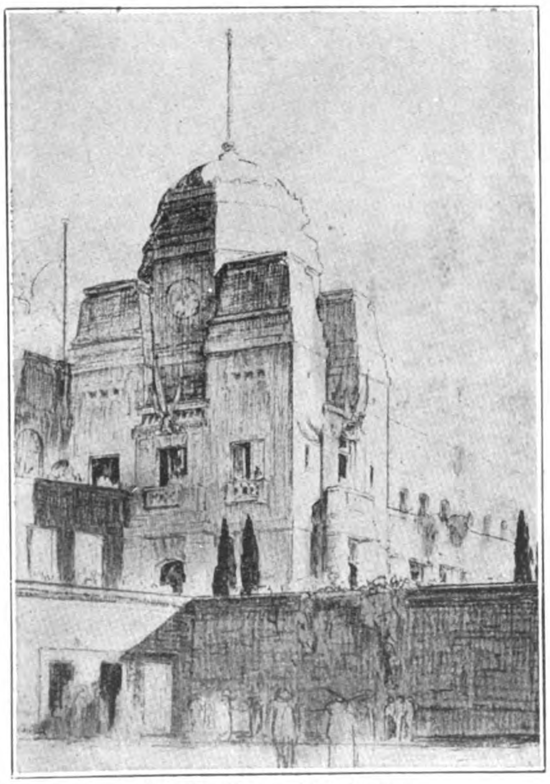
In the foreground stands a pair of Leogriffs, 25-30-ft. high and decorated in gorgeous colors. These are being specially brought from Burma. Behind them stands a bridge house, and in the stream running beneath it visitors will see Burmese miners engaged in ruby washing



The West African Building

eleven acres). These are the palace of industry and the palace of engineering. Both are of the concrete construction already described. Each building has two façades. One faces the chain of lakes and the other the axial line of the park, which runs north and south and separates the two buildings by a fine avenue 250-ft. wide, already lined with chestnut and lime trees. Both buildings are well advanced and are scheduled for completion in August. The exhibiting space in each is already practically booked up.

On the southern side of the lakes and nearer the stadium are the two sites on which Canada and Australia are about to start the construction of their respective dominion pavilions. These will each occupy a floor space of about 150,000 sq. ft. (between three and four acres). The main elevation will face the lake, and the two dominions will be separated by the continuation of the main avenue, which crosses the lakes by a bridge and leads up to a series of cascades and fountains. At the eastern and western ends of the lakes respectively are the pavilions of India and New Zealand. The Indian pavilion (already in course of construction,) and the Burmese pavilion, which adjoins it, have been designed by Sir Charles Allom in oriental style based on the finest examples of native art. Much of the decorative work is being carved and sent over from India and Burma. India will occupy an area of 90,000 sq. ft. (over two acres) and Burma 25,000 sq. ft. (over half-an-acre). The New Zealand pavilion is being designed by the exhibition architects and consulting engineer, Messrs. Simpson & Ayrton and Mr. E. O. Williams, and will be 50,000 sq. ft. in area (over one acre).



The Stadium—East Tower

Owing to the expansion of the plans of the Union of South Africa, a larger site than was originally contemplated is required for the South African pavilion. It will now be constructed east of the stadium, with the façade facing the broad road which runs between the lakes and the Indian pavilion, past the Burmese pavilion, and on to the southern boundary. In this southern section of the exhibition will also be housed the East and West African groups of colonies. The West Indies and Atlantic group have made extensive preparations for their participation in the exhibition, and will probably occupy a position between the South African buildings and the agricultural section.

Between Australia and New Zealand, and very near the southwestern entrance to the exhibition, an open-air swimming and diving pool is now being constructed. This when complete will be not unlike an ancient Roman bath. The bath itself is 325-ft. long and 60-ft. broad, and varies in depth form 3-ft. to 14-ft. Concrete terracing on either side will accommodate 1,750 seated spectators, and dressing rooms, slipper baths, and a toilet club adjoin.

North of the palaces of industry and engineering is the northern entrance, whence visitors coming from Wembley Park station will get their first view of the exhibition. Passing down a broad flight of steps the visitor will come to a massive entrance hall with colonnaded front. The entrance hall will give a vista over five acres of open gardens and up the grand avenue to the stadium. The gardens will be encircled by an open classic colonnade leading to the main exhibition buildings. Flanking the gardnes on the east will be the entrance to the amusement park and, facing this, a group of colonial buildings, including Ceylon. The exact sites of some other colonial groups are not yet finally settled, but so far as can be seen there will be no part of the empire which will not be represented at the exhibition.

To the east of the new loop line of railway which traverses the exhibition grounds will be the agricultural and horticultural sections, filling a space half as big as the whole of Wembley Park proper. Here again the final plans have still to be settled, but one object is to provide a group of model farmbuildings with accommodation for the leading British and dominion breeding societies. Arrangements are being made to secure a representative collection of pedigree stock, not only from this country but from the overseas dominions, where the quality of pure bred herds and flocks has reached a very high standard. It is understood that Sir Trustram Eve—who will be chairman of the Farmers' Club in 1924—is making arrangements for the Farmers' Club to have a club-house in the agricultural section and to be the host of the dominion farmers visiting the exhibition. The club will possibly be housed in a fine old tithe barn which is being loaned to the exhibition, and which will find a final resting place in the national institute of botany and agricultural museum at Cambridge. Access to this section will be through a series of gardens devoted to horticultural exhibits, designed to furnish an attractive display in massed colors.

Examples of contemporary art from every part of the empire will be housed in a fine art pavilion adjoining the palace of industry. This pavilion, occupying over three-quarters of an acre, will also contain a loan collection of British art, both modern and retrospective.

Plans are being made for a series of conferences, principally of an industrial and scientific character, to be held at the exhibition during the summer of 1924. These conferences will take place in the conference building, which will contain three large halls, the largest of them capable of seating 1,800 people. The conference hall has been adapted for use also as a concert hall, and will be the home of a series of chamber and orchestral concerts.

As may be inferred both from this brief survey and from the accompanying illustrations, the general architectural treatment of the exhibition buildings intentionally severely classic. The severity of the layout will be relieved by the wealth of color in the gardens and by the introduction of gaily colored kiosks and smaller buildings, and at night the exhibition will be lit by a new system of flood lighting in various colors or blends of colors, arranged to accord with the temperature.

## Transport Arrangements

The problem of persuading the public to visit an exhibition in this country has never been exhaustively studied. The disparity, for example, between the attendance at the Paris exhibition of 1900 (over 52 millions) and the attendance at the Franco-British exhibition of 1908 (under nine millions) is proof of that. There ought not to be any difficulty, at least of an insurmountable nature, in persuading 30 million people to visit Wembley Park, and it is from that point of view, *i.e.*, an average daily attendance of 150,000, that road and rail communications have been studied. Hitherto the fact has not been sufficiently appreciated that although an exhibition may be located within the London area, at least 50 per cent. of its potential visitors come from the provinces. Two stations, those of Wembley Park (Metropolitan Railway) and Wembley Hill (London and North Eastern—formerly Great Central—Railway), adjoin the two main entrances to the exhibition, and a third station on a north-eastern new loop line is being built in the exhibition grounds. Wembley Park station has been entirely rebuilt by the Metropolitan Railway during the past few months. Nineteen booking windows have been installed to deal with the traffic from six wide platforms aggregating over 2,500-ft. in length. A two-minute service and the reduction of the time of the journey from Baker Street to ten minutes will enable the Metropolitan Railway to handle at least 30,000 passengers per hour, while the through trains which can be run from almost every part of London will provide direct traveling facilities from all parts of the country. Wembley Hill station has also been enlarged. This station, reached from Marylebone, will relieve direct traffic from London, and in addition will tap a wide area of the Midlands and the North through the provincial connections of the North Eastern Railway. Again, five minutes from the south-western entrance to the exhibition is Wembley station, on the old north-western main line, now part of the London, Midland and Scottish Railway system. Side by side with this station is the Bakerloo tube, while connected with a ten-minute 'bus service there is Sudbury station on the district railway. No doubt Alperton and Stonebridge Park stations will also be used by many visitors. Altogether, eight railway stations are within easy reach of the exhibition.

So far as road traffic is concerned, the problem has been not only the improvement of existing roads, but the provision of a new main trunk road from London which would relieve the Harrow Road. This has been accomplished by the widening of Neasden and Forty lanes and the utilization of a portion of the great North Circular Road. This relief road, partly on account of its width and partly because it is fed by many roads from the suburbs and provinces, will probably become the chief method of access for motor cars and chars-à-bancs, leaving the Harrow Road for the existing 'bus services and trams.

Owing to the size of the exhibition grounds, which in the aggregate are more than double the area of the Franco-British exhibition, the problem of internal transport has had to be considered. Obviously it is no use bringing thousands of people to see the exhibition and then exhausting them physically in their efforts to cover the wide distances from pavilion to pavilion. To obviate this there will be a continuously moving platform right round the exhibition. This will consist of two moving pathways traveling along the principal roads at speeds of two-and-a-half and five miles per hour. The passengers on the faster platform will be seated and the platforms where they intersect with other roads and entrances to buildings will dive below ground. The principle of a moving platform is, of course, familiar to passengers on the underground, but no attempt has previously been made in this country to adopt this means of transport on the scale which will be used at the exhibition.

## Wealth of Empire Resources

So far as the dominions and colonies are concerned, it is impossible within the limits of this article to describe at any length their plans. It may be remarked that the total expenditure incurred by them will exceed very considerably one million sterling. From the point of view of the overseas empire the exhibition is part of a great publicity campaign, the objects of which are adequately to fulfil the three great needs of every dominion—men, money, and markets. The development of dominion resources demands an increased population, but it also demands the invetsment of very considerable capital. Finally, such development cannot really come into its own unless and until markets can be found for dominion produce. In this direction there is a wide field for educational effort. The function of the exhibition is to assist in the work of education. The dominions and colonies, by means of their pavilions, will demonstrate the progress which they have made in the development of their food products, their raw materials, and their manufactures, as well as the opportunities which they afford for further development. So far as food products are concerned, the restaurants will help to drive the lesson home. This, however, is only a means to an end, and it would be idle to pretend that the exhibition can accomplish its final purpose without a campaign on much more extended lines. From the autumn of the present year until at least the autumn of the year following the exhibition, the dominions and colonies must be prepared not only to invest their money in making known their resources, but to convince the public of the adequacy of supplies. If their advertising propaganda is carried out effectively, they may assume that every visitor who eats half an ounce of dominion butter at the exhibition will want to buy a pound of it for his own home, and that of every hundred customers who purchase the pound of butter, at least 50

(*Continued on page 709*)

# New Hematite Reduction Process

## Anzan Iron and Steel Works

*By S.M.R. Co. Intelligence Department*

AT the present moment when the town of Anshan, the seat of the S.M.R. Co. Anzan Iron and Steel Works, expects to emerge out of the gloom, in which it has lain enveloped since the close of the war, how this welcome change has been worked out must be of more than a passing interest to everybody, especially those concerned in iron and steel manufacture. We have given in these columns in a fragmentary way, from time to time the circumstances that have come to shed a ray of hope upon the almost desolate railway town of Anshan.

### Discovery by Geologist and Poet

In August, 1908, Mr. C. Kido, then superintendent of the S.M.R. Co. Geological Institute, who is son to the late Marquis Kido, one of the three greatest figures in modern Japan, with the late General Saigo and the late Marquis Ohkubo, and retired from the Company's service at his own request last April, happened to become interested in the name of a small hill at the west of Tangkangtzu station, well-known for the hot-springs close by, on the S.M.R. main line. It is called Tiehshihshan meaning in English "Iron Stone Hill." Mr. Kido, the geologist, started investigation and soon found that the hill hoarded an iron mine. This was the first discovery of the mine.

The subsequent investigations resulted in locating East and West Anshan, Takushan, Yingtaoyuan, and Hsiaolingtzu mines, in addition to Tiehshihshan mine, the first to be discovered. The S.M.R. Co., wishing to work these mines, approached the Chinese authorities with its proposition to mine them more than once, but without results. By the Sino-Japanese treaty concerning Manchuria and Mongolia, as signed in 1915, China has conceded to Japan the privilege of exploiting the Anshan mine district as an item of many concessions. Consequently the establishment of an extensive iron and steel works was planned. To start with, a new company under Sino-Japanese joint management was founded as a mining agency in March, 1916. It is styled the Anshan Chenhsing Mining Company. The understanding arrived at was that the new Company should supply iron-ore as material for an iron and steel works to be formed and managed by the Railway Company. Permission, therefore, was applied to the Tokyo government, and was granted in October, 1916.

At first, a plant capable of turning out 1,000,000 tons pig-iron annually (from which 800,000 tons of steel manufactures were to be put out) was planned. As the first step, the construction of two blast-furnaces, each with a daily capacity for 200 tons, together with the necessary auxiliary plants such as the coke-ovens, etc., was proposed. The drawing up of the plans was commenced in summer, 1916, and those for the two blast-furnaces had been almost finished by December, 1916, when with the great war in full blast, the iron and steel industries had reached their highest boom. Accordingly, the original plan was enlarged by adding thereto the erection of a steel manufactory besides two more blast-furnaces so as to increase the total annual production of pig-iron by 300,000 tons. This extension plan was well started on the road to execution, when, in 1919, the colossal war was brought to an end, and the so-called "war-industries" that had sprung up and flourished like stories in a fable during the war, were plunged at a drop to the depth of inactivity and neglect. This pushed the general economic market down to the bottom of depression. Then the presence of the tremendous surplus in iron stocks was raised to an exceedingly troublesome question in Japan. The dealers concerned stood aghast at the almost bottomless fall of the iron and steel quotations.

The Railway Company, grasping this sharp turn in the situation, at once suspended the construction of the third and fourth furnaces and the steel manufactory. In the meantime the second blast-furnace was completed in June, 1919. However, the relation of demand to supply on the iron market had to be considered. First of all, the question how to treat poor-ore awaited some workable solution. Therefore, the operation of the newly completed furnace was deferred, and only one furnace was kept at work.

### Vital Question of Ore-Concentration

The Anshan mine district was found to contain an immense reserve. The investigations made so far placed ths total reserve of ore containing more than 35 per cent. at about 200,000,000 tons. However, the major portion of the reserve is found to consist of poor-ore under 50 per cent., the rich ore occurring only in a limited quantity. Upon the commercially workable solution of this question of treating poor-ore, the future of the iron and steel works was considered to depend. Thereupon, with the discontainuation of all the enlargement plans, as above stated, a systematic study of how to deal with poor-ore economically was taken up, while the older blast-furnace was continued in operation.

In June, 1920, a party of American metallurgists and engineers were engaged to carry on a technical inquiry on the ground. They stayed about six weeks.

In September following, a practical experiment on a hematite reducing system, independently of the line of research pursued by the American specialists, was found to give an unexpectedly favorable result, and this, as event has proved, has furnished a precious clue leading to the key, with which the important problem of ore-concentration has been happily solved.

### Hematite Reducing System

The American experts worked on the line of turning poor-ore into rich ore by means of magnetic separation. As this belt is believed to hold an abundant reserve, the material available in the form of rich-ore will last a good length of time. However, the reserve of this zone does not wholly consist of magnetite, but contains an amount of hematite also. By the hematite reducing System, heating gas and reducing gas are made to operate upon hematite, in order to turn it into magnetite. It flashed upon the mind of the Japanese expert that it might be more successful to reduce the hematite into magnetite before subjecting it to magnetic separation, instead of following exclusively the separating method, as conceived by the American metallurgists, and in this happy conception they were subsequently confirmed.

There had been several methods of reducing hematite into magnetite. But, none of these methods had gone beyond the bounds of a laboratory scale, and never been applied yet to an enterprise on a sufficiently large scale for a business venture. At Anshan the experimenting of the same method on a factory scale was taken up. Next, indirect heating for the preliminary heating of the ore used to be adopted in most cases, and as to the ore, it was crushed into small lumps. At Anshan, the ore was subjected to direct preliminary heating on being crushed into no smaller sizes than intermediate. Then the reducing gas was made to pass through the ore-lumps without intermission. By this means the reduction of hematite into magnetite could be accomplished. This meant a remarkable improvement made in the working process. The ore so reduced was made to fall into the water to get cooled, so to raise the reduction efficiency. These were among the improvements introduced, and a perfect reduction could be effected by use of a furnace of a simple pattern. Besides, in both heating and reducing processes, economy in the consumption of gas was found possible to be effected.

Now that a perfectly reduced magnetite was placed within reach, further improvement in the magnetic separation process was sought. Crushers, tube mills, drying and concentrating equipments, and other necessary ones and magnetic separators were constructed on dimensions suited to a factory scale, and the entire reduction process was experimented upon continuously from beginning to end, and the efficiency in magnetic separation, together with the calculation of cost, etc., were carefully studied.

### A Valuable Discovery

A valuable discovery was made in the course of experiments, showing that there was a world of difference in separating efficiency

between use of magnetite in its natural form and its use after its reduction and concentration. How this favorable change could be secured was put down to an increase of the magnetite percentage by the reduction of the hematite ore, and also to a decrease in the consumption of motor power for the separation process applied to the reduced hematite owing to there being a wide difference in hardness, compared with natural magnetite.

At any rate, the application of the reducing and concentrating process to ore prior to subjecting it to magnetic separation was concluded to be the most advantageous method to be adopted at Anshan.

The Anshan mine contains hematite in the largest quantity, with magnetite occurring in the Takushan belt, which forms only part of the mining zone. Even magnetite put out from Takushan, it has been found, may be worked upon with advantage by first being put through the new reducing system. Several other samples of hematite obtained from other belts have been subjected to the same method with as satisfactory results.

But for the happy results given by the hematite reducing system, the major portion of the enormous ore reserve in the Anshan district would have had to be abandoned as little better than waste, excepting what is held in the Takushan belt. The new process has now demonstrated its potentiality to convert the almost valueless poor-ore into rich-ore at an economically workable cost. It may well be appreciated as a piece of brilliant triumph of science and perseverance, for Anshan especially.

There have been a number of patents granted to a similar process in the world. But, that for Anshan has been patented as one embodying a valuable improvement in working process itself. This feature would seem to make its invention doubly successful.

## What Might Have Been

Why the operation of the Anshan works has come to be brought to a deadlock is because of a fear that the rich ore reserve will prove barely sufficient to last only a few years even at the rate of 70,000-80,000 tons pig-iron per blast-furnace annually. Consequently, without the precious invention above mentioned, the closing-down of the works altogether would be inevitable from an economic point of view. Or, as the alternative the works would have to be retained in operation only as long as the natural reserve of magnetite in the Takushan belt is available, as proposed by the American specialists, thereby putting the plant in a comparatively disadvantageous position economically.

Thus, the invention and adoption of the new hematite reducing system has wrought a world of difference to the future of the works, and incidentally to the town of Anshan.

Now the works people are looking forward to the production of pig-iron at a reasonably low rate. On this very ground, brighter hopes may be built up by them for the second and third stages of the enterprise program, including steel manufacture, etc.

## First Stage Expansion Program

Concerning the first stage expansion program to be taken up from the present fiscal year, the sum of Y.11,000,000 or so is required for construction expenses, to be disbursed over three years, beginning with Y.500,000 for the current fiscal year, as already approved. The appropriation for the next fiscal year will by Y.7,000,000-8,000,000, with the remaining Y.3,000,000 for the fiscal year 1925. The principal part of the construction work will probably be executed in the next fiscal year 1924. Of the total disbursement, about 50 per cent. will be invested in the hematite reducing and the magnetic separation and concentration equipments, the balance left being for two more blast-furnaces, auxiliary installations for putting out 200,000 tons more of pig-iron, coke manufacture, reinforcing of motor power, manufacture of finer by-products, waterworks, etc.

At the initial stage of the steel works, the total annual output of pig-iron seems to have been estimated at 70,000-80,000 tons. At present, it appears easy to produce 100,000 tons a year per blast-furnace and may probably make the figure go above 100,000 tons by reason of added skill and riper experience. Thus it was the 200,000-ton annual production plan with two furnaces that was adopted at the outset, in order to work the existing two furnaces at full pressure. For lowering the cost of production of pig-iron at the Anshan works, the costs of the raw materials are to be reduced to the minimum, at the same time bringing down the general average cost by putting out as much pig-iron as the capacity of the plant permits.

However, the commercial side of disposing of the pig-iron outputs has to be considered at the same time, and on this account the manufacture of pig-iron in a large quantity can hardly be rushed hastily.

Therefore the new plan of the Company is to confine the total annual production to sufficient to let the two furnaces bring out to full play their manufacturing efficiency. It is for this reason that, as the first stage expansion program, a 200,000-ton annual production plan has been adopted. The detailed data concerning the extension plan, inclusive of costs of raw materials, current expenses, and other receipt and expense accounts are too dry and complicated to be reproduced in these columns. At any rate, it seems a moral certainty that at least the plant can be operated without incurring loss, as repeatedly confirmed by Dr. M. Ohkochi, professor of the Tokyo Imperial University, and three other authorities on metallurgy in Japan.

As to the second and third stage expansion programs, opinions may broadly vary as to whether or not a steel manufacturing plan shall be drawn up with a view to working upon the whole of the 200,000 tons ; whether or not half the annual output only shall be set aside for steel manufacturing ; or whether or not two new blast furnaces shall be constructed, so that, together with the two existing furnaces, the total annual output of pig-iron may be increased to 500,000 tons, upon the use of all of which steel manufacturing shall be planned.

With the recent earthquake about Tokyo and Yokohama glaring vividly in the experience of the nation, the question of building materials has been raised to one of universal and all-absorbing topics. The steel manufacturing plan of the Anshan works is in a way related more or less to the same question. The Railway Company naturally hopes to give a solution to the steel manufacturing program as early as possible by pushing forward its investigations with despatch.

Thus the Company is eager to realize the economic results of the establishment of the Anshan works and to develop it on most intelligent lines by concentrating the study and effort of the competent specialists on the Company's staff.

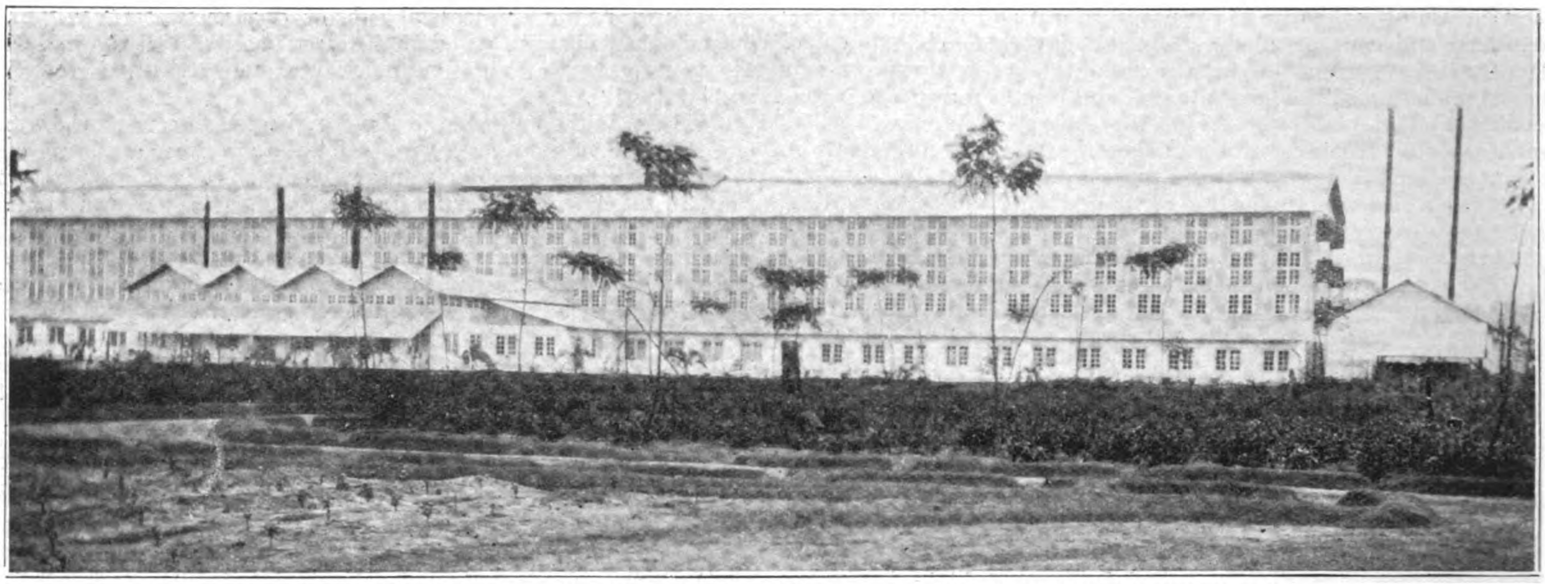
The Company is, at the same time, desirous of this problem of enlarging the Anshan works being carefully considered without misunderstanding or undue enthusiasm.

As the inventor of the new process of hematite reducing and magnetic separation, the name of Mr. T. Umene, formerly a member of the research department of the iron and steel works and now superintendent of the steel manufacturing office of the same works must be brought up to the fore.

When on the close of the great war in 1919, the iron and steel market of the world became seized with a panic, Mr. Umene cast about for some practicable way of rebooming the works, and he proceeded, with a firm resolution, to take up a course of painstaking research under the directions of Mr. T. Oka, assistant general manager of the works, additionally holding charge of the research department. The perseverance with which the intellectual effort of Mr. Umene and his assistants have prosecuted this important line of study, has at length been rewarded by the invention of a new superior process of hematite reduction and magnetic separation that has marked a fresh epoch in its application to a large scale business enterprise. This process has been duly patented by the Japanese government.

One point worthy of special mention is that Mr. Oka and the members of the research department, in addition to an immediate circle of the Company's officials directly concerned, have gone about their common task of unravelling the hitherto mysterious, but none the less valuable secret of success with a wonderful unison of purpose. They all have contributed the best shares of their effort quite apart from a materialistic reward, and the rich and glorious fruit that has ripened into this inestimable utility, is the off-spring of their tireless and devoted labors, that does credit to them and the Japanese at large, and may be held up as a brilliant triumph of science and perseverance. Next, to Mr. T. Suzuki, then at the head of the steel manufacturing office, Mr. Y. Adachi, then chief engineer, Mr. T. Yano, then chief accountant, and Mr. T. Yokota, then secretary of the works and now the Company's district agent for the Anshan district, who all have assisted Mr. Umene in attaining his grand achievement, a fair portion of the credit is also due.

This invention has not only brought a great boon to the Anshan works, but also is a matter for general congratulation for the empire at large.



One of the most modern Tea Factories in the East Coast District of Sumatra, owned by the H.A.V. (Handels Vereningen Amsterdam)

# The Java Tea Industry

*The J. C. Whitney Co., tea importers and exporters, with headquarters in Chicago, recently issued its Tea Talk No. 10, which deals in exceedingly picturesque and interesting style with the Dutch East Indian islands of Java and Sumatra*

## How Tea Growing Was Established in Java

AS early as 1609 the Dutch carried on a trade in tea between Europe and China and Japan (the first Dutch expedition to the East Indies having been in 1595 (taking up back to the time of Shakespeare and Queen Elizabeth, who had, we understand, and aversion to tea); it was not, however, until 1728 that the first attempt was made to grow tea in Java. It was not a success, and nothing further was done until 1826, when seeds and plants were again imported into the island. By 1830 the government realized that there was the making of a successful industry, and took over such areas as were then under tea. In 1832 tea makers came over from China. In 1838 an establishment was founded in Batavia, whither the product was brought from various estates to be finished. In 1839 Java tea sold in Amsterdam at 81 cents a pound, the government incurring a loss of 36 cents for every pound of tea sold.

During the next 40 years the possibility of the industry becoming a profitable one was realized. The quality of the tea, however, continued inferior, and it could not compete with that produced in British India.

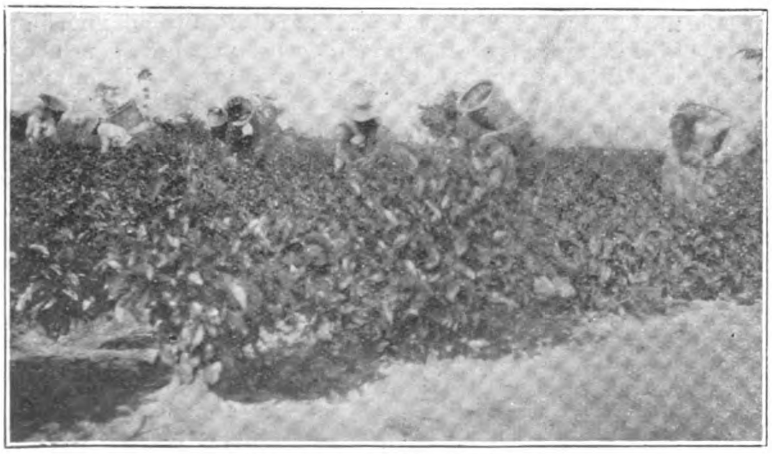
In 1878, tea seed was first procured from Assam, and this was the turning point in the career of the Java tea industry. The Assam type of plant first grown has been so successful in Java that it has now become the standard type of the island. About the same time, hand manufacture was replaced by machinery, and a considerable improvement in quality effected.

Between 1901 and 1914 tea production in Java increased from 16,750,000 pounds to 100,000,000. An experimental station was established under government control, and in connection with it there is now an experimental tea garden situated at a height of about 3,600-ft. above sea level. The quality of the tea shipped of late years has steadily improved, until to-day it is in regular demand. Production reached its height in 1919 with 110,541,200 pounds exported, but this included some accumulation from 1918 plucking. The year 1920 shows 93,680,400 pounds exported; so Java can produce approximately 100,000,000 pounds for export.

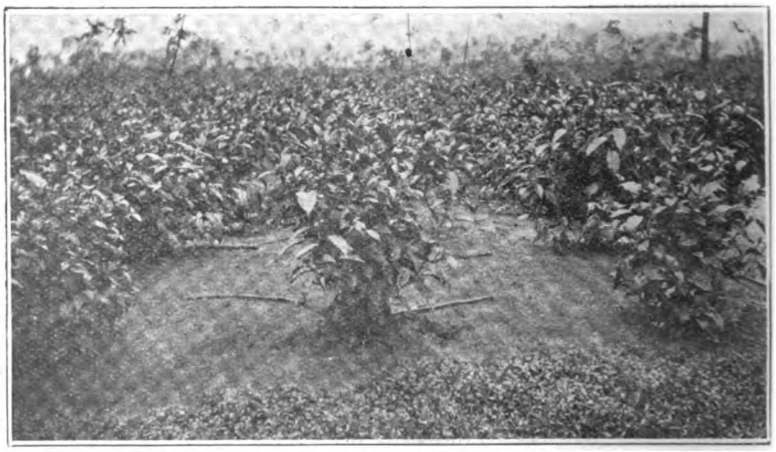
Curtailment of plucking was adopted in Java, as well as in Ceylon and India, during 1921 and 1922, export for both these years having been around 68,000,000 pounds.

The preferential duty placed by England and Canada on British-grown tea has cut off these markets somewhat for Java tea; but the lower prevailing prices of Javas against Ceylons and Indias bring demand to Java producers. Holland and Australia are the largest users of Java teas.

Prior to 1917 shipments of Java teas to the United States and Canada were exceedingly small, under 1,000,000 pounds a year, but war conditions, embargoes, etc., forced Java to ship very



Native women picking tea leaves



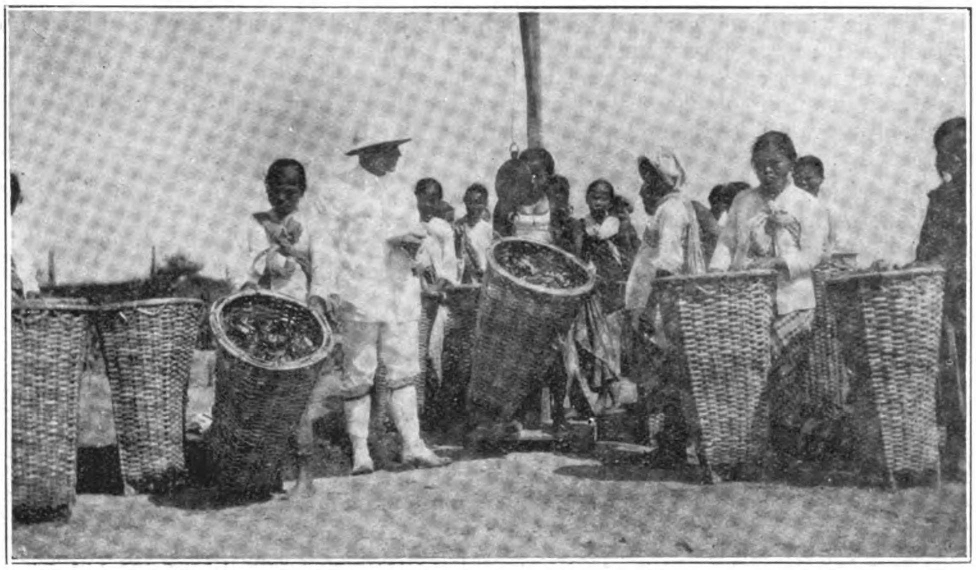
Tea tree field in the East Coast of Sumatra

large quantities to the United States during 1917 and 1918 (above 32,000,000 pounds in 1917). This seems to have introduced Java teas to American users, and export hither for 1920, 1921, and 1922 was 7,000,000 to 8,000,000 pounds per annum.

Not many years ago Java teas were purchased merely because of their low prices, and were considered suitable for use only in small quantities to reduce the cost of blends. Now Java tea, though in large part of common and plain-medium description, is as a rule carefully made and sorted so as to possess a regular appearance which attracts the blender. On the other hand, there is a Java tea grown at higher altitudes, having such flavor and bright tips as to make it suitable for use in substituting for British India and Ceylon teas; and for this class good prices are obtainable.

Though Assam-indigenous, Barcelona, and Tingui *jats* (seeds) have been so largely planted of late years, the oldest tea of all, the China jat, is still vigorous, and yields well. With the China and Ceylon varieties, other native tea varieties were looked for in British India, and various kinds were found in the valley of the Brahmaputra, these proving very suitable for cultivation.

The yield from most of the estates is good, but the plucking is likely to be coarse. For the old China tea, 450 pounds an acre are about the average, but for the new labd more recently planted with good jat 1,000 pounds an acre are not an uncommon yield.



Sumatra: Weighing tea leaves immediately after being plucked; an operation carried out in the morning.

## The Estates in Java Highlands

The entire backbone of the island of Java consists of a chain of volcanoes, and between these mountains are situated plains many miles in length and breadth,—plains usually of incomparable fertility. On the slopes of these mountains, in western Java, in the Preanger residency or province, are the chief tea estates of the island. On the slopes of the Gedeh particularly, a mountain 9,700 feet high, are a number of fine tea gardens, of which one, the Goalpara on the Gedeh, produces some of the best tea on the island.

The soils are dark-colored, deep, friable loams, into some of which a stick can easily be passed to a depth of 18-in. The lay of the land is usually excellent, affording easy drainage. The gradens, for labor reasons, are widely scattered, generally not more than two tea estates adjoining. They are usually large, over 1,000 acres in cultivation being common, and are mostly owned by companies. The elevation of the land under tea ranges from 800 to 5,000-ft. but the greater area lies between 1,500 and 3,500-ft.

The rainfall is generally well distributed in the tea districts, and varies from 100 to 190 inches in October to January, these being the wettest months, while June to September are the driest. The mean temperature at 1,000 feet is about 78° F. The best quality of teas is made during the dry season, the most luxuriant growth being in the wet months, November to February.

Changes of temperature have but little influence on the tea plant, which accounts for its being grown at greatly varying altitudes in Java and Sumatra, the only two islands in the Dutch East Indies where tea is cultivated.

Sumatra: A native woman is employed to inspect and direct the piekcrs

## Effect of Seasons on Tea Growth and Quality

January. Wet season ; heavy flush ; liquor plain.

February. Wet season ; heavy flush ; liquor plain.

March. Wet season ; considerable flush ; liquor plain.

April. Rain less ; flush smaller ; liquor slightly improved.

May. Rain ceasing ; flush smaller ; liquor shows nice improvement.

June. No rain ; small flush ; liquor shows nice quality and flavor.

July. No rain ; small flush ; fine quality liquor.

August. No rain ; small flush ; liquor choice quality.

September. No rain ; small flush ; liquor choice quality.

October. Some rain ; larger flush ; quality of liquor often very good, if not too much early rain.

November. Rain setting in ; large flush ; cup quality usually poor.

December. Rain considerable ; large flush, cup quality slightly improved against November.

The land is dug between each pruning, once heavily, 18-in. to two feet deep, and two or three times lightly ; the cultivation in this respect being rather severe. On many estates water trenches are dug at frequent intervals between the rows across the slope, and these are filled up and new ones dug every seven months. Between the hoeings, weeds grow rapidly, frequently to the height of the tea bushes. On one estate monthly weeding is done, as in Ceylon. Most of the land is terraced, as well as trenched, so drainage to prevent wash is not required as in Ceylon.

Good seed is an essential, either with the direct-sowing method or with the previous construction of seed beds. The seed is usually tested before it is put into the ground, either by placing it in water or in a sugar solution or both; floating seeds being eliminated and sinking ones used (it being generally understood that the floaters are bad and the sinkers good). The sinkers are immediately put out at the distances required, the floaters being planted out separately with much less space between. The seeds are sown at a depth of not more than an inch from the surface and at a distance from each other of 10 to 20 cm. Seed beds are provided with a roof of leaves or grass, should their position require this.

The first pruning is generally very high, and the work frequently indifferent ; large, heavy knives being used. The style of bush grown is in many cases lanky and rather thin, and on these estates the wood, even on comparatively young bushes, has a gray, hide-bound appearance. When cleaned, however, the bark is green and healthy.

Many of the factories are new and consist of large and expensive buildings well supplied with machinery and lighted by electricity, which in several instances furnishes the motive power also. The walls are chiefly strong, bamboo matting, with pillars of stone or iron. Notwithstanding the flimsy nature of these factory walls, the buildings are accepted for insurance at a very low rate. One factory visited was turning out 750,000 pounds of tea from four buildings, with a combined floor space of 81,090 square feet.

In some factories withering is done on floors or *chungs* four feet apart as in Assam ; a few have racks ; while in others the leaf is spread on the floor. Sun withering is commonly practised. In one factory, at a high elevation where coarse plucking is adopted, circular drums heated with hot air are employed, after the leaf has been partly withered in the factory and in the sun ; but the results as regards quality are poor, the leaf turning red in the process. As a rule withering is decidedly on the right side, and this may to some extent account for the amount of tip seen in the Java teas. Where both China and Assam bushes are grown on the same estates, the leaves are usually withered and manufactured separately.

Fermentation is generally heavy, from three to four hours in several factories. The leaf is spread on the floor without any covering cloth, so that there is a tendency for it to become dry. In other factories bamboo trays are used, which are carried out and spread over large barbecues near the factory, to complete the fermentation in the sun and to assist in drying.

All the factories visited were well supplied with firing machinery, chiefly of the large type. The temperatures are usually high, from 200° to as much as 300° F. and in some instances the teas are slightly burnt.

Sifting is generally very thorough, a considerable amount of hand sifting being done after the tea has passed through the sorting machines. Sortations follow the same lines as in Indias and Ceylons, with teas made largely into orange pekoes. pekoes, broken orange pekoes, and broken pekoes, and smaller percentages of flowery orange pekoes and souchongs. The hand sieves employed are of fine bamboo mesh and not of wire. Fannings and light leaves are separated by manipulation with bamboo winnowers, from 30 to 50 coolies often being engaged in this work alone. The result of this careful sorting is that teas are very uniform, full of tip, and of desirable appearance.

In some factories withering is done on floors or chungs four feet apart as in Assam ; a few have racks ; while in others the leaf is spread on the floor.

The final sortation is done by women, who do it by hand, the main purpose being the elimination of the still remaining red stalks and other impurities, such as bamboo fiber, etc.

### Java's Marvelous Roadways

A feature of the Javan inalnds greatly appreciated by the tea man are the roadways, which form an intricate and excellent system extending throughout the island. The three main trunks of the present road system date back to the famous Hundo period in Java. The rivers were crossed by large and powerful bridges of bamboo and teakwood, which were kept in perfect condition, while the roads were made durable and able to bear heavy weights by means of hewn teak trees. To-day the whole island is intersected with main roads, post roads, cross roads, and byroads, winding amid luxuriant tropic growths, past quaint villages, peopled by what seem to be gaily dressed fairies. There is literally no point in Java which the tea man cannot easily reach by carriage or motor car, and, with characteristic Dutch system and thoroughness, fresh horses for the former and the necessary equipment for the latter are procurable about every five to ten miles on the main roads. Thus traveling away up into the mountain districts, among volcanoes and tea gardens, is both easy and delightful.

The island of Java is about the size of the state of New York, its area being close to 50,000 square miles. Within this area is a population of over 40,000,000 people, making it the most densely settled section of the world. The trade of the island is facilitated not only by means of roads, but also by a total length of railway of 1,680 miles, and some 770 post, telegraph, telephone, and radiograph offices.

### Sumatra Enters the Tea Game

The area of Sumatra is 167,480 square miles and its population in 1916 was only about 4,000,000. The greater part of the island is not fully explored. In 1910 the government of the Netherland Indies appointed a commission to inquire into the possibilities of tea culture in the Padang highlands of southwest Sumatra. As a result of the particularly favorable report of this commission, certain tracts of land were applied for and the estates are now producing. At about the same time experiments were made near the east coast in the district of Siantar, and the growth of the tea plant was so successful there that a number of tea estates have been established. The district of Siantar, where the lofty Sumatra mountains stand on guard like gaints of granite and volcanic rock, lies between the town of Medan and Lake Toba.

Total production has been growing, having been approximately 5,000,000 pounds in 1918, 9,000,000 in 1919, 11,000,000 in 1920, and 9,000,000 pounds in 1921. Shipments to the United States have been exceedingly small, not more than 250,000 pounds a year, the larger quantities going to England and Holland.

### Special Items of Interest

The tea plant is much more subject to the rainfall than the temperature, which is evident when it is taken into consideration that tea culture is a leaf culture, and the production of leaves is of course to a great extent dependent upon rainfall. Long periods of drought are therefore destructive to the culture, and the laying out of tea gardens in districts which have an insufficient or very irregular rainfall must be guarded against. Fortunately most districts in Java and Sumatra, especially the hill districts, posses an abundant tropical and mostly regular rainfall, enjoying in this respect a very favorable position.

In Sumatra, in all probability *the* island of the cultivation of tea, the first plantation was opened about 13 years ago in the Ophir district, close to Padang, on the west coast of the island. A few years later the laying out of plantations was also begun in the rich producing district of Deli, on the Siantar plateau.

The tea is rather partial to certain kinds of soil. It prefers, taking the quantity of the product as criterion, soils rich in humus, not too heavy, and if possible virginal forest. The less nourishing volcanic soils yield as a rule a smaller quantity of produce, but often of excellent quality. It is, however, very dangerous to generalize, frequently very extraordinary exceptions occurring.

New grounds may be mainly divided into two main groups,—virginal forest, having heavy upper growth, and old cultivated grounds, used previously for some European or native culture, and therefore covered only with low shrubs and grass.

## Two Department Stores for Shanghai

Five or six years ago a company of Cantonese, the Sincere Co., Ltd., put up a building as high as the laws of the international settlement allowed, six stories. Two years later another company from Canton, called Wing On's, bought ground across the street from the first, and built. Both firms have stores in Canton and Hongkong.

China has only a 5 per cent. tariff and stores here are able to sell imported goods at reasonable prices. In some cases American goods is marked at less than in the United States. Concerning the new companies to be established here, a local newspaper says :

" Shanghai may in the near future expect to see two new 'palace emporiums' or department stores in Nanking Road." Nanking Road is the chief foreign retail thoroughfare of the city, and of the Far East. As with the Sincere Co. and Wing On's, the promoters of the new firms are Cantonese, S. K. Lau, who has retired from the management of the Sincere Co., being the founder and general manager of one, which will be known as the Sun Sun Co. The other is the Great Sun Co."

# Beet Sugar Industry in Japan

*By H. C. Huggins*

HOKKAIDO, the northernmost of the large islands which compose the 'mainland' of Japan, is the centre of a growing beet sugar industry which is expected in the not far distand future to make Japan entirely self-sufficing so far as sugar supplies are concerned.

Despite the marvellous growth of the sugar industry in Taiwan under the Japanese control since 1904, it has never yet been possible to raise sufficient cane in the Taiwan fields to keep the Japanese sugar mills occupied at anything like capacity for more than a small part of the year. The shortage of raw material needed to maintain production in the refineries has always been imported from Java and Cuba, and Japan's purchases of sugar abroad have been a considerable item in an unfavorable balance of trade.

The Taiwan sugar fields being inadequate to supply the needs of a growing demand for sugar in Japan, attention was turned to developing the extensive agricultural lands in the Hokkaido for the culture of sugar beets.

As long ago as 1888 experiments in sugar beet cultivation and beet sugar extraction were carried on in the Hokkaido under the supervision of American sugar engineers, but owing to lack of knowledge and interest on the part of the farming class, leading to utter indifference to the best methods of planting and growing, and on the part of the refiners causing damage to the beets in handling and refining, the results obtained were not such as to stimulate any great enthusiasm for sugar beet growing and the investment of capital in the Hokkaido in beet sugar refining.

It has been only in the past five years since the high prices reached by sugar during and after the war, that attention has been turned to beet sugar in Japan. Naturally the Hokkaido was the only location for such an industry, and there it is now being centred.

## Cultivation of Sugar Beets

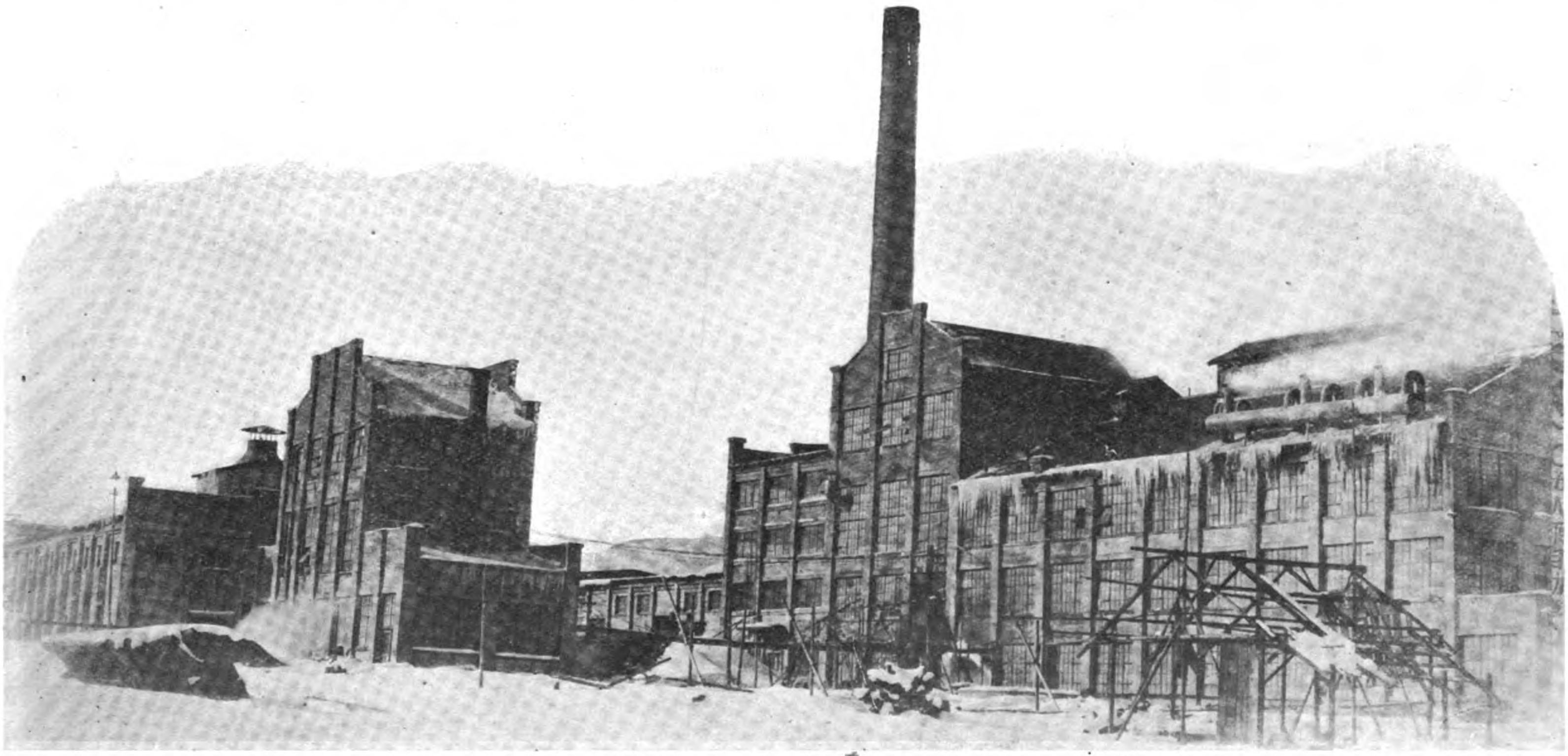
The population of the Hokkaido is small and the easily cultivated lands of that island which physically resembles the Pacific northwest, are sparsely settled and only cultivated in certain well-populated centres. To grow sugar beets it was necessary to induce the immigration of farmers from Japan proper (the island called Honshu), and to do this meant that it was necessary to give inducements to the immigrants.

The Hokkaido government sold land to the beet sugar companies at very low prices, which was again sold to immigrant farmers at cost on very favorable terms of payment over a long period of time. Those who did not care to buy land were allowed to lease holdings provided they contracted to devote a fixed part of the land to sugar beet growing, the beets to be sold to the companies at a fixed price. The factories not only contract with the farmers for all the beets they could raise, but also pay a good bonus to those farmers who show the largest crop per acre, and for beets with high sugar content. The companies buy the seed abroad (in Germany and Siberia), and distribute it to the farmers. During the season of growth, from March to September, the crops are under the constant supervision of experts employed by the factories. There are about 20,000 acres now under cultivation and this represents not more than half of the land owned by the sugar companies.

The Hokkaido beet crop matures early in October and from October to January continuously the mills are operated day and night in order to handle the beets harvested. There are no holidays and labor in the mills works in 12-hour shifts uncomplainingly. The farmers and their families supply the larger part of the labor needed in the mills, and thus add to their incomes. This attracts the better class of farmer from the main island, and despite severe crop failures in the first year of growing the farmers have continued to plant as desired by the companies and have remained at their work.

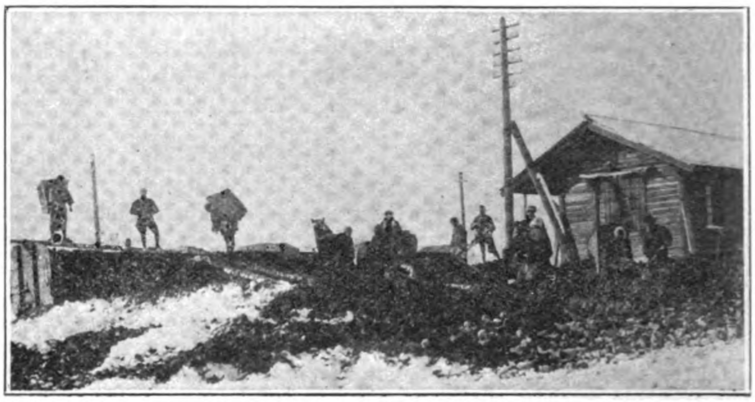
## The Factories

By far the most important of the beet sugar companies is the Hokkaido Sugar Company, which was originally capitalized at Y.10,000,000. This company owns an operating mill in the town of



SHIMIZU BEET SUGAR FACTORY

Hauling Beets to Storage Houses



Loading at a Way Station

Obihiro, erected in 1920, and started up the same year. The factory was erected at a cost of Y.3,000,000, and it is the centre of industry in the town which has a population of about 15,000, and is situated in the centre of a prosperous agricultural region. The sugar industry is attracting attention and the region's population is increasing. It is said that about Y.500,000 is annually paid the farmers for their sugar beets, and this sum goes far to increase the prosperity of the whole region.

The Obihiro mill was erected by American engineers, and it was designed and completely equipped by Dyer & Company of Cleveland, Ohio, U. S. A. The normal capacity is 600 tons of beets each 24 hours. This should produce about 80 tons of white granulated sugar, best quality, each day during the season. The Hokkaido sugar beets are the equal of the American in sugar content. The dry granulated sugar produced in the Hokkaido is pure white, and is packed in matting bags containing 100 *kin* (133-lb.) The dried beet pulp which is the by-product of refining is used as a dairy cattle food. Hokkaido is particularly rich in dairy products it being about the only part of Japan where good grass for cattle food grows without cultivation.

The Hokkaido Sugar Company owing to the general depression of business has not been able to pay dividends on its rather high capitalization. This was recently reduced to Y.5,000,000, the paid-up capital being Y.4,000,000. The company originally owned some 45 miles of railway operating in its sugar territory, but this has been transferred to a subsidiary corporation. This company is controlled by the Teikoku Sugar Company, one of the prominent cane refining companies in Japan. This company belongs to the so-named "Matsukata" line—in other words it is financed by the Matsukata interests under the direction of Mr. Shokuma Matsukate, son of Marquis Matsukata, who was one of the elder statesmen of Japan.

The Dai Nihon Sugar Co., one of the largest of the Japanese cane sugar companies, owns a beet sugar plant at Shimizu, some tens of miles distant from the Obihiro plant of the Hokkaido Sugar Company.

The Shimizu plant of the Dai Nihon Sugar Company was completed in 1922, and only recently started up. It was built by the same engineers as the Obihiro mill, and equipped by the same makers, with exactly the same machinery, so that its capacity, and potentially its performance, are not different from its rival.

The two mills now in operation in the Hokkaido are modern in every respect, they are fireproof, the floors made of concrete, and all the machinery is driven by electric power. They are both, despite their different ownership, under the direction of an American engineer, and in each plant there is an American sugar expert in charge of production.

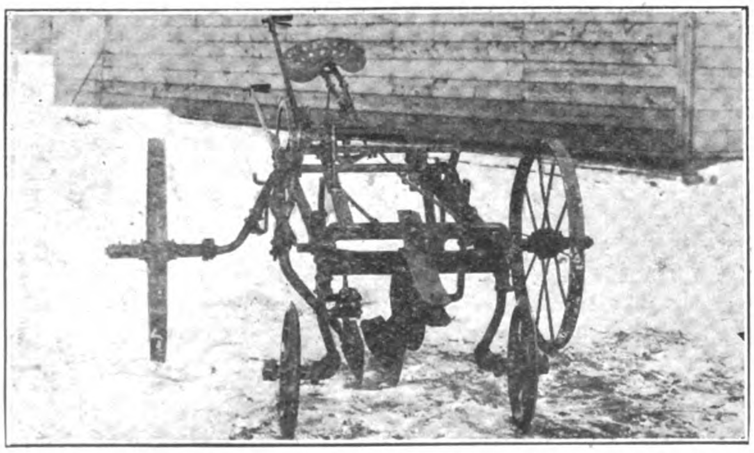
Labor is cheap in the mills, and the labor costs represent only about 20 per cent. of the cost of production. The other 80 per cent. represents the cost of the beets. Perhaps sugar beet refining in the Hokkaido can be carried out at a cheaper cost than in any other country in the world. Should this be possible, and the industry be developed, despite repeated discouragements in its inception, the competition of Japanese beet sugar on the Asiatic continent with Javan cane sugar may in the future be very difficult to meet.

Sugar consumption in Japan is on the increase, year after year. Unfortunately the Japanese consumption tax on sugar which is Y.9.00 per 100 *kin* (133-lb.), on the quality of sugar produced from sugar beets in the Hokkaido, seriously retards the increase in consumption per *capita*. The actual cost of sugar to the wholesale merchant is actually about 100 per cent. higher than factory cost, exclusive of manufacturer's profits.

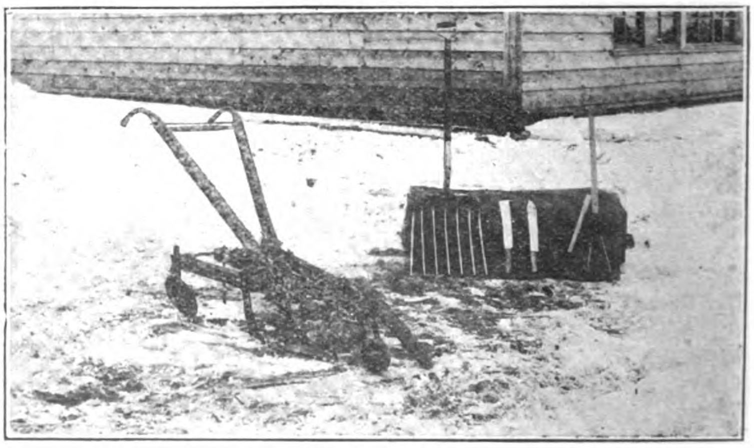
The Japanese government is inclined to encourage the production of beet sugar in the Hokkaido. It is expected that with proper attention to methods it will not be difficult to refine 100,000,000 *kin* (133,333,333-lb.) of beet sugar a year.

## Beet Sugar in Chosen

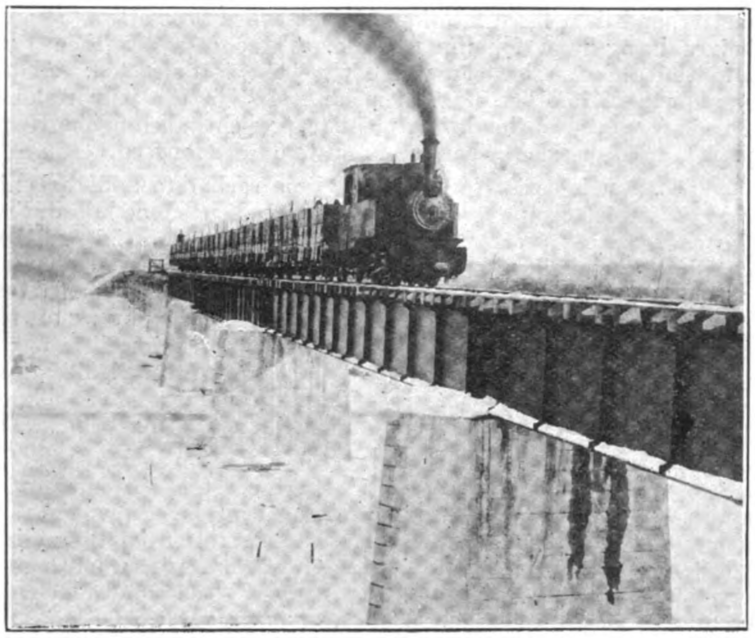
The Dai Nihon Sugar Co., and the Chosen government-general for many years have been interested in the production of beet sugar in Chosen. In 1917, owing to the success obtained from the various experiments carried out under these auspices, the Chosen Sugar Company was formed to undertake the growth of sugar beets and their refining. This company was a subsidiary of the Dai Nihon Sugar Company. However, owing to the impossibility of obtaining a supply of seed from either Germany or Siberia during those troubled years, the plans of this company were abandoned for a time. This difficulty in obtaining seed held back the development of the beet sugar industry in Chosen and in Japan during the very years when capital was to be obtained in any amount



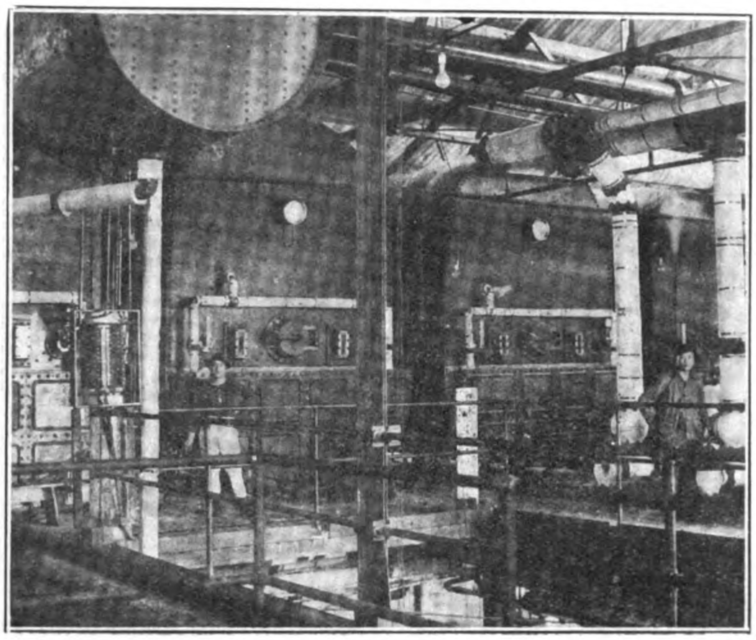
Beet Lifters, loosening them in the ground



Agricultural Tools used in Cultivation



Meiji Sugar Company's Railway at Takigawa



Evaporators

needed. Unfortunately now when seed is to be obtained, capital is wanting, and the industry is growing in both countries under severe handicaps. And it is only because of the intrinsic value of this industry that all efforts to bring it to maturity have not been abandoned already.

After the war the plans of the Chosen Sugar Company were revived and in 1919 the orders for the plant were issued. An American firm supplied the machinery, and in 1920 the mill was completed at Heijo, Chosen, and started up under American supervision. This factory is not yet, however, working at full capacity. The company while owning some land which it uses to cultivate a supply of beets for its own needs, has decided to depend for its supplies upon the Chosenese farmers. This has eventuated in a steady lack of supply, although the system has met with success in all other beet sugar-growing communities. The strangeness of the crop, and the indifference of farmers to raising it have been handicaps which had to be overcome in Chosen and in Japan as well. But under guarantees to purchase by the companies some progress has been made in turning cultivation over to the farmers. In Chosen the company will eventually turn its own lands over to the farmers, under a *proviso* that a certain portion of it must be sown to beet seeds annually.

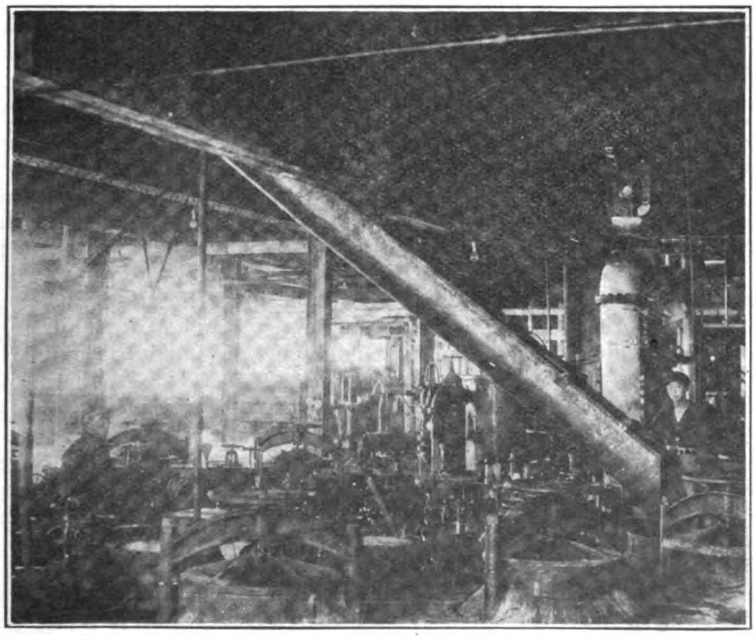
The Heijo plant is the same in size and capacity as the two plants erected in the Hokkaido. It will normally handle the crop from 7,500 acres. This crop is to-day about 10 tons of beets per acre, so that there will be about 75,000 tons of beets handled each season. With 600 tons of beets, the daily capacity, producing about 85 tons of sugar, this means an annual production of 10,625 tons of refined granulated sugar a year.

Estimating the production of each of the two mills in the Hokkaido at the same figure, 10,625 tons a year, this makes a total of 31,875 tons of beet sugar from the three Japanese mills now in operation. This is equivalent to 54,167,500 *kin*, something more than half of the Japanese government's estimate of the total production to be obtained in the Hokkaido.

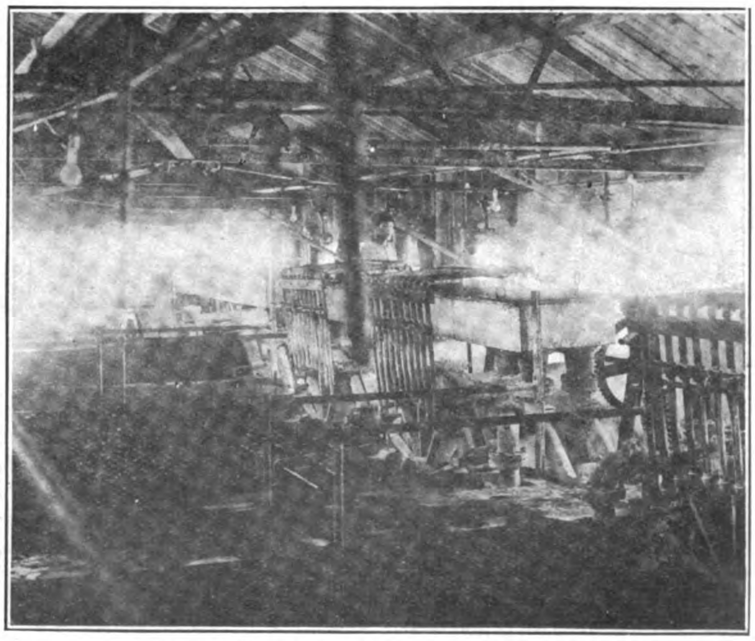
Land in Chosen is particularly suited for sugar beet cultivation, and the Chosenese farmers are gradually becoming accustomed to the crop. When prices of sugar become better, or more settled, there is every possibility of a considerable increase in the interest now more or less grudgingly shown beet sugar. When this happens an increase in production is inevitable.

## Beet Sugar in Manchuria

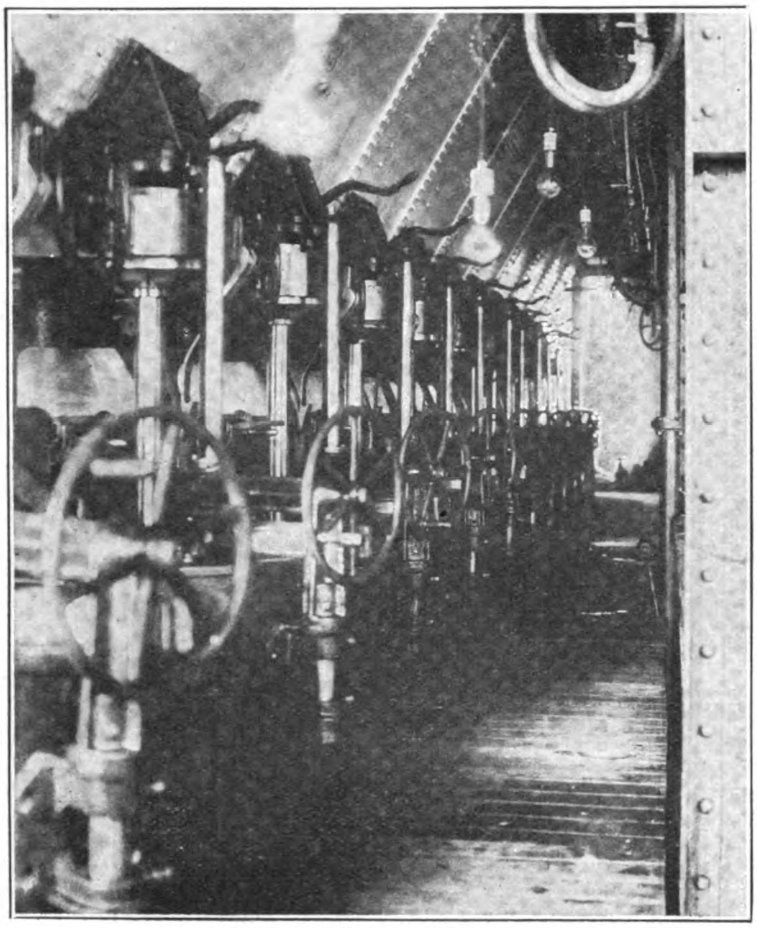
The Japanese turned their attention to sugar beet cultivation in Manchuria in 1918, and a company to refine was established under the name of the South Manchurian Sugar Manufacturing Co., with a capital of Y.10,000,000. This company included in its operations the manufacture of beet sugar, refined sugar from cane raws, and alcohol.



Diffusion Battery, Juice Extractors



Filtration Station. Battery of Kelly Filters



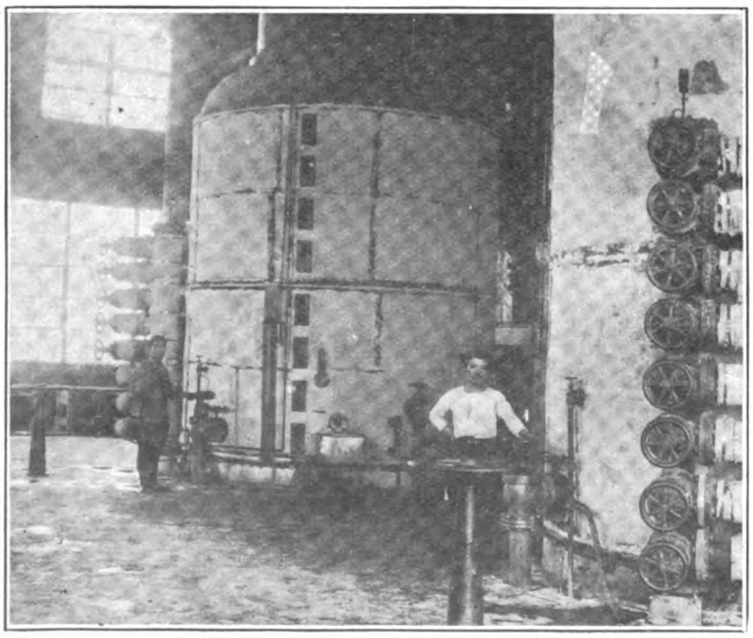
Centrifugal Machines

Sugar beet seed was difficult to obtain and the industry never grew as it should. The company paid dividends on sugar refined from Javan raws. But all preparations for an extensive industry have been made, and in the next five years or so it is probable that Manchuria will enter the beet sugar producing field along with Chosen and the Hokkaido.

### Method of Refining

The whole process of beet sugar manufacture in the Hokkaido is carried on in the following manner:—

The beets are conveyed to the mill from the storage bins by means of concrete flumes, waste water from the mill being used to carry them along. The beets are washed, to remove all foreign matter, and then sliced into long shreds, called "cossettes," special knives being used for the purpose. These cossettes then pass into the diffusion battery where the juice is extracted. About one-fourth of one per cent. of sugar is left in the pulp residue. This is conveyed to the drying plant (not yet installed in the Heijo plant), dried, packed in bags and sold to dairies for feed.



Vacuum Pans, Sugar Crystallizers

The raw juice is clarified with lime sacharate and carbonic acid gas, which are produced in the Steffens house lime kiln during the desugarizing process. The next process is filtration, further clarification and filtration until a thin, clear, brilliant juice having a light amber color is produced. Evaporation is then carried out to reduce the bulk of the juice. This is accomplished by a multiple evaporation system of big capacity. The "thick juice" is again clarified and filtered, and is then made ready for crystallisation, which is carried out by means of large vacuum pans capable of turning out 300 bags of refined granulated sugar at one time.

The product from the vacuum pans is known as "massecuite," a brown, heavy mixture of white sugar crystals surrounded by syrup. This is passed through centrifugal machines revolving at a high speed, which separate the sugar crystals from the syrup, which is then pumped into a second vacuum pan where again crystals are produced in the same manner. The resulting "massecuite" is separeted in another battery of centrifugal machines.

Sugar from the first crystallisation is washed with clean, cold water which removes all traces of the syrup without dissolving any material amount of the sugar, this process takes place in the centrifugal machines. This washed sugar is then passed to the special driers, and the process of manufacture is finished. After being dried and screened, this sugar is ready to be packed.

The sugar from the second crystallisation is yellow-brown in color, and is re-dissolved and sent back to the first vacuum pan where it is mixed with the original thick juice. The adhering syrup from the second making of crystals, after being removed by crystallising is attempted. It is sent to the "Steffens" plant, where it is desugarized as described, by the use of quicklime. This process destroys the molasses by precipitating the sugar, and leaves as a residue a waste of water containing all the salts and minerals which the original beet has taken up from the soil, including a considerable percentage of potash and nitrogen compounds. At present this waste water is not being used, but in time the necessary equipment will be installed to collect this valuable by-production.

## Mercury Mining and Reduction in Kweichow, China

THE mercury mine of Dong-shun-hsien, Kweichow, has been in operation many years. If, what the natives say is dependable, their ancestors were engaged in mercury mining in the Ming dynasty, 1368-1644. The veins are found in the limestone strata and in isolated patches or pockets. There are two kinds of mercury. One is red and transparent, and the other dark-red and opaque. The latter contains a small amount of antimony, but both contain no pyrite.

The methods used in opening the mine and in smelting the mineral are very poor and crude. In opening a mine holes are drilled to a certain depth, and into them 2 to 3-lbs. of gunpowder are introduced. The result of the explosion after the ignition of the gunpowder is 200 to 300-lbs. of mercury ore. After the breaking up of the rocks into small particles they are put into the native furnace for smelting. The furnace consists of three boilers and one earthenware basin. Over the brick foundation of the furnace the first boiler is placed, and the second boiler up-side-down on the first, a 12-in. hole being made in its centre. The second boiler is covered with mud held in place by a bamboo network, and upon this the third boiler, also with a hole in the centre, is placed. This third boiler is then covered by an earthenware basin. After heating, the mercury is evaporated and condensed on the entire surface of the earthenware basin. This is rubbed off and put into bamboo tubes. The mercury obtained in this way is ready for sale.

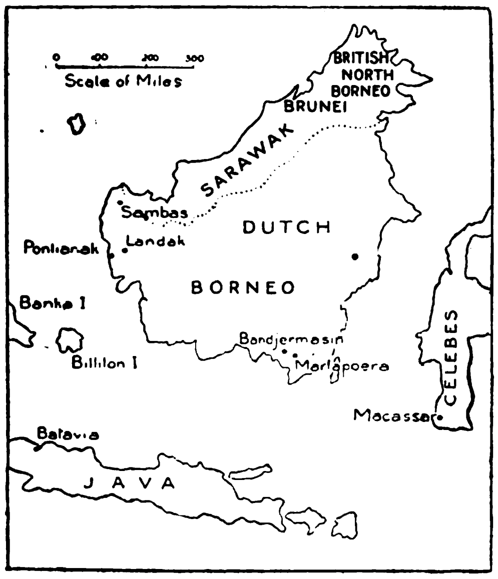
# Diamonds in Dutch Borneo

*By A. S. Wheler, M. Inst. M.M., and J. H. Foran, Assoc. Inst. M.M., in the Mining Magazine*

BORNEO has long been known as a diamond-producing country and, before South Africa sprang into prominence and practically monopolized the world's diamond market, the value of its output probably ranked level with, or higher than, that of either Brazil or India.

Tavernier, a Frenchman, writing in 1684, was apparently the first European to record the fact that the gem was found in Borneo, having seen the stones during his travels in Hindustan, where they were greatly treasured by the natives owing to their superior quality to the Indian diamond. Since then various writers such as Raffles and Posewitz (in his book "Borneo") have made brief references to the fact, but no description has been given as yet either of the nature of the occurrence or of the native method of winning the gemstones as far as the authors are aware.

The original matrix of the diamond has not yet been discovered in Borneo, although a few isolated stones are reported to have been found *in situ* in various parts of both British and Dutch territory, but such reports lack corroboration and their authenticity is therefore open to doubt. The present output is derived entirely from alluvial deposits, and there are only two places where the production is of appreciable value. These are at Martapoera, near Banjermasin, and at Landak, near Pontianak. The former is situated on the south coast of the island, near the port of Banjermasin, on the Barito River, and the latter at about the centre of the west coast. The Martapoera field is the more important of the two, and the subsequent remarks refer to the mode of occurrence of the diamonds and the native methods employed in winning them in that locality.




**Map Showing Position of Diamond Deposits in Borneo**

The industry is at present entirely in the hands of the local native Banjerese, a mixture of Malays and Javanese, although Europeans have entered the field with the intention of introducing big-scale modern methods such as open-cut working and dredging. The diamonds are found in gravel deposits forming the old river beds of the present era and extending often on to the adjacent flats as a result of overflow during periods of flood. The channels are being rapidly silted up with sand, clay, and other fine sediment, with the result that the rivers are now losing themselves in a coastal swamp plain at their outlets. This overburden is barren and increases in thickness going down stream.

The gravel layer is composed of well rounded water-worn pebbles, rarely exceeding 12-in. in diameter, and rests on a bedrock of sedimentary strata decomposed to a clay, and not readily distinguishable as bedrock. Quartz pebbles predominate in the wash, and water-worn pitted pebbles of corundum, with fragments of Ti O2 in the form of brookite crystals, are prominent among the heavier concentrate associated with the diamonds and hence are regarded as favorable indications. A small amount of gold and platinum is also present, but rarely in sufficient quantity to make their recovery the object of special attention by the natives, except when a rich pocket is found when, of course, they collect it.

The native method of working these buried river bed gravels is to sink a shaft to bedrock and to take out as much of the wash around the shaft bottom as circumstances permit. The size of the shaft is usually 1.5 metres square ; it is sunk to a depth of five or six feet, and a collar set fixed, from which other sets are suspended by means of rattan at, say, 2 metres centres or less. The shaft is then open-lagged with poles, or saplings, of sufficient length to reach the wash, and these are driven down as the sinking proceeds. When the ground is too loose to stand with only this support, long grass is packed in behind the lagging.

Each village community ("kampong") has its own diggings, the work being done by parties of men and women who are members of the same family as a rule, since outsiders could not be trusted to abstain from thieving a stone they might chance to see in handling the gravel! Two men work in the shaft bottom excavating the ground with short crowbars or their hands, and packing it on to small wicker trays, which are then handed up from one native to another, standing on the shaft setts, until finally dumped at surface, the empty baskets being passed down. Water encountered in sinking is handled in similar fashion by baling with kerosene tins cut down to about half size with a wooden handle fixed across. The handing up of the full basket or tin and passing down of the empty one is performed so rapidly and dexterously that a surprising amount of water or gravel can be dealt with. A gang of 16 natives (say 12 men and 4 women) will sink a 5 by 5-ft. shaft to a depth of 20-ft. in a day or two, depending on the amount of baling to be done. Native shafts rarely exceed 30-ft. in depth.

The gravel, which is piled in a separate heap from the barren overburden, is then puddled in a prahu, or native canoe, which is 2 to 3 metres long, and hollowed out of a tree trunk. The gravel is placed in this and it is filled with water and pedalled backwards and forwards with the feet by a native seated at each end, while a third native periodically adds water and gravel and removes the puddled material, from which the bigger stones are thrown out by the puddlers. The process is crude and inefficient where the clay is at all stiff.

The puddled ground is now washed ("dulanged") in native bateas ("Linggangan"), which are 75 cm. diameter with a vertical depth of 22 cm. from rim to apex, and made from a single piece of wood. The worker stands in a stream or pool with the water reaching to his hips and taking 2 or 3 kilos of wash, sieves it through a coarse rattan sieve having a rectangular mesh of about 1.5 cm. by 4.5 cm. The oversize is examined for large stones by scraping over with the fingers and tossing over in the sieve before being rejected.

The undersize falls into the batea and is washed. The natives are particularly expert at this ; they first thoroughly agitate and mix the material by rabbling it with the fingers, and then, resting the dish on the water, rock it so as to impart a circular swirling motion to the contents. This sets up a wave traveling around the interior of the dish carrying with it the lighter material, and by a slight raising of the hand the rim of the dish is correspondingly depressed on the opposite diameter permitting the overflow of a portion of the wave and its burden of lighter wash. The hand is then depressed allowing fresh water to enter. This completes the cycle. After 8 or 10 turns the wash is again agitated and mixed and once more swirled. The excess water is then drained off and the material remaining in the batea is scooped up with the fingers and spread in a thin even layer on the sides while slowly revolving the batea with the other hand. This renders any diamonds that may be present easily visible to the practised eye of the panner, and he imbeds them temporarily in a small wax-filled hole bored in the rim of the dish.

Fresh material and water are then added and the panning resumed. The concentrate from each cycle of operations is thus retained in the dish until finally panned off for gold and platinum content if present.

The Borneo gem is held to rank equal, if not superior, to any in the world. The majority of the stones are of good quality, known in the trade as "close goods," whites preponderating ; next are the yellow and smoky colors ; blue-whites are rare, and occasionally greens and reds are found. In size the stones probably do not exceed ¼ carat on the average. Big stones are extremely rare, the largest found for several decades being a 32-carat fragment and an 11-carat recently discovered (in 1920), and valued at 16,000 and 5,000 florins respectively in the rough ; the finding of even a 5-carat stone is a cause of considerable comment and dangerous envy among the workers ! The shape is good on the average, well crystallized octohedra predominating, with comparatively few cleavages or fragments.

The diamonds produced are split and polished locally, the mills or spindles being owned by Arabs or local Malays. The splitting of diamonds is a trade, or rather art, requiring considerable experience and skill, as the stone must be split along the proper cleavage planes to obtain a successful result ; otherwise it is easily spoiled and its value greatly depreciated. Splitters receive no regular scale of pay, and are usually given a bonus on successfully splitting the larger stones, which it can be readily understood is nervous work.

The polishing is done by setting the diamond at the desired angle in soft metal (a lead alloy), filled into a small brass cup-shaped mould. The spindle forming the extension of this is gripped in a small jaw or vice fixed on the end of a wooden handle or arm about 25 or 30 cm. long. The diamond is then carefully rested on the rapidly revolving horizontal cast-iron disc, or plate, keyed to a vertical steel spindle power driven, the wooden arm being held in position and prevented from moving by two stops (usually nails) driven into the bench, one on each side ; the necessary degree of pressure is applied by resting small weights on the arms. By using three or four of these arms or rests the polisher can deal with that number of stones simultaneously, as against the Amsterdam polishers whose practice is reported to be the handling of only one stone at a time.

Cutting and polishing costs may be figured roughly at 6 to 7.50 florins per carat for ½ carat stones and under, and at 10 to 15 florins for larger stones. The florin rate of exchange varies from about 11 to 12 to the £1.

Each polisher has to provide his own disc ; the abrasive is obtained from Ceylon ; and coconut oil has been found to be the most suitable lubricant as it spreads evenly and does not clog.

Natives often cut and polish their own stones, hiring the spindle from the mill owner.

The main objective in the local mills is to produce a stone of maximum size, sacrificing brilliancy to attain this end, whereas in Europe the weight is far less important than maximum brilliancy or fire. Hence there is a considerable difference in the price a cut stone would fetch in the Oriental native market and in Europe ; for whereas it might, and probably would, be regarded in the latter as spoilt by local cutting, it would fetch a good price in the Orient.

There were several mills in operation before the war, but at the time of writing only two mills (of 60 spindles) were running. This is due to the fact that the import of South African stones, which practically ceased on the outbreak of hostilities, has not yet been resumed on the pre-war scale, though they are now reappearing.

Formerly, parcels of rough Cape diamonds were cut and polished here to the extent of more than half the output of the mills, and found a ready sale in the Far East at lower prices than Martapoera stones. Weathy Chinese (outside China), Malays, and Japanese are inordinately fond of the most extravagant display of jewellery, setting diamonds in the links of the watch-chain, and bedecking their womenfolk with huge and hideous gem-studded pendants more like a breast-plate than a necklet, which are worn at every possible function and occasion : the purchase of these ornaments is regarded by them as a form of investment.

# The Magnesite Deposits of Manchuria

*By S.M.R. Co. Geological Institute, Dairen*

THE magnesite deposits occur at intervals in the form of lens or bed alternating with dolomite throughout a range extending from Kuanma-shan, 5.5 k.m. east of Tashihchiao (210 k.m. north from Dairen, and 154 k.m. south from Mukden) as far as Moku where one of the principal talc deposits is located, about 30 k.m. northeast of Tashihchiao station. Others occur at a number of places along the South Manchuria Railway in the southwestern direction, to a point 8.5 k.m. southwest of Kaiping station (29 k.m. from Tashihchiao).

Although the deposits now being worked are confined to Kuanma-shan, Niu-Hsin-shan and Pai-hu-shan, yet there are many other fields large enough to be worth operating, in other parts of this district.

The entire exposed deposits cover large areas estimated at 11,552,000 *tsubo* (350 square kilometres approximately).

The main deposits of this seam, which constitute the northeastern portion, from a mountain range rising from 250 metres to 500 metres above the plain level, while the remaining part in the southeast takes the form of mounds, only 50 metres high, or takes hollows.

Talc deposits are found in association with the magnesite chiefly in the very sheared zone.

The geological formations observed in this area are gneiss, pre-Cambrian system, alluvium, granite, and several dike rocks. The general geologic section of this district is as follows :

| | |
|---|---|
| Quaternary .. .. | Sand and gravel. |
| Dikes .. .. .. | Porphyritic diabese (?) and quartz porphyry. |
| Cambrian .. .. | Absent. |
| Algonkian .. .. | (lower part, slate, schists), (upper part, dolomite, magnesite, marble, quartzite and sandstone, etc.) |
| Archean (?) .. .. | Gneiss. |

Gneiss generally belongs to biotite granitic gneiss of uniform texture, and is overlaid by the pre-Cambrian (perhaps by algonkian) schists and slates. The lower part of this schist complex are characterized by some accessory minerals such as staurolite, garnet, and anderlusite, etc., constituting the mountain range of surface formations throughout, especially extensively distributed over the southern part of this area.

The upper part consists generally of schist, dolomite, or of alternation of schist, slate, and dolomite, etc.

The youngest rocks of this region are dikes classed as pre-Cambrian and the youngest sedimentary rock is quartzite. Beneath the latter unconformably lie an olden rock series of the same descriptions as given above.

These rocks are intruded by later pre-Cambrian granite, syenite, and other igneous rocks.

With their varying degrees of resistance to erosion and weathering, magnesite and dolomite constitute the principal ridges traversing the area, forming excellent magnesite deposits and takes a northeastern course.

The deposits are composed of a land coarse crystalline mass of magnesite and are found generally in beds or lenses alternating with dolomite, showing a distinct contact line with dolomite. They also associate with a thin bed of schist or slate occasionally.

The relative position and number of beds of these geological constituents are not constant, but the total thickness of these two layers (magnesite and dolomite) is at least 15,000 metres, of which the dolomite takes up over 70 per cent., and the magnesite beds less than 30 per cent.

As to talc, the S.M.R. Co. has suspended mining altogether.

The sales returns for magnesite these three years follow :

| Fiscal year. | |
|---|---|
| 1920 .. .. .. .. .. | 4,204 tons. |
| 1921 .. .. .. .. .. | 3,078 „ |
| 1922 .. .. .. .. .. | 5,112 „ |

The price quoted ranged between 3 yen and 3.50 yen per ton for delivery at either Tashihchiao or Tapingshan station.

As to talc at Haicheng, the returns were as under :

| Fiscal year. | |
|---|---|
| 1920 .. .. .. .. .. | 837 tons. |
| 1921 .. .. .. .. .. | 2,543 „ |
| 1922 .. .. .. .. .. | 2,466 „ |

The price quoted on talc in its natural form, not including packing charges, was from 8 yen to 8.50 yen per ton.

It may be added the above represents what was handled by the S.M.R. Co. only.

The total annual demands at present may be placed at 7,000-8,000 tons of magnesite, and 10,000 tons of talc.

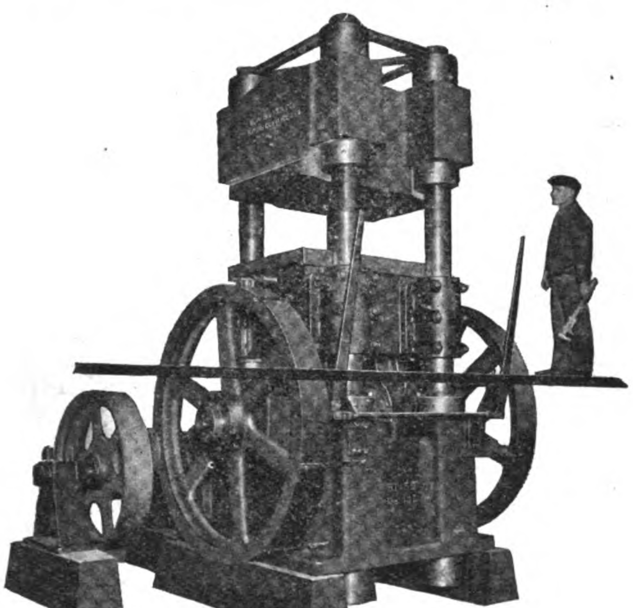
# The Increased Demand for Metal Ceilings

THE rapidity with which metal ceilings are growing in favor in all parts of the world is due chiefly to two reasons :

(a) The relative high cost of lath and plaster work.

(b) The many advantages of metal ceilings, including architectural beauty, fire resistance, permanence and security.

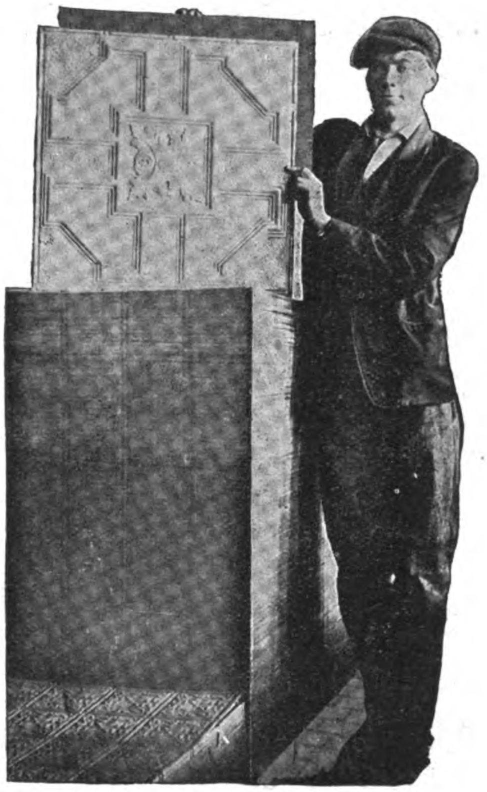
The former impossibility of obtaining accurate and precisely cut designs when such designs were formed by drop hammer stampings no longer exists. The introduction by such firms as the Berger Manufacturing Company of the use of the draw press for the formation of metal ceilings has removed this lack of precise detail. In addition to this, the use of the draw press has established a uniformity in designs heretofore lacking. Draw-presses in use for



this purpose are capable of exerting a pressure of 900 tons on a single plate. Formerly metal ceiling designs were simply reproductions of molded plaster work and were, in general, too ornate and, due to rapid change of pattern and the destruction of dies, lacked a permanence of detail and continuity which prevented purchasers from making extensions to ceilings already installed. The use of the draw press now permits not only a variety of designs suitable to all tastes and styles of architecture, worked out with a depth, sharpness and uniformity of detail impossible to the early processes but, at the same time, through the careful retention of obsolete dies, permits customers to-day to obtain the same design they ordered a number of years ago.

The qualities enumerated above have caused architects and construction engineers all over the world to appreciate the advantages of the use of metal ceilings and to specify them more and more for residences, schools, churches, stores, theatres, public halls and industrial and office buildings. There has been an especially rapid development of use for service in places where the flaking off and falling of plaster would be peculiarly disadvantageous. In particular, the use of metal ceilings and side walls has increased tremendously for use in establishments and rooms devoted to the painting of various products ; experience has shown that the use of other types of ceilings and side walls is apt to injure and ruin the painting and finishing of products due to the sifting down and settling upon the fresh paint and finish of flakes and powdered plaster. For instance, the General Motors Company have put up 70,000 square feet of steel ceilings in the finishing and painting rooms of its Muncie, Indiana, plant in order to prevent plaster dust from falling and spoiling fresh paint.

This immunity from cracking, flaking or deteriorating, taken together with general strength and light weight, make metal ceilings especially serviceable in places where there is danger of earth tremors. As an example, we are told of their adoption by a Ronam Catholic Church, St. Joseph's at Marblehead, Ohio, near the shore of Lake Erie, where the jars from frequent blastings at the near-by limestone quarries do not permit the use of plaster.



The fire resistance of metal ceilings is one of their greatest advantages. And this, undoubtedly, is one of the reasons why, of late years, these ceilings have been used so extensively in churches, schools, stores, public halls and industrial and office buildings, where the hazard of fire introduces great jeopardy. Metal ceilings in numerable cases have prevented the spreading of fire from floor to floor and thus have been extremely helpful in checking losses of both property and lives. There are many instances where the use of metal ceilings and side walls have essentially assisted fire fighters in getting fires under control and saving lives and property.

Another important advantage of metal ceilings is that they successfully resist the attacks of rodents and insects. This makes them especially desirable for use in countries where these forms of life swarm.

A matter of especial interest is the increasing demand for American manufactured metal ceilings in foreign countries. These are being shipped in increasing quantities to all parts of the world. As an example of appreciation and satisfaction, we may cite that a Canton manufacturer has been shipping to various points in India for the last ten years many thousands of dollars' worth of metal ceilings, while in every Latin American country there are hundreds of Parish Churches importing these ceilings. The large increase in the demand for and use of the metal ceilings shipped by this manufacturer is undoubtedly due, in part, to the excellent priming oil and lead coat with which these ceilings are finished and which naturally preserves them in good condition until erected, after which they will last a life time if kept well painted ; previous to the practice instituted by this manufacturer, ceilings were generally sent out protected merely by a coat of white-wash.

# A Super Power Project for Manchuria

ACCORDING to a Mukden despatch, Colonel Machina, adviser to the three eastern provinces, is planning to start an electric enterprise somewhere along the upper reaches of the Yalu and, with the help of Mr. Kurihara, expert, conducting investigation to that end, has now decided, prompted by the encouraging results obtained, to establish an electric company under China-Japanese management after obtaining permission from Marshal Chang Tso-lin. As a first program, it has been planned, so says the despatch, to construct plants capable of generating a total of 100,000 kilowatts, and it is expected that, when work on the entire program is completed, no less than one million kilowatts will be available. At that time, it is expected the company will supply the railways, tramways, and other industrial interests in Manchuria and Mongolia with electricity at the lowest rate possible. It is understood that the South Manchuria Railway, naturally much interested in the project, will shortly appoint a party of forty to investigate all necessary arrangements to be made thereanent, particularly as regards the actual situation of the project.

# Compressed Concrete Works, Singapore

THE possibilities of compressed concrete pipes as a superior substitute of the cast iron pipes for purposes of irrigation, sewerage, hydraulic schemes of all kinds, and for manifold other uses have occupied the attention of engineering experts all over the world for several years, but it is only during the past year, by the establishment of plant for the production of Hume pipes, that Singapore has been given the opportunity of judging for itself, says the Singapore *Free Press*. Here, where a water scheme of considerable magnitude is on the eve of fulfilment and the town's sewerage clamors for attention, the matter has a peculiar interest. The questions " Will Singapore's water supply of the future flow from Johore, beneath the Causeway and across the island through concrete or steel or cast iron pipes ? " Will Singapore sewage be disposed of through one of these three mediums ?, are questions which must exercise the minds of any who have considered the relative qualities of the three materials.

The use of concrete and steel in combination was completely revolutionized by the discovery in 1910 of the process, whose romantic rise to fame can scarcely have been surpassed. Thirteen years ago when concrete pipes were as yet undreamed of, two brothers—though they lived in Australia they originated from Scotland—Mr. E. J. Hume and Mr. W. R. Hume, were manufacturing ornamental steel work in Adelaide, with successful and profitable results. Seeking further scope for their enterprise the brothers turned their attention to concrete and it was not long before they realized the immense possibilities of combining it with steel. They concentrated their energies and experiments in combining these two materials for the purpose of producing pipes of an improved type, suitable for water supply purposes. By the use of centrifugal force the concrete was compressed and the steel embedded in it in a way that gave perfect results. The practical application of the invention occupied the brothers for the next two years, years which were full of difficulties and disappointments and disheartening results. But eventually success was completely achieved and a perfect pipe was produced. A long time elapsed before the inevitable reluctance of engineers to give practical support to the undertaking was overcome but after the ice had been broken orders flowed in freely, and the success of the Hume pipes was assured. Early orders included the contract for the laying of 96,000-ft of 4-in. pipe for telephone conduits, about 30,000-ft. of 9-in. pipes for the Port Adelaide sewers and about 6,000-ft. of large pipes for the East-West Transcontinental Railway. The reputation of the Hume pipes spread from South Australia and steps were taken for the development of the work in England, America and South Africa. The war, however, put an end to negociations but it also had the effect, through the sortage of other materials, to assist the development throughout Australia, where large works were established throughout the continent. Forty miles of sewer pipes were laid in Melbourne, ten miles of high-pressure water pipes were laid in Hobart, Tasmania, and there was a new and important departure in Queensland, where large concrete cylinders were supplied for the sinking of 150 wells, cylinders also being manufactured for wharf construction in Burnie, Tasmania. Now the South Australian government have contracted with the Hume Pipe Company for £3,000,000 worth of pipes for the River Murray irrigation and reclamation scheme, a powerful company has been formed in South Africa ; and in England the patent rights have been taken over by the Starton Ironworks. This is one of the most significant episodes in the history of the Hume pipes. A firm which is one of the world's largest manufacturers of cast iron pipes has decided to embark on a new industry which is in direct opposition to its own, realizing that the cast iron pipe has been superseded.

It will be seen, therefore, that from an inauspicious beginning the process has been developed until it has come to be of world-wide importance from an engineering standpoint. It has been adopted in countries all over the world, and is now being patented in the Straits, were during the last twelve months works have been established in the Serangoon Road adjoining the Woodleigh filters.

The process in an extremely simple one but is the result of years of experimental work. The materials for making the concrete are obtained on the island, the sand from the adjoining filters and the metals from Mandai quarry. The reinforcement is made separately, being woven, into a casing, on a revolving drum the texture of the steel wire depending upon the pressure of water the pipes are intended to resist. The reinforcements are placed inside a cylindrical mould with movable adjustmens to allow of all sizes of pipes being manufactured. As the mould slowly revolves by friction drive the machine mixed concrete is fed into each end from the bed of the plant and distributes itself equally. The concrete is compressed to a wonderful density by centrifugal action. The speed of the revolution is increased, the superfluous water is expelled as there is no inner mould to impede it and a finished pipe is produced in a few minutes. The simplicity, rapidity and economy of the process is most striking. Pipes are made from 10-ft. in diameter to 4-in., the latter being made four at a time on a single machine. The extraordinary effect of centrifugal action in compressing, drying and finishing the pipes is realized when one finds it impossible to make a mark by pressing the thumb with all one's weight on the newly made pipe. The pipes, with no inner mould to support them, are rolled away in their cases placed in a steaming chamber for four to six hours, then rolled into the open, stripped of their casings and rolled off as finished pipes, being left in the open to mature for about thirty days. In this connection Singapore climatic conditions have to be dealt with, and the pipes have to be watered daily while left in the open. The engineers saw the various makes of pipe tested and were also able to inspect pipes which had been laid at the works.

The policy of the Hume Company, Mr. Williams told a *Free Press* reporter subsequently, is to save costs and the risks of transport by establishing field plants wherever possible right on the site of the work. The matter of establishing a permanent plant in Singapore or its vicinity was being dealt with, and an enormous quantity of Hume materials would then be able to be manufactured. Special attention is being devoted to anti-malarial pipes, and the qualities of the ordinary water pipes are being tested by the municipality, for whom the Company are constructing a 30-in. main from Kallang reservoir to the Woodleigh filters, the first job which the Company has undertaken in Malaya.

# The Siam Cement Company

THE celebration of the tenth anniversary of the Siam Cement Company, which has recently taken place, draws attention to the industrial possibilities of that country, and is therefore deserving of more than passing notice in " The Record."

Hitherto it has not been possible to regard Siam as an industrial country, in the accepted sense of the word, and in fact the Siam Cement Company is the first purely industrial enterprise of any magnitude to achieve what may be called a permanent success.

The first conception of a local cement factory originated as far back as 1895 but although thorough tests of raw materials were made at that time with satisfactory results, the attempt fell through owing to lack of financial support.

In 1913, however, his majesty the king became keenly interested in the question, and the scheme eventually materialized in the formation of the present Company, which was registered on the 14th of June, 1913 with a capital of Tcs. 1,000,000, under the style of " The Siam Cement Co., Ltd." Siamese capital preponderates and his majesty is a large shareholder himself.

A site between Bangsue Railway station and Klong Prem, about five miles out of Bangkok, with good facilities for both rail and water transport, was chosen for the establishment of the factory.

The necessary plant, consisting of a rotary kiln 120-ft. long, with corresponding mills for grinding the raw materials and regrinding them when fired, was ordered, and the factory started working in May 1915. Since that time it has been steadily turning out a yearly output of 140,000 casks, which has been practically all absorbed locally. The total export for the whole eight years does not exceed 20,000 casks.

The principal raw materials required for the manufacture of cement are clay, marl or chalk, coal and a small amount of gypsum.

The Company possesses a big clay field adjoining the factory, which will supply sufficient material for at least fifty years, and as clay of the same good quality is found in the whole Menam valley, the supply may therefore be considered inexhaustible.

Marl was at first transported by rail from a deposit near Chong Kæ station, some 180 kilometres north of Bangsue, but later on a deposit of the same quality was found near Ban Moh station, only 90 kilometres from Bangsue, and this being much nearer than the deposit at Chong Kæ, the Company now takes its supply of marl, about 50,000 tons a year, from Ban Moh, reducing thereby its

transport expenses by a considerable amount. The supply of marl is also unlimited.

When the factory was first started, liquid fuel was used for heating the rotary kiln, but it was soon found that coal was far more economical as fuel, and in 1917 a plant for drying and pulverizing coal was installed, since which time pulverized coal has replaced liquid fuel entirely for heating purposes.

Anthracite coal has up to now been imported from French Indo-China, but lately a portion of the Company's requirements of coal has been obtained from a Siamese Coal Mining Company, which started operations some months ago in the Southern (peninsular) part of Siam, and the results obtained from the use of this coal, which is lignite, have been quite satisfactory.

Gypsum is found locally, but as the deposits are far from the railway, the cost of extraction and transport is very heavy, so that local suppliers of gypsum cannot at present compete with prices quoted from abroad.

As all the raw materials were tested very carefully before operations were started, and the plant ordered was of the best possible design and make, the Siam Cement Co., Ltd. has succeeded in turning out Portland cement of good quality from its inception; and the numerous buildings erected in Bangkok during the last eight years, in the construction of which locally manufactured cement was used, prove satisfactorily that the quality of the cement has been kept up to the required standard.

It may be mentioned here that Portland cement is a name accepted throughout the world for cement manufactured according to a certain process, and that the name has nothing to do with the locality. The origin of the name lies in the fact that the color of the first cement produced was the same as that of the rocks near Portland, on the south coast of England.

The trade returns of the Siamese customs department for 1913 and the preceding years show an average import of about 120,000 casks of cement annually, and it was therefore decided to design the factory with a capacity corresponding to this figure; but the use of cement during the last eight years has become very popular, and although the actual output of the factory has been as much as 140,000 casks per year, a considerable amount of cement has also still been imported yearly. It was therefore decided in 1921 to increase the capital of the Company to Tcs. 3,000,000 (of which Tcs. 2,625,000 has been called up) and to install a second and larger rotary kiln, 180 feet long, with corresponding mills for grinding and re-grinding.

On the 14th of June, 1923, when the Company celebrated its 10th anniversary, all the new machines were in working order, and the capacity of the whole plant is now 300,000 casks a year.

The present labor force consists of 230 Siamese (of which 200 are men and 30 women) and about 70 Chinese.

The Siamese laborers are chiefly employed in the factory to look after the machines, for which kind of work they have proved themselves well adapted, while the Chinese are employed for the rougher work of transporting the raw materials, packing the cement and so forth.

The Company has always made a point of providing the labor staff with sanitary dwelling houses, with the satisfactory result that a large number of the laborers have settled down at Bangsue.

In addition to having achieved a technical success, The Siam Cement Co., Ltd., has also been successful financially, although it has had to meet a strong competition from imported cement in the local market, the import duty of 3 per cent. being so low as to afford practically no protection to the home industry.

The following figures of expenditure, covering a period of eight years from May 1915 to May 1923, are interesting:—

| | *Total for 8 years Tcs.* | *Annual average Tcs.* |
|---|---|---|
| Wages ... ... ... ... ... | 957,668 | 119,708 |
| Electrical power ... ... ... | 632,470 | 79,060 |
| *Raw Material* | | |
| Railway freight for marl, etc. ... | 895,390 | 111,923 |
| Coal ... ... ... ... ... | 1,779,630 | 222,453 |
| Pebbles and gypsum ... ... ... | 51,084 | 6,385 |
| Import duty on machinery ... | 57,955 | 7,242 |
| | 4,374,197 | 546,771 |

The total production for the eight years amounts to 1,096,180 casks, or an annual average of 137,023 casks, and the average dividend paid over the same period is 12 per cent.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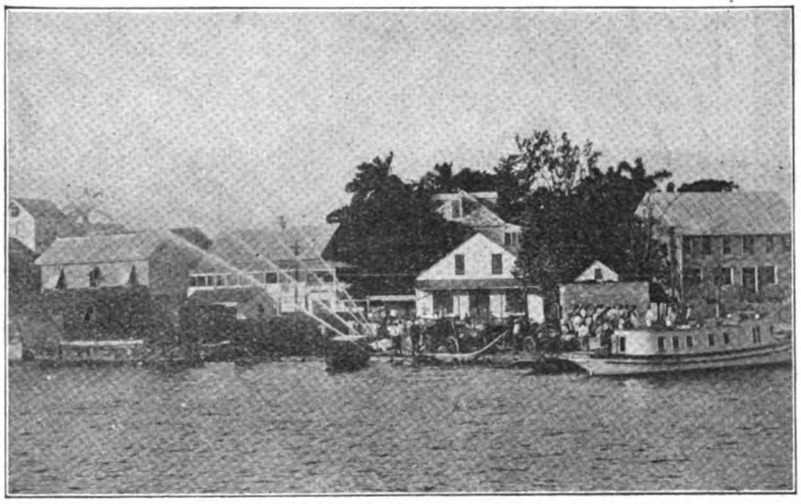

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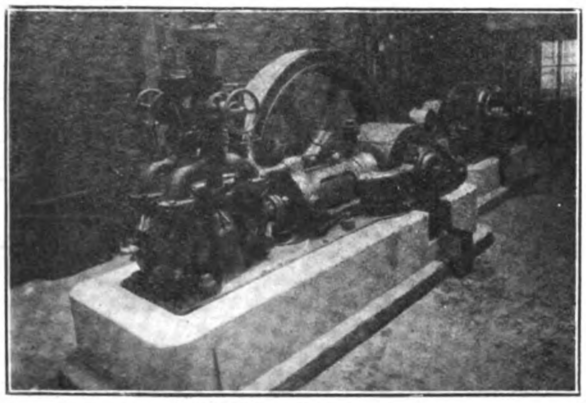

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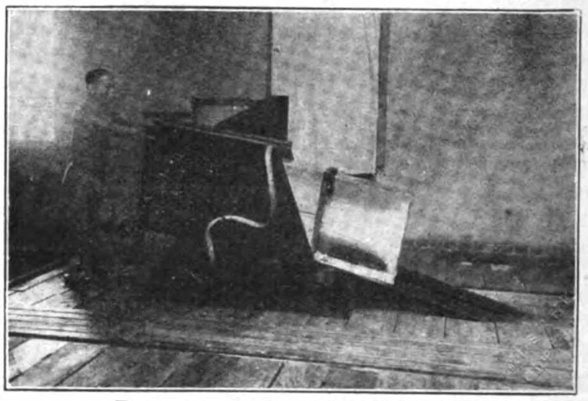

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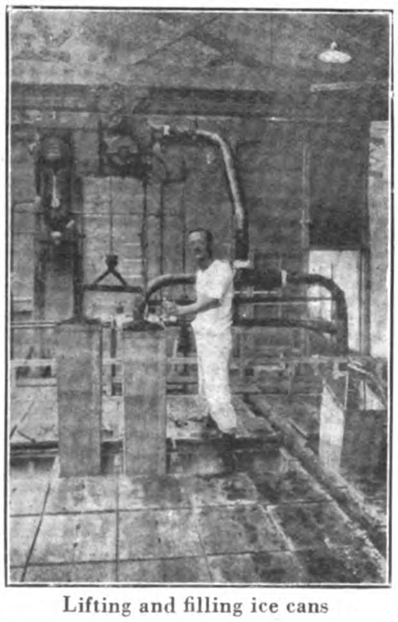

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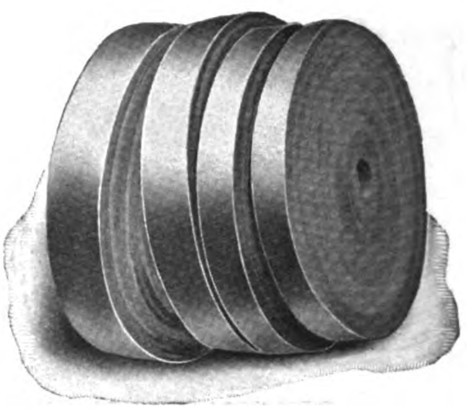

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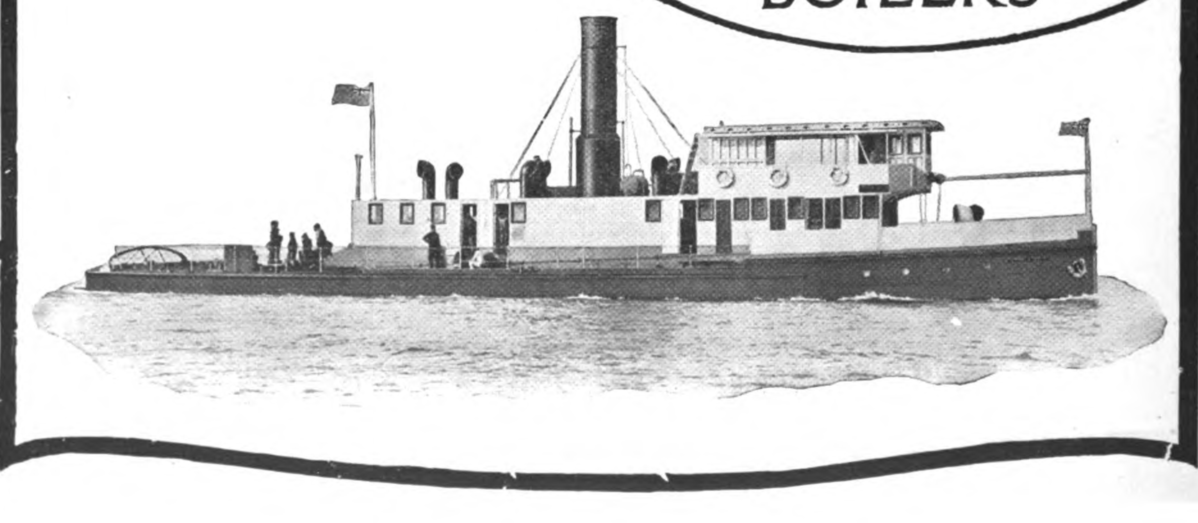

# The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, DECEMBER, 1923 No. 12



# Dollar Diplomacy in China

## Who Will Profit by Intervention?

IT seems incredible that there are Americans so indifferent to the consequences of intervention in the affairs of this country that they are willing to be guided by publicity-seeking leaders into urging their government to take a step that would invite not only the permanent hostility of the Chinese people but turn all other Asiatics against them. The situation over which our government is asked to take control is without precedent. The Chinese seem to prefer the present chaos and disorder to any measure of foreign control. They would never consent to it and would unite to oppose it when they would unite for no other purpose. Their passive resistance would make it impossible of success ; their universal remedy of a boycott would immediately be brought into play against any nation or nations responsible for such interference with their affairs. Intervention on any scale to produce an improvement would involve a large organization. If such intervention was the result of international action would Americans have a position of leadership or even a permanent participation? Would Americans be content with less than equality with other nations in fact and in appearance in positions of control ? Where would the American government find competent and experienced persons with that profound knowledge of China as would enable it to maintain a leadership or even a secondary place in the shaping and execution of policies ?

If international intervention is undertaken, the Japanese would expect a prominent part and would be entitled to it. Their part would be efficiently taken, but the more prominent they become, the more obstructive would be the Chinese, the more abusive and suspicious their allies. This applies with equal force to Americans or British. Would the British be conceded the leadership in such intervention. Would they take the leadership in the sense that carries with it the main risk of a Chinese boycott? Their leadership would have certain advantages. There are, perhaps, more British subjects in the Orient available and fitted for such duties. If they should be put in charge, representing all the powers, the job would be well done, but Americans would suffer in pride, prestige and pocket. The British would take all the commercial advantages connected with such leadership—it would be all they could hope to get out of it. In any event, whether Japan or Great Britain takes the lead, Americans are likely to suffer commercially if they or their government participate in any plan to govern China in whole or in part against the Chinese will, particularly any international plan. If they should be foolish enough to listen to the call of the go-it-alone jingoes, every other foreign interest would combine to defeat them.

If the powers agree upon an administrative organization to carry out the grand undertaking, just what should they attempt to do ? Reform China's administration in all branches, in spots, or along one particular line? Should they just confine themselves to controlling her fiscal affairs and take over the levy and collection of all her revenues, reduce expenses to income and doing all that goes with it, or, simply try to keep order in China, awaiting—what? Should the powers finance the huge deficit between present revenue and present current administrative and other expenses ? Should they take their own armies into China ? If so, under one command ? How many armed men would be required to control the situation, preserve law and order and insure the proper collection and remission of taxes to the central authorities ? Who will pay for this great army ; the foreign nations already bowed down under a load of past war debts, or will the enormous costs be added to China's present obligations ? Or, shall the representatives of the powers sit still, look wise and endeavor to enforce their plans without adequate backing at hand under their own command ?

Should the powers set about the disbandment of China's large armies ? Shall their arms be taken from them ? Is the vast organization needed for the commissary features of this job appreciated ? Of course, the arms can be left in the possession of the Chinese while the foreigners are trying to govern China ? The Chinese are most pacific and would not use them. Should any responsibility be assumed for the immediate future of the million or more disbanded soldiers? Shall they be sent to their homes, with money for travel and temporary living—say a matter of twenty dollars apiece—or more than thirty million dollars ? Should labor be provided for them or other means of support to prevent inevitable banditry on a greater scale than before as a means of sheer existence ? Is the extent of the lack of demand for labor realized ? Not counting the men under arms there are always millions of half-starved, idle men.

There are, perhaps, some super-Americans who can surmount these difficulties and direct a go-it-alone intervention from their swivel chairs in the Robert Dollar building at Shanghai, but they would be the only political geniuses and military leaders with the exact knowledge of China that our country could rely on to carry through to success such a stupendous undertaking. The secretary of state would be relieved of much anxiety and responsibility by the inner council which formulates national policies in Shanghai while the army and navy would be provided with a ready-made staff of trained tacticians who dashed across the Pacific at the first call to arms in 1917 and defied the enemy from the most advanced and exposed trenches on the Far Eastern front at Shanghai. The greatest American tactician had his headquarters in Shanghai at the outset of the great war and skilfully directed the German march on Paris from this dangerous position, until, wounded in self-esteem was forced to evacuate by the tremendous pressure of allied public opinion. As soon, however, as America entered the war, the little Napolean hastened back on the first steamer with a new chief-of-staff, assumed command of Far Eastern operations and drew up complete plans for the next war between his own country and Japan. The generalisimo has since retired. His most capable chief-of-staff who stood bravely at his side during the heaviest bayonet charges on the Shanghai trenches, is now in command directing preparations for the next great forward move. Since the plans for the Japanese campaign and Chinese alliance were pigeon-holed by the war college the dashing young general has been engaged in drawing up plans for an American invasion of China. Everything has been carefully thought out in advance, and when the commanders-in-chief of the American army and navy arrive in the Whangpoo they have only to report themselves to G. H. Q. on the Yang-king-pang, and receive instructions. Their work is cut out for them in advance. By that time the state department will

have practically ceased to operate in China and all official contact with the government at Washington will be carried on by a confidential staff officer appointed by G. H. Q. in Shanghai. This is by no means an exaggeration. It is simply the logical sequence to activities, intrigues and politics indulged by a group who rush in where angels fear to tread.

On the other hand, there are a few Americans at home and in China who have not yet attempted to ram their opinion down the throat of the government. These men, however, are very, very meek. They have to be, as they have learned to their cost that it is most disagreeable and unprofitable to oppose the erstwhile feldmarshal and the group who support him in penalizing all who hold opinions not in accord with their expert views. Now, we unfortunately belong to this penalized and "un-American" minority who entertain other ideas as to how American interests can be best advanced in this country. We are so hopelessly opposed to the plans of the militant oligarchy that we even believe that China should be left to work out its own salvation, no matter how long she takes, or how much injury is inflicted on American trade while she is doing it. China will probably continue for a long time to make an awful mess of things, but bad as this mess will be, no other country can do better. An end must come all things and there is still hope that the merchant and educated classes will bestir themselves to save their country from utter ruin. Intervention in China at this time will fail after precipitating a period of greater confusion and turmoil.

The craze for intervention which followed the Lincheng outrage has worn itself out. The Japanese have come to the very sensible solution that China is entitled to work out her own destiny in her own way and are determined to stand by her while doing it. British opinion at home has also awakened to the danger to their trade and prestige involved in the continuous demand for intervention, and at least two prominent newspapers have registered disapproval of the attitude assumed by the *Times* and *Reuter's* correspondents at Peking. American intervention would prove very profitable to trans-Pacific shipping lines by creating great activity in military, commissary and quarter-master shipments. It might also temporarily increase the circulation amongst the soldiers and sailors of some flag-waving jingo sheet but with a boycott on American goods as the result of such intervention, it is difficult to see where or how any other interests would profit.

There are many inarticulate Americans amongst those whose trade would suffer, who hold to the view that it would be better to confine American efforts to an American plan administered by Americans and concentrate on some particular object that will preserve our standing with the Chinese rather than create the opportunity for any favored group to profit at the expense of other national interests. This feeling is daily becoming stronger as the truth is being forced home that the misdirected activities of the militant minority are already undermining the feeling of confidence reposed by the Chinese in American disinterestedness, and unless these activities are repudiated, the ultimate effect will be a complete loss of American prestige in this country.

There is only one safe way in which the American government can render effective aid to China while she is passing through her transition period. There are high class, dependable and competent American engineers in China: one such American concern has recently finished a great engineering task in Shantung under a contract with the provincial government for the redemption of a large area flooded through a break in the Yellow River dyke. There are other important jobs of a similar nature. There is, for instance, the straightening of the Yellow River through the province of Honan. This river has killed more people than any other river in the world. The flood of 1887, when more than a million lives were lost, was a far greater disaster than the recent earthquake in Japan.

There is also the improvement of the Grand Canal that will restore this ancient artery of commerce and reclaim vast areas for cultivation, furnishing labor for several years to many thousands of suffering Chinese. The contract for its improvement was let by the Chinese authorities in 1916 to an American company, but as yet nothing has been done. Complete surveys and plans have been made, work could be started within two months notice and employment provided for least 15,000 men. Here is a real task, which, when completed, will permit boats of three to five hundred tons to pass through the locks where now only twenty-ton vessels can navigate the rapidly silting and narrow channel. Freight rates would be cut in half and the reclaimed areas provide sites for thousands of new farms and town lots whose sale would more than pay for the cost of the work.

Then there is the Hwai River improvement scheme, dovetailing into that of the Grand Canal, a stupendous undertaking that will eliminate floods and famine and bring contentment and prosperity to many millions of poor people who yearly face the destruction of their crops and homes. The Yellow River, the Grand Canal and Hwai River schemes are all more or less related, part of one huge problem that should appeal to the humanitarian side of all Americans. Then there is the construction of great trunk highways, opening up territories where the railway cannot hope to enter for another generation, creating immediate markets for American motor vehicles and bringing indirect benefits far exceeding the initial outlay. There is also the extension of common education in China, plans for libraries and other projects that will benefit the Chinese and bring cumulative returns to American trade.

Most of these schemes can be financed through the remainder of the Boxer indemnity. The funds that are now being expended to send students to American colleges might well be diverted for some years to these purely humanitarian development schemes. There seems to be little sense in continuing to turn out hundreds of college graduates each year, who, on their return to China, can find no employment outside of politics. The Boxer indemnity funds might be converted by special agreement to some scheme that will bring the greatest benefits at this time to the greatest number and not concentrated in defraying the expenses of youths whose families as a rule are fully capable of financing their superior education abroad. The claims of the great masses of China to a share in the benefits arising from the remission of this indemnity are far greater than the needs of a few hundred privileged students whose selection is now more a matter of politics than fitness.

The money need not be given to China unconditionally. By a carefully devised revolving fund plan with provision for repayments by the provinces or districts specially benefitted and by making use of the legitimate proceeds from the sale of the enormous reclaimed tracts, the fund might be the means of bettering conditions in China for the next fifty years. The plan is practical and feasible and will bring greater and more lasting benefits to the greatest number then the present system of flooding the country with returned students who cannot find employment.

Such a scheme is far better than intervention and will bring many indirect advantages to Americans and preserve the faith the Chinese have reposed in our good intentions towards their country. Such a scheme will promote American trade in every hamlet throughout the vast republic. Intervention without general Chinese consent would precipitate a boycott that would ruin every American trading interest in this country with the sole exception of the very limited few who would, profit enormously by this application of the new Shanghai conception of dollar diplomacy.

G. B. R.

# Changing Friendships

ALL observers of conditions in China agree that the day of the anti-Japanese movement is over. Everywhere the people are more friendly to Japan and are in favor of a closer relationship between the two countries. The earthquake naturally has had something to do with this change in sentiment. The Chinese people are fundamentally decent and will not take advantage of an act of God. But the earthquake came much after the change set in. The change is the result rather of a more favorable policy in Japan toward China and a realization on the part of the Chinese people that disturbed conditions and economic chaos only result from boycotts and the confounding of international relations with domestic politics.

Most of the anti-Japanese tendencies in recent years were the direct result of internal politics. The "ins" always tried to be on friendly relations with Japan. The "outs" always attacked the "ins" as traitors. The most anti-Japanese group for some time has been the Chihli faction, but now that it is in power and has to do business on a basis of keeping itself in power, it has made its peace with Japan.

The point of the matter is that two nations as closely related to each other as China and Japan, cannot be in a healthy economic position as long as they keep quarrelling, particularly when there is nothing to quarrel about. And the Chinese is a sufficiently good business man to know that. He knows that he has lost more boycotting Japan and disturbing his own business conditions than the Japanese have lost, and he knows also that whereas the Japanese are organized for recoverry, he is not.

The textile industry of China proves the point. During 1919, 1920 and even as late as 1921, the Chinese cotton mills were the pride of all progressive persons in China. They wrote articles about the wonderful progress being made. Dinners were given; speeches were made; certain individuals gained an international reputation as the leaders of a great industry which eventually would put Manchester and Osaka to shame. What is the result to-day? The textile industry of China is in a condition of chaos and decay, appalling as it is discouraging to all the friends of China. Mills are closed or running half-heartedly. The industry has lost its force and it would be impossible to sell a cotton mill share on any market at a respectable figure. The industry has gone to pieces not because of bandits and soldiers, but because of too much politics, labor troubles, poor organization and confusion of ideas. It has gone to pot because it lacked recuperative strength to overcome the evil effect of chaotic condition engendered to some extent by the very men of the industry who to-day are seeking the friendship of Japan to pull them out of a hole of their own digging. Altogether unassisted by foreign capital and foreign management this industry will never recover and present indications are that the assistance will only come from Japan.

China has often changed her friendships. There was a time when Russia was the most hated of nations. America has suffered from these sudden veerings of affection. Regional friendships and changing friendships are always evident. For instance, when the Chihli party was opposing Japan because Chang Tso-lin was said to be favorably disposed toward Japan, all parties in Yunnan, Kweichow and Kwangsi were bitterly anti-French. And they still are. During the Washington conference, a returned student attached to the Chinese delegation attempted to stir up an anti-American sentiment because he personally disagreed with what was being done. That sort of thing is always happening, and it is always costly to China. China always pays the bill. And her misfortune is that the masses of the country, a healthy, sturdy, hard-working, friendly people know no way of resisting these forces of evil in land, these men who stir them to passionate loves and hatreds of friendly powers, who desire now only to see in China peace, order, good government and a prosperous people with money enough to buy goods.

# Childish Perversions

POLITICIANS in China are utilizing the disturbed conditions of the country for the purpose of enriching themselves. The politician in China is a different breed from the militarist, who leads bandit and coolie armies to plunder. The politician is generally an educated man, perhaps even a returned student from some European or American university. He has not the excuse of the militarist that he is old-fashioned and without clear ideas of the proprieties of statecraft in a modern world. He knows. And when he plays China for a sucker and holds up foreign interests because he feels that the foreigners will not utilize strong-arm methods to protect their rights, he knows exactly what he is up to.

The worst offender in this direction is Chekiang province, the *tuchun* of which holds his office and exercises his influence largely because of foreign friendship and support. He used to be the defense commissioner in Shanghai and made a splendid record with the result that foreigners, regarding General Lu as enlightened, favored his promotion. His opponents have never been able to unseat him because the foreign city of Shanghai serves as a bulwark against attack. Yet this same General Lu, as *tupan* of Chekiang, has been devising every possible scheme for damaging foreign trade and commerce in his province.

Not only has he imposed illegal taxes, but he is now seizing houseboats belonging to foreign firms and it is even reported that he has taken possession of godowns, of one because the name of the foreign company was painted on the building; of another, because it was not. This same official imposes an illegal cigarette tax because he claims independence from Peking, its laws, mandates and treaty obligations; at the same time he refuses to respect foreign trade-marks because they have not been registered with a new trade-mark registration bureau, the *bonâ-fides* of which has not yet been recognized by the diplomatic corps in Peking. He utilizes his alleged independence to hurt foreign trade; he ceases to be independent when he can hurt foreign trade better by recognizing Peking. His political aim, of course, is to damage the position of the Peking government *vis-à-vis* the foreign powers. His actual achievement is to upset the economic conditions of his own and neighboring provinces and to damage the foreigner's business.

Lu Yung-hsiang is not alone in this nefarious business. He is perhaps little to blame, for he is one of those ignorant militarists who really know not what they do. To blame are the educated politicians who work out these schemes and who make fortunes out of them. Of all the money collected for the cigarette tax perhaps not more than 10 to 15 per cent. goes to the province. The remainder goes into the private pockets of the provincial assemblymen and the tax-farmers who devised the tax. In Kiangsu province, that is exactly what is happening to-day. The *tuchun* and civil governor are both opposed to the tax as illegal and the *tuchun* has made a public statement to that effect. But the provincial assemblymen want the tax and have put it through because of what they can get out of it. It is reported that the tax-farmers will be a group of provincial assemblymen and that the officials are rather fearful to interfere with what rapidly will become a vested interest.

In Anhui, Honan, Hupeh, and in many other provinces the politicians are doing everything possible to utilize the generous spirit of the foreign powers since the Washington conference to further their own ends. From Anhui reports come that the transit pass of the Chinese maritime customs, which is suppose to exempt goods from the *likin* tax, is refused recognition by *likin* collectors. One can go right through the country, up to the very gates of Peking, and perhaps beyond, to find well-planned attacks on the treaty rights of foreigners.

The solution of the problem, of course, is concerted action of the powers in making it clear to these young politicians that trickery never got anything for a nation, that sooner or later the powers grow weary of tricks and childish pranks and will set the house in order and spank the child. They have got to be shown that a treaty obligation will be enforced in China and that although it is admitted that some of China's treaties are unilateral in their benefits, China must place herself by her own means, in a position of ending an umbrageous position. Great Britain, the United States, Japan and other powers have not reached their present position through the charity and friendship of any other nations. The position will be the same with China. It is up to her to modernize herself and to become a decent citizen of the world if she wants to end the period of extraterritoriality and of limited autonomy. But she won't end them by trickery and deceit and indecent treatment. She won't end them by regarding treaties as scraps of paper. She won't end them by ignoring contractual relations.. The conduct of her politicians to-day is only tightening the noose around China's throat at the one moment in her modern history when she had a chance to free herself by legitimate means of all unfavorable conditions.

# A Study on the Fluctuation of Copper Currency

*By Wu Yuan-hai*

THE problem of copper currency is the most complicated in the study of the money system of China. It is by far harder a problem than silver currency, no matter from whichever standpoint we look at it—from the historical standpoint, or the political, or the economical, or the financial, or the social. But we must be aware of the fact that, it never really become a problem until the end of the late Manchu dynasty; and since the installation of the republican government, following after many other social, political and economical problems, it has begun to attract the attention of the public, and become more important since the year 1919. Up to the present, the problem is still unsolved, and most probably will become a national problem since, and will be seriously studied both by the practical and the theoretical.

## Position of Copper in the History of Chinese Coinage

When we look into any authentic history of the Chinese nation, we will at once find out that, the history of the adoption of copper as a medium of exchange is as old as the history of the country itself. It is true that silver was also denominated in transactions at a later date, but it had never been put into the form of coins until the later part of the Manchu dynasty, when the eagle dollar was introduced into this country and found convenient, so similar form of silver coins were being minted. Although the term "tael" had been in usage much earlier, but it is an abstract measurement, and no such coin as representing a tael has ever been made. In reality, China has a copper period up to the second half of the last century, when foreigners came in and brought with them the silver currency.

The present is the period of transition from copper into silver. Both by virtue of the law for the national currency and the rising of the standard of living, silver has gradually gained its place as standard money in commercial centres and large cities. Whereas in the interior and in smaller cities copper still retains its old day prestige.

As a result, China at present is having a bimetallic system of money, with its peculiar characteristic of being composed of silver and copper instead of gold and silver. In fact, both copper and silver are given the full legal tender by the usage of society in spite of the law for the national currency. According to the currency law, copper coins, as subsidiary money, are legal tender only up to the value of one dollar in one transaction; while in practice conformity to this law is not at all taken into consideration. In such a state of monetary system, unless a fixed ratio of exchange between both metals are established and enforced by law, the monetary system itself will be deteriorated and hence occasion serious consequences, as in the case of China to-day, under unlimited coinage and legal tender, in unlimited amounts.

Now copper coins are by law subsidiary money, but in fact its coinage is unlimited and legal tender full. On the other hand, if we take it to be a standard money side by side with the silver dollar, we find that its intrinsic value is not up to the fixed ratio as it should be. At once the matter becomes the most serious at this time of the history of Chinese coinage.

## Causes of the Depreciation of Copper Coins

(1) Overminting of New Copper Coins.—In fact it is unlimited minting. These new coins appeared first in the year 1919. According to the report of the Tramway Company in 1921, there were 27 new copper coins in every 1,000 coins the Company received in 1919; while at the end of 1920 the amount rose up to 84 per 1,000, and in January 1921 to 108 per 1,000. Take for instance the 10-cash copper coins, in 1915 there were about 22,000,000,000 pieces in circulation; and in the years 1919 and 1920 the amount of new coins increased made up a 12 per cent. of the total, i.e., 2,600,000,000. Another proof of the overminting of copper coins comes from the trade register of the customs house. The import of brass and copper has been increasing during the recent years. In 1913 the total value of copper and brass imported amounted to 7,372,000 H.K. taels. In 1914 the amount was slightly increased; while in 1915, 1916 and 1917, the amount had been considerably decreased. Suddenly in 1919 the amount rose up to the double of the amount of 1918 which was a little higher than that of the preceding year. In 1920 the amount was increased to as much as 12,935,489 H.K. taels. Now this confirms our first fact that in 1919 the overminting of new copper coins began to take effect. We also must bear in mind that very little of the imported brass and copper was put into industrial or art use, which again proves the fact that the greater portion of them was minted into copper coins. Such reckless minting is mainly due to powerlessness of the central government, and hence the practical independence of the warlords who have found the minting of copper coins a very good means to enlarge their private treasuries. Minting machineries are imported to this country every year, and when they cannot find time enough or facilities enough, they used to entrust the business of minting to a certain foreign country secretly.

(2) Debasement of the New Copper Coins.—At the first sight one can easily reveal the fact that new copper coins are thinner than the old ones, and hence lighter. Upon an analysis, we further find out that the copper content of the new copper coins is not up to the prescribed percentage by law for the national currency. At an experiment on 50 different kinds of copper coins, we find out that about one-third of the new coins are at an average not up to the lawful weight, and certainly more than half of them fail to have enough copper content. As to the old coins in these 50, all of them manage to pass the standardized weight and content. To state part of the law for national currency, every 2 cents copper piece should have a gross weight of 28 candareens, and a copper content of 95 per cent.; while every 1 cent copper piece, a gross weight of 18 candareens, and fineness same as 2 cents copper piece. As to the difference between the 1 cent and 2 cents new copper in respects of weight and fineness it naturally follows that in both respects the former is the more worthy.

(3) Unlimited Amount in Individual Transactions.—"The amount of copper pieces involved in one transaction shall not exceed $1.00":—this is the article in the law for the national currency in respect to the legal tender of copper coins. As copper coin is a subsidiary coin, so its legal tender must be restricted. But Chinese customs and usage do not conform to this restriction. As copper coins had for quite a long time been popularly used and socially recognized as the standard money of this country, so in this particular time of transition, unless the government is strong enough to enforce this restriction, such unlimited transactions will of course encourage and render the unlimited minting of debased copper possible. China should be considered to be a country in which such things as "System of Money" and "Standard Money" are merely terms in scraps of paper, and in fact no system of money or standard money has been in existence.

(4) Extravagant Issuance of Copper Notes.—Paper is surely much cheaper than copper. Then according to Gresham's law cheaper money will drive out dearer ones. However, in the case of copper coinage this law does not work to that extent as it should. Instead of being driven out by cheaper copper notes, copper coins have been affected by the notes and brought to the same exchange level with them. This result is just the opposite to the result of silver notes. We, of course, wish to know the reason why silver notes must either drive out silver bullion or silver coins or depreciate their own face value; whereas copper notes

do not drive out copper coins or depreciate by themself, but make the copjer coins to depreciate side by side with them. This is a matter of psychology. Generally speaking, people do not consider the value printed on the copper notes are large enough to necessitate a questioning into the credit of the parties who issue them. On the other hand, the minimum face value of any silver notes is one dollar, which is, of course, a considerable amount to the average Chinese citizen. Such would certainly causes copper currency cheaper in places where copper notes are issued, but the difference will never be very great until Gresham's law begins to take effect.

## Cause of the Appreciation of Copper Coins (Especially in the Last Few Months)

It is a very abnormal happening to find that all the public had long been troubled by the depreciation of copper coins and just able to device some means to prevent its growth, now there suddenly arises the problem of the unprecedent appreciation of the same copper coins. We all just hope that the market value of copper coin will not depreciate any more, but suddenly we are afraid it might appreciate too high. This problem is new and has come to existence only for a few months, so it is still out of our power to ascertain what are the real causes of this appreciation. Yet we can get the general opinion of the public, which certainly will give us the explanation at least for the present.

Almost every reasonable person in Shanghai will tell you that the recent rising of the market value of copper coins is due to speculation. Some body or party is controlling the whole scene at the back of the curtain. We cannot say who are to call to account for this rising, but the ones who have the greater portion of copper coins in their hands are the ones mostly suspected. There are two reasons to believe in this explanation. Firstly, although new copper coins are prohibited to be shipped to Shanghai, but smuggling is still getting on pretty well off; and furthermore we certainly can assert that the coins that have already been put into the Shanghai market are still remaining in the same place, as generally their market price is cheaper in other seaports or interior cities. Secondly, the people and merchants of Shanghai have learned to speculate since the beginning of the great war (of course they also practised speculation in former days, but not so varied and unscrupulous), and after the bursting of the stock exchangv bubble, they have found nothing to meddle with and just happened to find a victim in copper coin.

## Effects of the Fluctuation

(1) Harm to The Money System.—Copper coin is a subsidiary money, and so beside the intrinsic value, the mint value, and the face value, it should not have any market value. As soon as it is given a market value it must either become a commodity or somehow or other considered to be one of the standard money also.

(2) Injury to the Small Shop-keepers.—Take the Tramway Company as an example to compare with. In the fifteen years between 1908 and 1921 the Company sustained a total loss of $4,102,933, ranging from $50,812 to $658,572 per year. Now the Tramway Company is a large company, so although the loss is great but the profit in business will compensate for it. It is really the small shop-keepers and the wage-earners who suffer the most and feel it the least. It is not uncommon to find that the small shopkeeper had to sell his goods at the old prices, while because of the exchange he buys at a higher cost. As to the wage-earners, inspite of the repeated demand made upon the employers for a raising of their wages, yet the rise in wages can never be proportionate to the rise in price of goods. At this point we might just as well point out that the recent prevalence in strike among the Chinese factories is none the less due to the depreciation of copper coins.

(3) Injury to the Average Citizen and Wage-Earner.—As a rule, whenever the exchange value of money in use is depreciated, there will follow a general rise in price. Copper is commonly used in retail transactions, so any changes in its exchange power will affect nothing of the wholesale prices of goods. Certainly the average citizen and the wage-earner are the ones to suffer. In recent years the wholesale prices of certain goods have a tendency to rise also: this is due to the fact that demand is greater than supply. But some goods, when their wholesale prices do not rise or even drop, and yet their prices rises in the market, which fact is certainly a result of the depreciation of copper coins. One most important fact to be borne in mind is that, prices of goods will never resume their old standard again, even though the price of copper coins may be dropped. The recent appreciation of copper coins affords a good proof: practically not one of the daily necessities or other sort of commodity has been lowered in price. Instead of what we expect, prices of goods shows sign of rising upon every fluctuation of copper coins. This is the only and the safest way of the small shop-keepers to prevent themselves from being involved. Consequently, the common people will suffer.

## Remedial Measures

(1) Prohibit Influx of Copper Metal.—As we have seen in the preceding paragraph most of the brass and copper imported are but into coins, so the best way is to check their unlimited importation. Then the provincial mints will not find enough copper metal to mint coins to the fullest extent.

(2) Stop New Copper Coins being Shipped from One Locality to Another.—That is to say, every locality regulates its own need and lets just the right amount of copper coins to float in the market. Such measures have generally been adopted by commercial and political authorities.

(3) Establish a Law to Punish the One Who Speculates.—This is necessary. There is a law that prohibits using too much an amount in one transaction, so there are orders that stop over-shipping. But there is no law or order from any authorities that prohibits people hoarding up a large quantity of copper coins with the main purpose of creating a better market and hence reaping profits.

(4) Supervision of the Various Mints.—Minting of subsidiary coins will give some profit, and this is what most of the governments of the world take to be compensation for the loss in minting the standard coins. Certainly the minting of debased subsidiary coins will yield still greater profits. Thus supervision is needed with regard to the number, weight, and contents of the coins.

(5) Giving Every Description of Copper Coin a Market Value of Its Own According to What it Worths.—Not according to its face value, but according to its intrinsic and extrinsic characteristics, a copper coin is given its market value or price. There is a general tendency towards this respect, for instance, in the market we find the price of lighter coppers cheaper than that of the heavier ones, but, of course, the discrimination has never been made so accurate, and the assortment not so strict.

## Radical Measure

Radically speaking, the fluctuation of copper currency is a natural outcome of the government's lack of ability to enforce the law for the national currency. A coin, no matter standard or subsidiary, has no price but has value. The standard coin is self-contained, so there is no question with regard to its having a price or market value as it is economically termed. But in the case of subsidiary coins, they have an intrinsic value, a mint value and a face value. It is not self-contained,—its face value is greater than both its mint value and its intrinsic value. So long as the government can limit the amount of them according to the need of the people, and restrict the amount in individual business transactions; as well as afford to receive or exchange them according to their full face value, there is no question about the depreciation of the subsidiary coins. The Chinese government cannot fulfil all the requirements, and thus copper coin, as a subsidiary money, will always acquire a market value (price) irrespective of its being new or old, relatively heavier or lighter.

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THERE are thirty electric power companies in central Japan, practically all of which are hydro-electric developments. This section is also the scene of Japan's largest cities and industries, so that within a circle of 150 miles radius are located both the nation's principal users of electric power and her principal sources of supply.

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So generous was nature in providing waterpower sites in Norway that to-day electricity, water-derived, is in very general use. With less than three million inhabitants, Norway stands second to America in the prevalence of electric cooking and heating. The consumer buys his electricity at so much per year instead of on a current consumption basis.

# Japanese High Voltage Power Transmission Systems—II

By S. Q. Hayes, General Engineer, Westinghouse Electric and Manufacturing Co.

From "The Electric Journal"

*Super-power* systems in the eastern part of the United States and in California have been thoroughly discussed in the American technical press within the last few years, but little has been published about smilar developments in other countries, so that Japan's progress in high-voltage power transmission should be of interest. In this article, it is the intention first to take up some of the more general features in connection with the larger power transmission systems and then to go into further details relative to certain interesting features of the generators, transformers, synchronous, condeners, switching equipment or other important devices.

(*Continued from page 699*)

IN Osaka, the Daido Electric Power Co. may arrange to tie in their system with that of the Osaka Electric Co. and later may make connections with the Nippon and Ujigawa systems. Within the next ten years the combined output for these four systems, feeding into Osaka, will be about 1,000,000 k-v-a.

## Osaka Electric Light Company

The main interconnections of the steam plants of the Osaka Electric Light Co. are shown in Fig. 10. At the Kasugade No. 1 station, there are three 12,500 kv-a turbogenerators supplying power in bulk to the West Ajikawa station. The Kasugade No. 2 station is provided with two 25,000 kv-a, 11,000 volt turbogenerators feeding through oil circuit breakers to a double set of bus-bars. These busses supply three groups of feeders, one for the local service, one connecting to Kasugade No. 1 and one connecting to East Ajikawa station.

In the West Ajikawa station, there are five 3,000 kv-a turbogenerators connecting to a sectionalized bus. Tie feeder connections are made to the East Ajikawa generating station.

In the East Ajikawa station, there are two 5,000 kv-a generators and one of 12,500 kv-a. The generators are connected either to groups of feeders or to a sectioned main bus. Fig. 10 does not show any of the tie connections to the Daido circuits but indicates 125,000 kv-a in steam turbogenerators on the system.

## Nippon Power Company

In competition with the transmission system of the Daido Electric Power Co. and the distributing system of the Osaka Electric Light Co., the transmission system of the Nippon Power Co. and the generating and distributing system of the Ujigawa Electric Co., supply power to the Osaka district. For a number of years the Ujigawa Electric Company has been transmitting power at 55,000 volts, 60 cycles, about 21 miles to the Noe substation and an additional six miles to the Osaka substation.

The increasing demand for power in Osaka led to the development of hydro-electric installations at greater distances from Osaka and the Nippon Power Co. was incorporated for this purpose. The active work on the Nippon system at present covers the transformer station at Sasazu, a generating station at Seto, several switching stations, and the receiving station at Osaka. Probably the next installation will be a new steam station at Osaka.

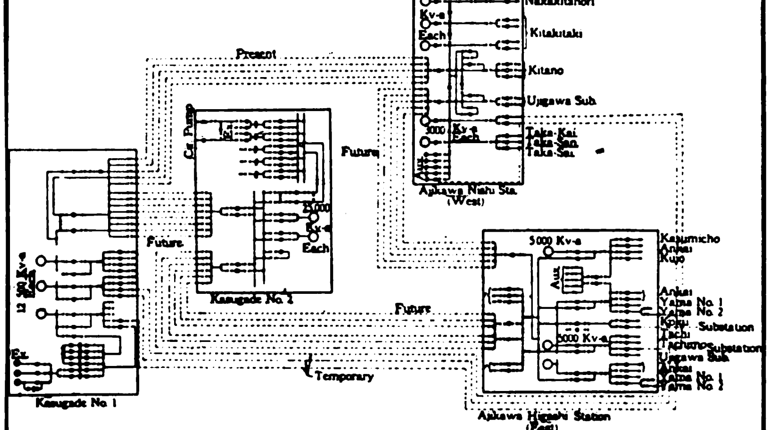



FIG. 10—INTERCONNECTIONS OF THE OSAKA ELECTRIC LIGHT COMPANY'S GENERATING STATIONS

The equipment at Sasazu is based on two incoming lines at 60,000 volts, with two 25,000 kv-a transformer banks stepping up from 60,000 volts delta to 154,000 volts star. A tie connection to the 154,000 volt Daido transmission system will be made later.

The Seto power plant, now being built, is to contain four 7,500 kv-a, three-phase, 11,000 volt, 400 r.p.m. waterwheel generators with direct-connected exciters and one motor-driven exciter. Connections are made with two 5,000 kv-a generators in the neighboring station of Maseyama. There will be two banks, each consisting of three 5,000 kv-a single-phase transformers, stepping up to 145,000 volts.

Not far from the Seto station is the Seki switching station where tie connections will be made to the systems of the Hakusan Water Power Co., and the Daido Electric Power Co. From the Seki switching station to the terminal station at Osaka is a distance of 132 miles. A number of switching stations will be used for sectionalizing the 154,000 volt transmission lines.

The main function of the Nippon Power Company is to furnish power to Osaka to supplement that supplied by the Ujigawa Electric Company. At the Osaka substation, now under construction, the switching equipment will control the following circuits:—

- Two 100,000 kv-a, 140,000 volt three-phase 60 cycle incoming lines.
- Two banks of 30,000 kv-a each, 140,000-50,000-11,000 volt step-down transformers.
- Four 25,000 kv-a, three-phase, 50,000 volt, 60 cycle outgoing lines.
- Two 25,000 kv-a, 11,000 volt synchronous condensers.
- Four 5,000 kv-a, 11,000 volt, three-phase, 60 cycle outgoing feeders.
- Two 140,000 volt busses with tie switch.
- Two 50,000 volt busses with tie switch.
- Two 110,000 volt busses with tie switch.
- One grounded neutral circuit of transformers on the 140,000 volt line.

The oil circuit breakers will have rupturing capacities of 4,300 amperes for 154,000 volts, 8,000 amperes for 50,000 volts and 33,000 amperes for 11,000 volt circuits respectively. Provision will be made to supply

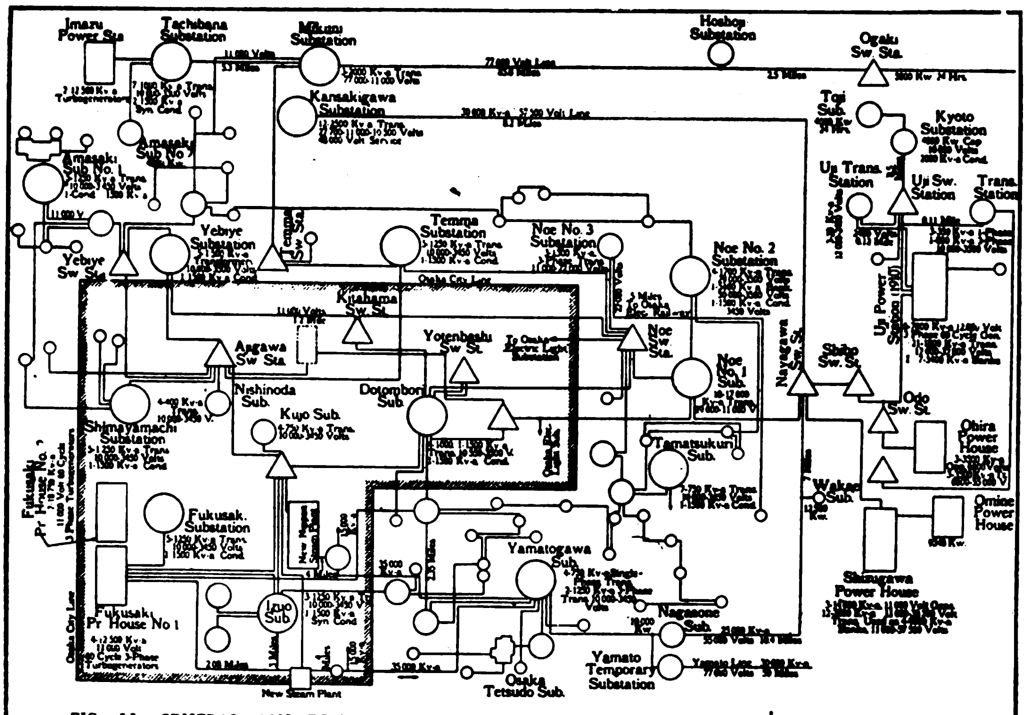


FIG. 11—GENERAL CONNECTIONS OF THE UJIGAWA ELECTRIC COMPANY'S POWER SYSTEM

oil for the outdoor circuit breakers, with a congealing point of—40 degrees C. to prevent it from freezing.

The transformers for the Osaka substation comprise seven single-phase units arranged in two banks of three each with one spare. The capacity of each bank is 30,000 kv-a at 140,000 volts, for the star connected primary, with two full capacity five per cent. taps and reduced capacity taps for 120,000 volt service. The capacity of the secondary winding is 37,500 kv-a at 50,000 volts star with seventy-five per cent. lagging power-factor, and the capacity of the tertiary winding is 25,000 kv-a at 11,000 volts delta. The 140,000 volt winding is connected to the incoming lines, the 50,000 volt winding is used for outgoing power and the 11,000 volt winding is for 25,000 kv-a synchronous phase modifiers and outgoing feeders.

The synchronous phase modifiers are three-phase, 60 cycle, units having a capacity of 25,000 kv-a at zero per cent. leading power-factor and 17,500 kv-a at zero per cent. lagging power-factor. Each unit is provided with a 250 volt, shunt-wound exciter and a wound secondary starting motor which is capable of starting the phase modifier and bringing it up to speed three times in succession with three minute intermissions, and is capable of driving it for a period of 30 minutes when charging the transmission line for synchronizing with other systems at Sasazu.

The 50,000 volt feeders from the Osaka substation will connect with the Noe substation and the new steam station of the Nippon Power Company and possibly form part of a 50,000 volt ring bus around Osaka. The 11,000 volt feeders probably connect to the Fukusaki steam generating station of the Ujigawa Electric Co. and supply power to several substations.

## Ujigawa Electric Company

The general connections of the Ujigawa Electric Company are shown in Fig. 11, the connections to the Nippon system being made through the Noe substation and other points.

Lake Biwa, the largest lake in Japan, has for its outlet the Ujigawa (Uji River). A short distance from the lake there was installed, in 1909, the first hydro-electric station of the Ujigawa system. This plant, the Uji power station shown in Fig. 11, originally contained five 5,500 kv-a generators of German make which were not satisfactory and were replaced by 7,000 kv-a Japanese built generators, so that the station now contains six 7,000 kv-a generators, one being a spare, wound for 12,000 volts, and seven 5,400 kv-a transformer banks, one being a spare, which are connected delta low-tension and star high-tension for 55,000 volt service.

Two 55,000 volt outgoing feeders, from the Uji power station, pass through the Shibo and the Nayagawa switching stations to Noe. Lines are tapped into these 55,000 volt feeders, at the Odo switching station, from a second hydraulic station, the Ohira plant which contains three 3,500 kv-a generators and three 3,500 kv-a three-phase transformers. The Shizugawa station, now under construction, will contain three 14,000 kv-a, 11,000 volt generators, and will have a tie connection to the Omine station. The Shizugawa station will contain four 9,000 kv-a transformer banks and will have two outgoing 55,0C0 volt feeders tying in at the Nayagawa switching station.

To supplement the hydro-electric power, the Ujigawa Power Co. has the Fukusaki steam station in Osaka. One part of this station contains four 12,500 kv-a turbo-generators which supply power to fifteen 11,000 volt outgoing feeders; the newer part has two 18,750 kv-a turbo-generators.

In Osaka and vicinity, there are about twelve important substations, each having one or two synchronous phase modifiers of about 1,500 kv-a rating and a total installed transformer capacity of about 75,000 kv-a. Other stations without phase modifiers have a total capacity of about 25,000 kv-a so that there are roughly 100,000 kv-a available, at 3,500 volts, for the local distribution in addition to large amounts of power distributed at 11,000 volts.

The Ujigawa system is used primarily for power distribution and requires special permission to supply current for lighting purposes, as the Osaka Electric Light Co. takes care of the lighting requirements of Osaka and vicinity. Power is supplied at 11,000 volts by the Tamatsukuri substation to the Osaka Electric Railway at

(*Continued on page 760*)

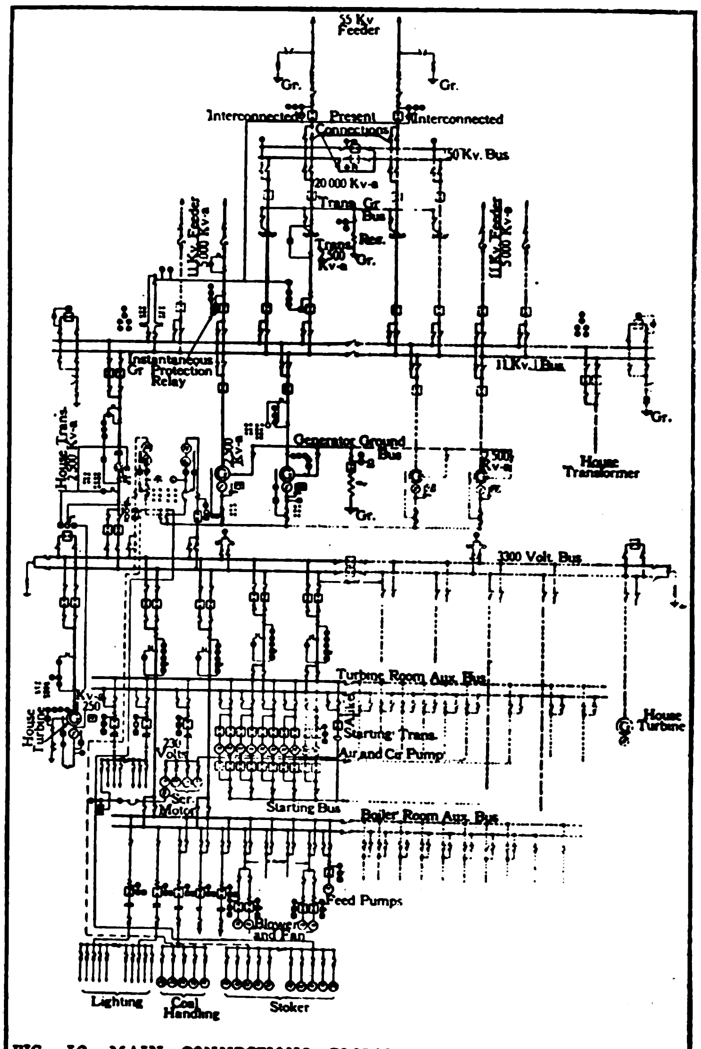
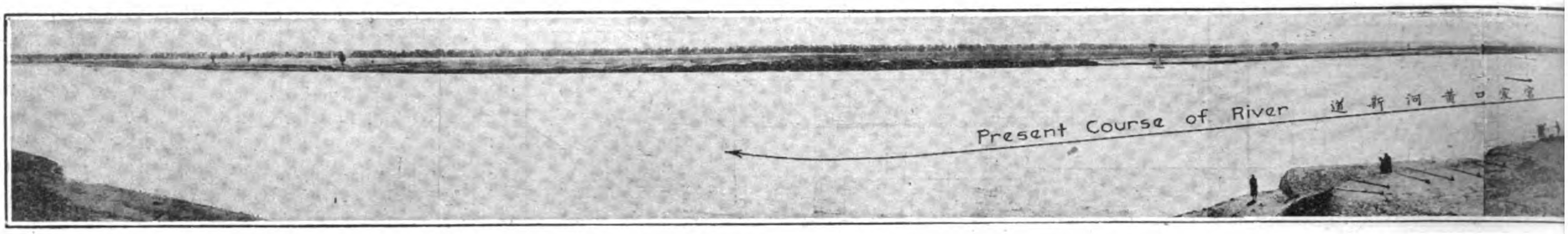


FIG. 12—MAIN CONNECTIONS PROPOSED FOR THE NEW NIPPON STEAM GENERATING STATION AT OSAKA




# How Americans Can Intervene in China

## A Proper Use for the Boxer Indemnity Fund

THE acceptance of the Yellow River diversion project carried out by the Asia Development Company marked the completion of a notable work whereby approximately 1,800 square miles of land were reclaimed and over a quarter million refugees enabled to return to their lands, rebuild their homes and harvest a bountiful crop planted in June of this year after the river was diverted to its proper channel. The story of this engineering feat is one which should serve as an object lesson and influence American chambers of commerce and other bodies to bring pressure to bear on their government along lines that will make for the further carrying out of similar schemes that will add more to national prestige and trade expansion than all the prevalent demands for armed intervention. The happiness of three hundred thousand persons in possession of their homes recovered to them from the bottom of a great sea of flood waters by the wizardry of modern engineering science is certainly something that overshadows in importance the depredations of a few bandit bands in the same locality. The story of this remarkable feat, which can be duplicated many times over in the same provinces, is best told in the following correspondence from Tsinan on the occasion of the acceptance of the work by the governor of Shantung:

Chief Engineer L. Fred Patstone and a group of Yellow River officials inspecting the work. Wang Tze Feng, representative of the Governor, standing next to Patstone

Two years ago, in August, 1921, the Yellow River broke through its northerly dyke near Li Ching Hsien, flooding 1,800 square miles of rich farm land at the mouth of the river and rendering 300,000 persons homeless and destitute. To-day the river is switched back on a new and safer course, the flood menace at that point has completely vanished and the gladdened people are returning to their homes to begin anew a life struggle in a region to which an unkind destiny has contributed more than the usually allotted share of human sorrow.

For 4,000 years of recorded history the Yellow River has devastated human life and progress along its changeable courses over that great alluvial plain, which geologists tell us was eons ago a great Inland Sea, with the mountainous parts of Shantung merely a large island off the coast. During this time it swept its millions of tons of loose soil down from the plateaux of Western China, gradually and inexorably throwing up in its path a huge silt barrier, until it filled the Inland Sea and thereby joined the Shantung island to the mainland. At the same time the stream, baulked and headed off by its own handiwork, and the mountainous country ahead, bored its way first to the north then to the south of the Shantung mountains, wherever its waters found a line of least resistance. And at each of the ten or more recorded alterations in its path it scoured the countryside with soil, ever building its almost insurmountable barriers, to thrash back again and again in desperation, devastating human life and property and laying waste great areas in yellow desolation.

After the rocks was dumped in the dam it was made water-tight by means of kaoliang packs and earth fill

And still men fought with it. Equipped with but a meagre knowledge of hydraulic science men have grappled with this writhing creature of the western watersheds since before the dawn of history. They fought against it, with it and for it, ever digging ditches, building dykes and struggling to confine it to a reasonable course. But despite their battles, their coaxing, their primitive appeal to the gods, the water dragons and the turtles, whom they charged with breaking down the dykes, this not only great but powerful elemental thing sloughed through their dykes, filled up their ditches and laughed at their gods.

Following this 1921 break the Chinese of Shantung, led by their progressive civil governor, General Hsiung Ping-chi, were face to face with the repeated failure of the old Chinese methods and determined to call in the aid of the west to help solve their problem. Even then it was not without some doubt that they entertained tenders from a foreign firm, for there was still a root prejudice against foreign methods. It was held that foreigners had but a few decades experience to guide them, whereas China had 4,000 years and more. The foreigners would ask much money, they would throw much of it away, since they were great spenders, and in the end their efforts, experimental as far as China was concerned would, without doubt, end in no material benefits. These and similar gloomy forebodings were among some of

the things with which the courageous civil governor and his associates were faced.

But the doubters were soon due for a series of revelations. Upon examination of the tenders it was found that the foreign firms bid was more than one million dollars under than the lowest Chinese bid. The Chinese tenders were based on the old methods. The foreign on the modern. Here was astonishment. The province of Shantung would have had to pay the lowest Chinese bidder nearly three

View during excavation of leading channel, 12,550 men employed in length of one mile

million dollars, but the foreign bidder asked only one million and a half. It was a chance not to be idly dismissed. It was a chance for the people of Shantung to see what foreign, modern science could do for them and at a marvellously lower figure than by their own ways and means. On November 22, the civil governor signed a contract with the Asia Development Company, and in December of the same year, for the first time in history, foreign science was applied to China's greatest material problem.

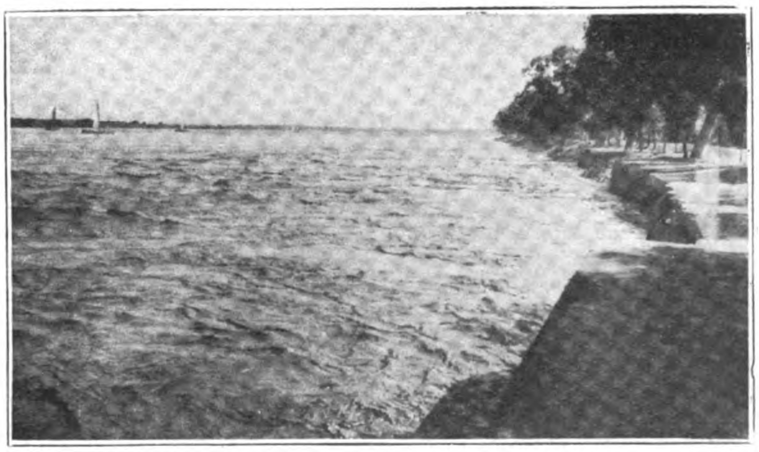
The price was not the only revelation in this contract for the Chinese marked with continued approval and pleasant astonishment the speed and workmanlike manner in which the foreign company set about its tasks. The dramatic side of the struggle was also not lost upon observers, for here was the advanced science of the west on trial for the first time in a court of conservative, skeptical judge and jurymen. Would the west succeed? Would it fail? And in the answer probably lay the destinies of China's own people, for if the west should fail then it would throw back the scientific advancement of this people possibly several decades, and at the same time, lose for the west the natu.al part it must play in the economic and industrial development of a great eastern nation.

But the west succeeded. Guided by modern trained engineers and aided by their appliances 25,000 laborers were thrown into the battle against this yellow destruction. Great obstructing arms, after the manner of a giant traffic policeman, were thrown across the traffic, huge channels, one a mile the other seven miles long, were cut across the country, long, impregnable dykes weɹe stretched over the plain and without hesitation a great twisted bend of the river was eliminated, as calmly as a surgeon would remove a useless and irritating appendix. With the co-ordination that comes with applied science the progress of these colossal surgical operations moved ahead simultaneously. All the while the Yellow River dragon threw its forces into the struggle. It sentdown flood waters, and when they failed it threw into the breach great ice packs, which wrestled with and battered against the dykes and groins. But they held. The west was gaining its mastery. The mechanical pile driver plunged its 75-foot Oregon piles into the river bed, moving irresistably against the river's attacks. Behind it came the creeping barrage of 53,000 yards of rock ballast, held in a framework of piles, then came the reinforcements in the shape of kaoliang packs to defeat seepage, the river's last hope of success.

Ironically the river that fought the engineers, carried from 120 miles up stream, the rocks with which they defeated it. In the end four miles of dams and dykes threw their weight into the struggle and at a given moment the river was asked to surrender the fight by retreating through a prepared course eight miles long. On May 15, 1923, the Yellow River was let into the new coures, and accepting defeat with good grace, helped its victors by scouring a deeper and larger channel on its new journey to the sea in an old bed which it had itself long since despised and abandoned.

It was this victory that hundreds of Chinese and foreigners from many parts of Shantung and China, assembled in Tsinanfu on November 2, to celebrate.

In accepting the completed work, Civil Governor Hsiung gave high praise to the contractors for the manner in which they had conducted the work and especially for the kind treatment accorded the 25,000 laborers. He acknowledged the advantages of using machinery and modern scientific methods in controlling the Yellow River and hoped that they would be followed in the future. The Asia Development Company has completed with Chinese money the first of a great series of conservancy works which have been contracted for by Americans under loan terms which the American people apparently refuse to subscribe to. This company should be encouraged to carry on and complete its mission, and in default of loans, which seem impossible to raise, the American government should extend every assistance within its power to carry out further schemes of a similar nature by diverting the Boxer indemnity funds from educational work at this time in order to provide employment for many young engineers and bring the greatest happiness and good to the greatest majority in China. The millions of impoverished country people who are ground down by merciless taxation in order to raise the funds which go towards defraying the expenses of educating the sons of rich men in America are entitled to a share in our philanthrophy. There is no better way to bring happiness to these people than in following up the work of the Asia Development Company and providing the finances whereby this company or other successful tenderers can take up the further improvement of the Yellow and Hwai Rivers. This is the sort of intervention that will bring its own rewards and offset the pernicious activities to destroy American prestige in this country.



Yellow River in flood the early part of August 1923. Note the kaoliang packs protecting dyke

# The "Lake" Monolithic House

## Homes by the Mile; An American Invention Offered to Japan for Reconstruction

ONE of the most interesting plans submitted to the Japanese government for the rapid rebuilding of Tokyo and Yokohama comes from Captain Simon Lake of submarine fame who has prepared special designs of a concrete house, which he calls monolithic, for use in Japan. This invention provides for the casing, in complete slabs of specially prepared concrete, the whole side, or end or floor or roof of a house, with standardized window casings and door frames inserted. These slabs, it is claimed, are capable of withstanding jar and shock, and may be put together speedily by the aid of a huge crane, which straddling the street, drops the big slabs into place, with a minimum exertion of man power and a maximum of speed.

### "Homes by Mile"

"Homes by the mile" is the term which Mr. Lake employs to describe his invention and production.

This in other words means homes built by machinery—a bigger application of the practice of the use of horsepower rather than man power. There have been ventures into the realms of ready-made houses—homes ready to set up, but these are dwarfed by the big program which Mr. Lake has worked out. In what he has done there is a wide variety of opportunity for exercise of distinctive tastes and at the same time the application of the great features of economy and speed in production.

Houses by the mile and erected at amazing speed on the Lake plan will solve the problem of Japan's immediate necessity, and wherever applied, may serve to abate the present-day high cost of building.

The process of building is decidedly novel. It is an adaption of concrete, but in its application, entirely different from anything heretofore brought out in this line. The finished product does not convey any idea of concrete construction.

If a home seeker wants a home that has the appearance of being brick construction he can have it. The stone effect is obtainable and many different varities of stucco and like appearances are easily to be had. The possibilities are almost unlimited.

### Monolithic Houses

In a building program the required slabs will be cast to size. For buildings of moderate proportions, the castings will be of such size that the exterior walls will be made each in one piece. The floorings and partitions, and the roof will be made in block also.

These will be brought together and locked and when finished will form practically a monolithic structure.

A feature of the plan is standardization to such a degree that volume production will be possible. In anticipation of this, construction on an economic scale is worked out. It is intended to employ horsepower vastly more than man power.

The necessary machinery to handle the massive and heavy castings of houses of large dimensions has been planned and in the event of sizeable developments the machinery can be erected and houses can go up "in the twinkling of an eye."

A single casting will represent the labor of laying 2,000 bricks.

Statisticians have figured out that the cost of horsepower is 5 cents an hour and one horsepower is equal to eight man power. The economy of an expense of 5 cents an hour as against $6 an hour can readily be appreciated.

When Mr. Lake talks then of the erection of a seven room cottage for $3,200 and the building of even an eight room house of almost similar plans for only $2,500 the importance of the work in which he has been engaged in recent years can be better apapreciated.

Sketches prepared of various architectural styles are pleasing in appearance, and comfortable and convenient for living.

The types represent a wide variety of cottage construction, in either the country or at the shore. Shore cottages are particularly appealing, since they embody a new idea of spacious open side and roofed over upper parts, privacy being obtained by drawing large curtains.

Some styles run to the great proportions of castle-like structures, embodying new ideas that are sure to become popular. Present-day conditions, such as garage spaces are provided in the bigger structures.

### Subjected to Severe Tests

As to the durability of the new construction there is little doubt in the minds of a committee of experts who prosecuted some severe official tests. New York City has a bureau of standards which has drafted requirements embodied in its building code and not long ago a delegation composed of five borough representatives met at the Lake experimental plant and tried out specimens of the concrete castings. The standard demands of the building code are ability to withstand 240 pounds pressure per square inch of surface. A cast was made on the spot and within a few minutes after the forms were removed it stood a pressure test of 350 pounds per square inch. Taking a section which had been cast some time pressure was applied and when it stood a test up to 3,100 pounds per square inch the officials were amazed. The fact that the forms can be worked so quickly after having been cast and that they improve as they age are regarded as valuable features. Ordinarily the concrete process is slower, drying out and seasoning of the common concrete construction being a requisite. Furthermore it is possible to work in the open with this new process even in zero weather without resorting to the use of salt to prevent the mixture freezing. The new practice involves a hydrating method.

### Important to Quake Country

The importance of the invention to a country where earthquakes are common is better appreciated by a realization of the durability qualities already mentioned. The solid monolith construction will withstand much shaking as is further evidenced by the fact a Lake construction was loaded on an automobile truck and carried over rough highways, a distance of twenty-five miles. Once on the way the truck was forced off the highway and rolled off the hard shoulder, dropping several inches and yet the concrete structure was not damaged in the slightest degree.

Construction of this type is also fireproof, there being little or no wood in it to burn. In connection with the standardization ideal window frames instead of being of twenty or more pieces will consist of a single standard form made to fit into the opening provided in the casting.

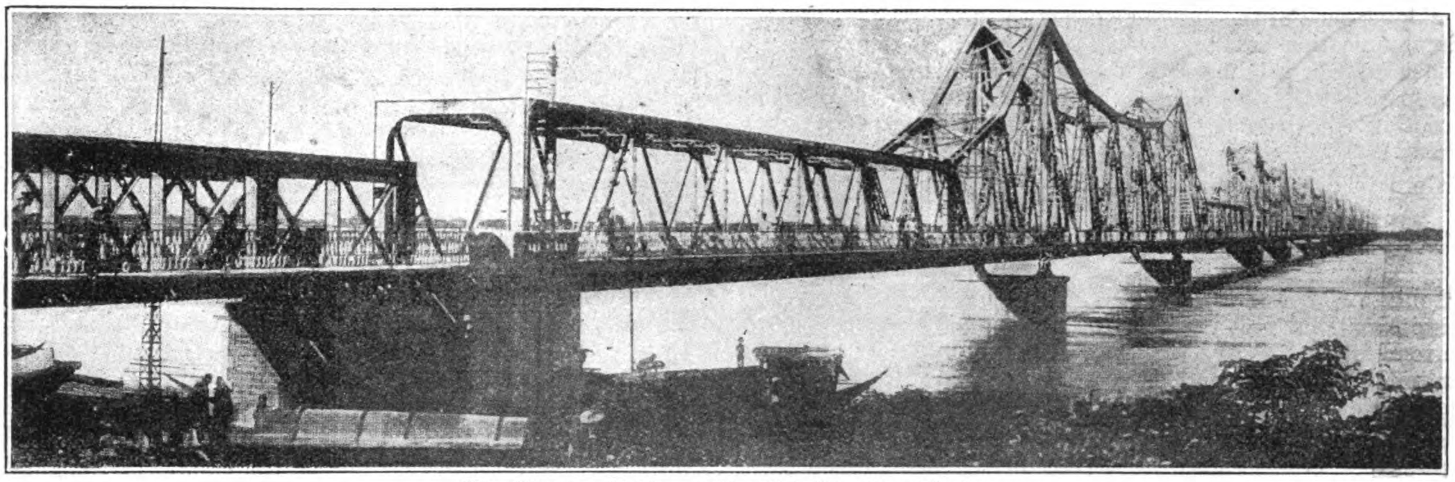
# Saltpeter in China

A monopolistic agent handles the saltpeter, as well as the sulphur, output of Kiangsu, China. This representative, who maintains offices called the bureau of saltpeter and sulphur for the province of Kiangsu, is the sole agent for the sale of the production of these two chemicals in Kiangsu. The principal saltpeter producing area in Kiangsu is Soochow and surrounding districts. For rights of monopoly, the bureau pays $10,000 monthly to the Kiangsu provincial government known as "chun hsiang," or military revenue.

The annual output of saltpeter in Kiangsu is estimated at 10,000 piculs. Shanghai does not buy much of the article, the consuming centres being Changchow, Yankchow, Chinkiang and Tanyang. Main purchasers are firework manufacturers and silversmiths.

Methods of digging are crude (by hand laborers), and no machinery is used. For shipment the saltpeter is packed in sacks of rushes. The yearly quantity of salpeter produced in Chihli is in the neighborhood of 500,000 catties of only a rather crude form.

The annual output of saltpeter in Honan is estimated at 2,000,000 catties. The method of extraction in general use is placing the crude salpeter in earthern jars and pouring in water. A jar produces five or six catties of saltpeter. In the province of Kweichow there exists the Kwangih Saltpeter & Sulphur Co., whose plant and head office are in Kweiyang.



The Doumer Bridge at Hanoi before its widening

# Indo-China Railways—1.

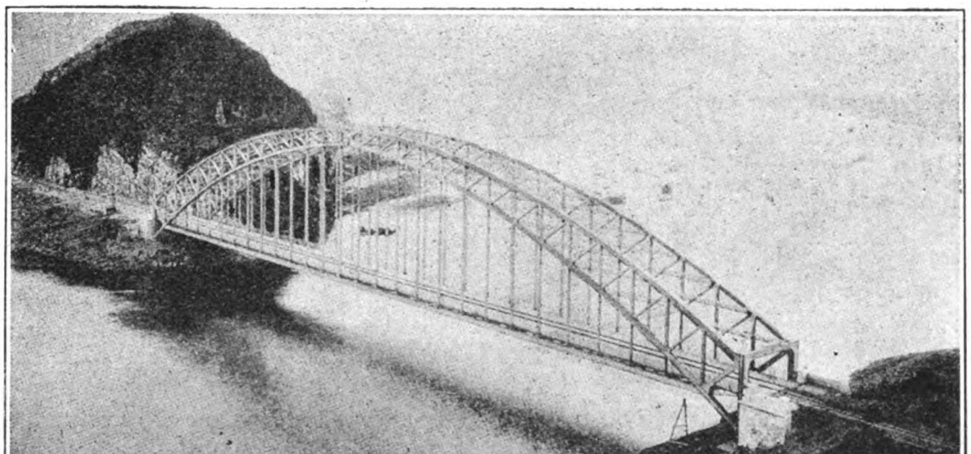
## History

THE construction of the railways of Indo-China may be historically divided into three periods: (1) Prior to 1898; (2) from 1898 to 1910, during which time the program of 1898 was being realized, and, (3) since 1910, when improvements and additions are being made.

### I.—Prior to 1898

#### A. Saigon-Mytho Railway

Towards 1880 a first proposal for railway construction in Cochin-China was made and this included a line from Saïgon to Vinh-Long with extensions to Soc-trang and to Lang-Yuyen, Chau-doc and Phom-Pen. The plans and estimates were worked out in the colony and submitted to the French admiralty, who decided that it would be better to omit for the time being the extensions and thus confine the first attempt at railway construction to a short section in a comparatively easy country, so obtaining useful experience for extensions later on. This line was built by a private company who ran it till December 1911 when the colony took it over.



525-foot Span Steel Railway Bridge over the Song-ma on the line from Hanoi to Vinh and Ben Thuy

#### B. Hanoi, Nam-Kwan or Kwang-si Railway

The hard and laborious campaigns for the pacification of Upper Tonkin between 1885 and 1894 necessitated the maintaining of numerous effectives in the mountain-country round about Langson and Cao-Bang, and as early as 1889 the building of a railway of 60 cm gauge was contemplated. This line was to run from Phu-Lang-Thuong (up to which point light boats could navigate all the year round from Haïphong) to Langson.

Work was started in May 1890 but all sorts of difficulties caused delay. Labor was rare and also difficult to maintain in an unhealthy country and where robber bands, safe in the mountain fastnesses of Cai-Kinh, frequently raided the camps in search of provisions and of European hostages for which they could claim ransom.

Eventually the French parliament intervened and, abandoning the system of grants from the mother-country by means of which the expenses had hitherto been met, it made more ample arrangements for the improvement of the colony to be met by an important loan.

This loan of 80,000,000 francs was authorized by the law of February 10, 1896 and was subscribed 28 times over, thus showing the value of the credit of Indo-China on its first appearance in the home market. Out of this sum 13,200,000 francs were allocated for the liquidation of other works undertaken prior to the Phu Lang Thuong-Langson railway, and 20,000,000 francs for the extension of this line from Phu-Lang-Thuong to Jia-Lam and from Langson to Dong-Dang as well as the widening of the gauge from 60 cm to 1 metre (from 1-ft. 11⅝-in. to 3-ft. 3⅜-in.).

The portion of the line between Jia-Lam and Phu-Lang-Thuong cost about 160,000 francs per mile and was carried out between 1897 and 1900. The other extension from Langson to Dong-Dang cost about 272,000 frs. per mile and was carried out between 1897 and 1901. The actual cost of converting the gauge came to about 96,000 frs per mile.

At the same time it was considered advisable to throw a railway bridge over the Red River and thus join Hanoï up to Jiam-Lam and to other projected lines. Having decided to meet the cost out of the funds of the protectorate, tenders were invited and most of the great French firms competed, the contract being eventually let to Messrs. Davdé et Pillet for the sum of 5,900,000 francs. The bridge begun early in 1898 was opened in February 1902, thus connecting Hanoï directly with the Chinese frontier by a line 105 miles long.

### II.—From 1898 to 1910

#### The 1898 Program

While the latter part of the Kwang-Si railway was being constructed a vast project of railways was being worked out with the view of not only assuring the defence of the country, but also

of developing each of the five countries of the union and facilitating intercommunication between them as well as connecting them up with their foreign neighbors. This project was submitted to the French parliament, before whom His Excellency Governor of General Doumer personally pleaded, and was approved by the law of December 25, 1898.

It provided for the following lines :—

| Names of Lines | Approximate length miles | Approximate cost francs |
|---|---|---|
| Hai-phong to Hanoi and Lao-kai .. .. | 237 | 50,000,000 |
| Hanoi to Nam-Dinh and Vinh .. .. | 203 | 32,000,000 |
| Turan to Hue and Kwang-Tri .. .. | 109 | 24,000,000 |
| Saïgon to the Khan-Koa and the Lang-Bian | 404 | 80,000,000 |
| Mytho to Vinh-Long and Cantho .. .. | 57 | 10,000,000 |
| Miles .. | 1,010 | 196,000,000 |

These costs were met by means of a loan of 200,000,000 francs raised by three calls. This was found sufficient for all the proposed lines with the exception of that from Mytho to Cantho (never started) and the branch to Lang-Bian (unfinished). The line between Haï-phong and Lao-kai entailed, however, heavy supplementary expenditure.

By the same law the general government was authoized to participate to the amount of 3,000,000 francs in the private company who undertook to build a railway between Lao-kai and Yunnan in China. The authorization to build this line was obtained from China in 1898 as part of the advantages guaranteed to foreign powers consequent on the war between China and Japan.

## Realization of the 1898 Program

### 1. Railways Worked by the Colony

HANOI TO VINH, TURAN TO DONG-HA AND SAIGON TO NHATRANG

These railways were built in a similar way to that adopted for the two ends of the Langson line. The earthworks, the buildings and the laying of the rails were let by tender in lots of various sizes. All metal work was let by competition. The permanent-way and all accessories as well as the rolling-stock were ordered direct by the administration. This method has generally been found satisfactory to the administration, whenever it has been possible to furnish the contractor with fully detailed plans, and the work was in a well-known region where everything was plain sailing and labor easy to obtain, and where at the same time the staff of inspectors was ample and efficient and there was no need to rush the work.

It may be added that the cost of the completed work never surpassed the estimate by more than 25 to 33 0/0 which was a much better result than was the case in the two other systems tried, viz.: payment by schedule on the Langson railway and letting by contract on the Saïgon-Mytho and Lao-kai-Yunnantu railways.

*A. Railway from Hanoï to Nam-Dinh, Ninh-Binh, Thanh-Hoa and Vinh.*

This was carried out from 1901 to 1905.

From every point of view—planning, construction, opening, country run through and running—it may be divided into three sections :

(1) From Hanoï to slightly beyond Ninh-Binh (73 miles) in the Tonkin delta ;

(2) From this point to Song-Ma (81 miles) in the rolling and but slightly cultivated country between Tonkin and North Annam ;

(3) From Song-Ma to Vinh (Benthuy) a distance of 49 miles joining the two centre of production in North-Annam—the deltas of the Song-Ma (Thanh-Hoa) and the Song-Ka (Vinh).

In accordance with the law authorizing the loan decrees were issued as follows :

On April 20, 1890 for the two end sections, and on December 7, 1900 for the intermediate link which was delayed owing to there being a choice of plans on the Tonkin-Annam frontier and to the difficult work necessitated by the bridging of the Song-Ma river.

On each of these sections the earthworks, ballasting and laying of the permanent way were let in one contract, and the important steel bridges in three separate tenders.

The Hanoï to Ninh-Binh section was started on January 9, 1903 and in December of the same year trains ran as far as the Song-Ma. The bridge over this river with a span of 525-ft. was completed by the end of 1904.

The completion of the line was delayed by extraordinary floods which submerged it in several places. This necessitated the raising of the road-bed and other supplementary works including the facing of some of the embankments with stone at the various weak spots. It was possible, however, to open the line on March 17, 1905 and it has been running without a hitch ever since.

Including all this extra work this railway cost 41,000,000 francs as against the 32,000,000 estimated.

*B. Railway from Turan to Hue, Kwang-tri and Dhong-Ha.*

This line, like the one just described, forms part of the great Trans-Indo-China trunk railway as proposed in 1898.

The first part built was from Turan to Hue on account of the political necessity of connecting up the capital of Annam with a port easily accessible to boats plying on the surrounding seas. The second part from Hue to Dong-ha was built solely as an eventual part of the great trunk railway.

The earthworks, etc., of the Turan-Hue section were at first carried out by contract and eventually by schedule. This was completed by the end of 1905 and the permanent way in 1906, the line being opened on December 15 of the same year.

The second section from Hue to Kwang-tri was authorized by decree on January 27, 1905 and was opened during 1908 in four successive parts.

The running of this line has always been at a loss which will probably continue until it has been connected up to the other lines north and south of it. At the same time it is liable to frequent interruptions owing to typhoons and floods.

Its total cost including everything was 34,500,000 francs being 7,500,000 over the estimate, of which 6,900,000 frs. were incurred on the Turan-Hue section.

*C. Railway from Saïgon to Khanh-Hoa.*

Two projects were considered each having a common portion of 82 miles between Saïgon and Tan-Linh, running thence either along the coast with a branch to Langbian or inland to Djiring and direct to Langbian.

The first named project was eventually adopted and work on the first 82 miles was authorized by the decree of June 17, 1900, but progress was hindered by numerous difficulties, not the least of which was the insufficiency and instability of labor, and it was not till the beginning of 1908 that this section was opened.

A decree dated January 27, 1905 authorized the second section. but here again the same difficulties were met with and it was only in 1913 that this part was opened.

The total cost of the line from Saïgon to Khan-hoa amounted to 73,000,000 francs.

### 2. Railway Worked by the Indo-China and Yunnan Railway Company.

The part of this railway running from Haï-phong to Lao-kai and lying wholly in Tonkin was constructed by the colonial government who, in accordance with the agreement of 1901, was to hand it over all complete to the private company.

Where running through the delta between Haï-phong and Vietri this line was certain of a heavy traffic, but beyond it was merely a link with Yunnan.

The decree authorizing the first named section was dated April 21, 1899 and that for the second section December 7, 1900.

The work on the first section were carried out between 1900 and 1903 without any difficulty and plenty of efficient labor was available. The line was handed over to the Company and opened between Haï-phong and Jia-Lam in April 1903, and between Jia-Lam and Vietri in November of the same year.

On the second section between Yen-Bai and Lao-kai, passing through a desert and unhealthy region, it was very difficult to obtain labor so that it was in May 1906 only when the line was handed over to the Company and even then the last 95 miles before Lao-kai were not complete.

The line from Lao-kai to Yunnan-fu was constructed and equipped by the Company, the rôle of the colony being confined to a subsidy of 12,500,000 francs and an option of purchase for 3,000,000 francs during 75 years.

The route finally adopted follows the valley of the Nam-Ti and reaches Yunnan-fu by the valleys of the Pa-Ta-Ho and the Tatshen-Ho. This was through a very difficult country and necessitated much bridging, tunelling, etc.

Recruiting the coolies, transporting material and provisions, arranging for the sanitation of the camps and protecting them against the raids of Chinese robbers were each and all difficult problems for the contractor. To this were added the technical difficulties of the line itself; 3.422 viaducts, bridges and culverts—an average of 11.7 per mile—of a total length of over three miles, and 155 tunnels totalling about 11½ miles in length. The steepest gradient was in 40 and the radius of the sharpest curve about five chains.

Delayed by frequent difficulties, the line was opened in successive sections between June 15, 1908 and April 1, 1910, on which latter date the first locomotive steamed into Yunnan-fu.

The traffic on this line has rapidly increased in spite of the frequent yearly interruptions in the broken ground of the Nam-ti and Pa-Ta-Ho valleys, where important supplementary works had to be carried out, on account of frequent land-slides during the rainy season.

Owing to all these difficulties the actual cost of the line largely exceeded the estimate of 94,000,000 francs, and was fixed by an arbitral commission in 1908 at the sum of 165,000,000. The colony was therefore obliged to furnish a new subsidy of 53,000,000 francs, which it raised by a loan authorized by the law of March 14, 1909.

## III.—From 1910 to 1920

By 1911 the various railways authorized by the 1898 program were complete, except:

The Saïgon and Khan-hoa Railway which was still in progress, and the Saïgon, Mytho and Cantho Railway, which had not been begun.

Furthermore, towards the close of 1910 the credits arising from the loan of 200,000,000 francs were exhausted, so that a new loan of 90,000,000 was authorized by the law of December 26, 1912, to meet the cost of various works for the economic development of the colony, and included 22,600,000 francs for the completion of the reduced program of 1898, and 28,300,000 for planning and constructing the following new railways:

(1) The first portion of the Vinh and Dong-ha railway, eventually to form part of the Trans-Indo-China Trunk line, and

(2) A line from Dong-Dang to Na-Sham forming an extension of the already existing Kwang-Si railway.

The completion of the 1898 program included not only improvements on existing lines, but also the completion of the Saïgon and Khan-hoa railway with a branch line running towards the Lang-bian plateau, all of which was carried out between 1912 and 1914.

Plans for the Vinh and Dong-ha line had been prepared in 1897 for the 1898 program, and in 1912 were again taken up with the result that a decree, dated September 11, 1913, authorized a start on the first section between Vinh and Tanap. A subsequent decree, dated June 26, 1915, sanctioned a start being made on the portion between Dong-Ha and the river Nganson but the immense difficulty of obtaining labor and the general rise of prices due to the war paralysed the work so that by the end of 1919 the situation on the whole of this railway was as follows. Between Vinh and Tanap (5½ miles) the earth works, and the masonry of the large bridges and buildings were finished. On the second and third sections (82 and 45 miles) plans were completed and the line staked out.

The extension towards Na-Sham of the Kwang-Si railway was based on the idea of striking the Song-Ky-Kung at a point accessible to light craft at all times of the year. The cost was estimated at 1,800,000 francs. The work was authorized by the decree of April 16, 1913, and in 1919 everything was ready for the laying of the permanent-way; this however, was supplied only after much delay and the section from Dong-Dang to Na-Sham was opened for traffic in November 1921. The total cost, including sundry improvements, amounted to 3,400,000 francs; and it may be said that this large excess over the estimate was largely due to the high price of the piastre from 1919 to 1921.

## IV.—Present Situation

No new railway has been opened since that between Dong-Dang and Na-Sham, but the extension of the existing railway system is one of the first items on the program of the government, especially the completion of the Trans-Indo-China main-line running from north to south and connecting up all the local capitals, and the building of new lines to open up Laos.

The construction of the Vinh and Dong-Ha section has been vigorously taken up and it is hoped that Hanoï and Hue will be connected up by railway by 1925. At the same time plans for lines between Hue, Nha-trang and Saïgon as well as from Saïgon to Pnom-Penh and the Siamese frontier have been started and a special commission composed of French specialists has been already engaged for some months in laying this out, while another commission is engaged on the plans of a railway from the Krong-pha to Saïgon line (or from some point on the Trans-Indo-China main-line) to Dalat, the important hill-station on the healthy and picturesque Langbian plateau. This will be a mountain railway from Dalat to Krong-pha, the present terminus of the Langbian branch.

Before the end of the year a start will be made on the plans of a railway in Northern Annam to connect Laos with the Gulf of Tonkin and passing through Tanap and Tah Kek.

Finally plans for the extension of the Saïgon to Mytho line towards Soc-trang and Bac-lieu will certainly shortly be made out.

(*To be continued in January.*)

# Woolen Industry in China

Steady progress is being made by the native woolen industry in Tientsin, mills now in operation manufacturing nearly all products obtainable anywhere. Incidentally Hugo Stinnes the German magnate is, according to rumor, about to establish a woolen manufacturing plant there also.

Among the commodities made now by Chinese native factories are shirts, trousers, cloth, hosiery, knitting thread, scarfs, blankets, gloves, yarn, cloth rugs and carpets. About 15 mills are in operation.

The Chung Hua Co., at 160 Yung Kong Li, East Seward Road, Shanghai, manufactures woolen shirts and trousers. At Harbin, an industrial works for the poor, makes woolen cloth, hosiery and other knit goods. It has 25 woolen cloth weaving machines, knitting machines, and sewing machines. The Kai Yuen woolen and carpet factory is located at 81-83 Lan-man Hutung, Peking.

The products of the Li Hsin Textile Mill, which has its office and mill in Ningpo, are woolen scarfs, hats, etc. The Manchu-Mongol Woolen Manufacturing Co., in Mukden, is a Japanese concern with an annual output of 80,000 blankets, valued at Yen 11,000,000 and 150,000 yards of cloth, valued at Yen 850,000.

The Pu Li woolen mills are at Tsunghochen, (Chingho) on the Peking-Kalgan railway, and are operated by the board of military affairs of the Chinese army. These mills were established to make woolens for heavy winter uniforms, and goods, weighing three pounds to the yard, for overcoats, and still heavier for blankets. According to the latest report, the principal products were plain and colored felts and carpets.

Liu Cheng Li and Liang Wenchow established the Shih Hsing Woolen Weaving Co., Ltd., in Taiyuan-fu, Shansi, with woolen gloves, hosiery, etc., as its products. The Jeh Yung Woolen Manufacturing Co., of Chunkiang, Szechuan, and the Tsing Woolen Weaving Factory of Tsining, Shantung province, manufacture woolen cloth.

The Wuchai Woolen Weaving Works, at Wuchai, Shanse, manufactures blankets, scarfs, gloves, shirts and hosiery. Woolen and yarn cloth are the products of the Yu Hua Woolen Weaving Co. The China First Woolen Spinning and Weaving factory, near the Zeh Hui bridge, Shanghai, produces woolen goods of good quality. It has a special product in a kind of quilt to replace the usual cotton covering. Woolen yarns are produced by the Lung Hwa Woolen Yarn factory, Wei Yih Woolen Yarn factory and the Wei Yih Woolen Yarn Manufacturing Co. All are in Shanghai.

# The Tapioca Industry in Java

CASSAVA, or tapioca, as it is generally known, from which plant various kinds of foodstuff are obtained, came originally from Brazil, from which country it has spread over all the tropics and sub-tropics. In a wild state, the plant is frequently found in the forests of South America, and it is mostly due to the Portuguese that it has been transplanted to other parts of the world. With a few exceptions, due to unfavorable climate, tapioca is now cultivated in every country between the Latitudes of 30° N. and 30° S.

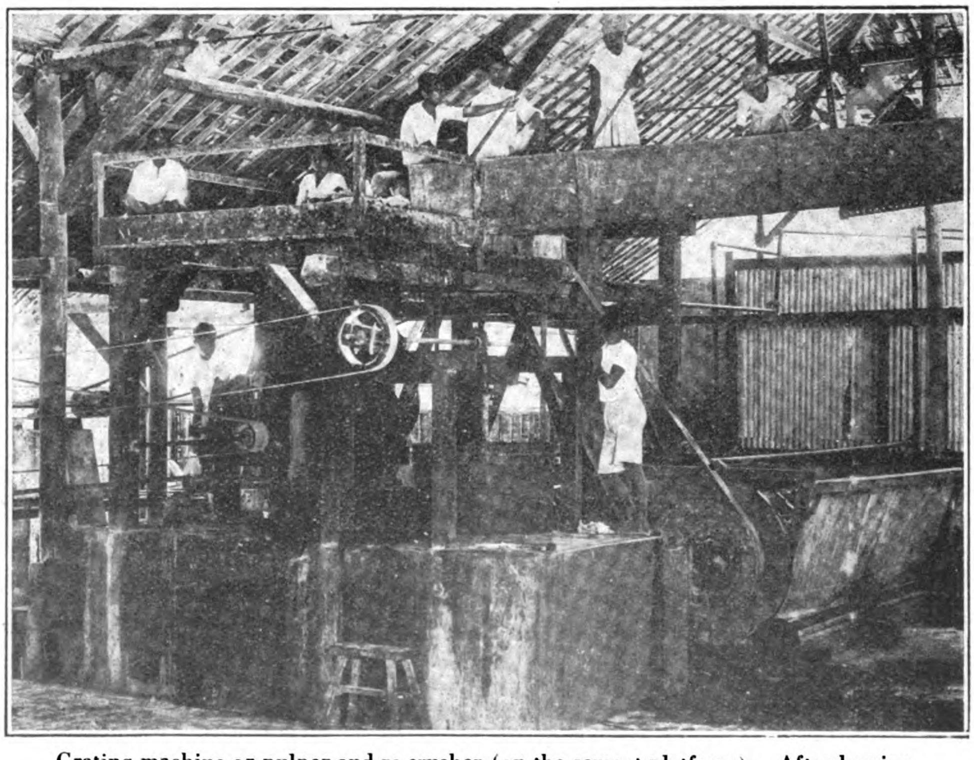
Concerning the origin of the cassava raised in Java and other islands of the Dutch East Indies only very little information is available. It has been recorded that about the year 1850 the plant had been found in Java from time immemorial and that it had probably been imported from China. At that time, however, its cultivation was only carried on in special districts of the island, principally in the residency of Bantam (West Java). During later years special attention has been paid to the extension of the cultivation and the preparation of tapioca products.

The food value of the tuberous roots of the plant (which are like carrots, tapering cylinders, 12 to 20 inches long) has long been known, and in some parts of the world, more especially in South America and West Africa, the tapioca root is in many regions for the native population what the potato is to many civilized peoples, i.e., an indispensable article of diet, a prime necessity of life.

In European countries the best known product of the tapioca plant is the flour or starch, but for a number of years past, by means of a sort of stiffening process in the starch factories, a number of products have also been prepared from the wet flour, which are put on the market under the names of tapioca flake, siftings, pearl, seeds, etc., and which are largely used for industrial purposes, while the roots, after being cut into pieces and dried, as well as the waste obtained in the manufacture of the flour, are for the most part used in the preparation of feeding-stuff for live-stock.

For a long time the cultivation of the cassava was principally limited to West Java, but since the beginning of this century it has spread also over Central and East Java. Thanks to the erection of a great number of factories of various capacities producing tapioca flour and other products, it has grown to be a very important industry, especially in the district of Kediri, where there are now factories in which over 1,000 laborers are employed. The Preanger district, also, is to-day an active centre of the industry, and most of the factories here are owned by Chinese and native capitalists. Besides by the factories themselves, a great quantity of tapioca flour is made by the natives in their own primitive way, and the product thus produced is called kampong (village) flour, in order that it may be distinguished from that made in the factories under European or Chinese management. It is not uncommon to find the natives selling their flour to Chinese millers who carry out the work of washing, sifting and drying the product.

Bringing the peeled cassava roots to a trough above the grating machine

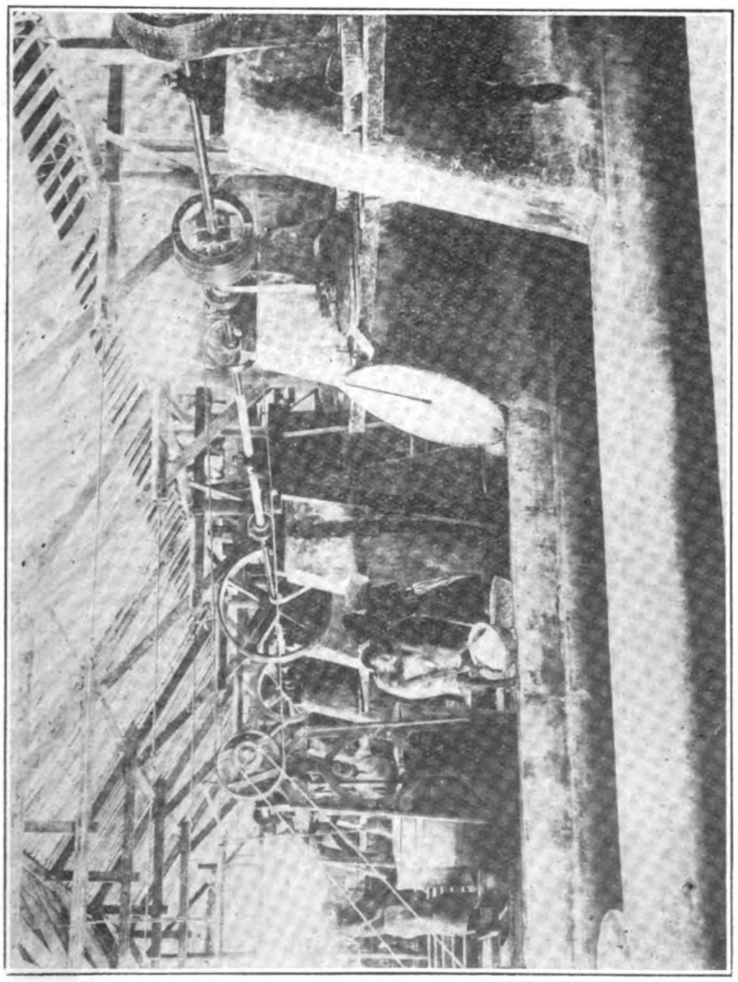


Grating machine or pulper and re-crusher (on the cement platform). After leaving these machines, the pulp is washed away to the cylinder sieve (down to the right).

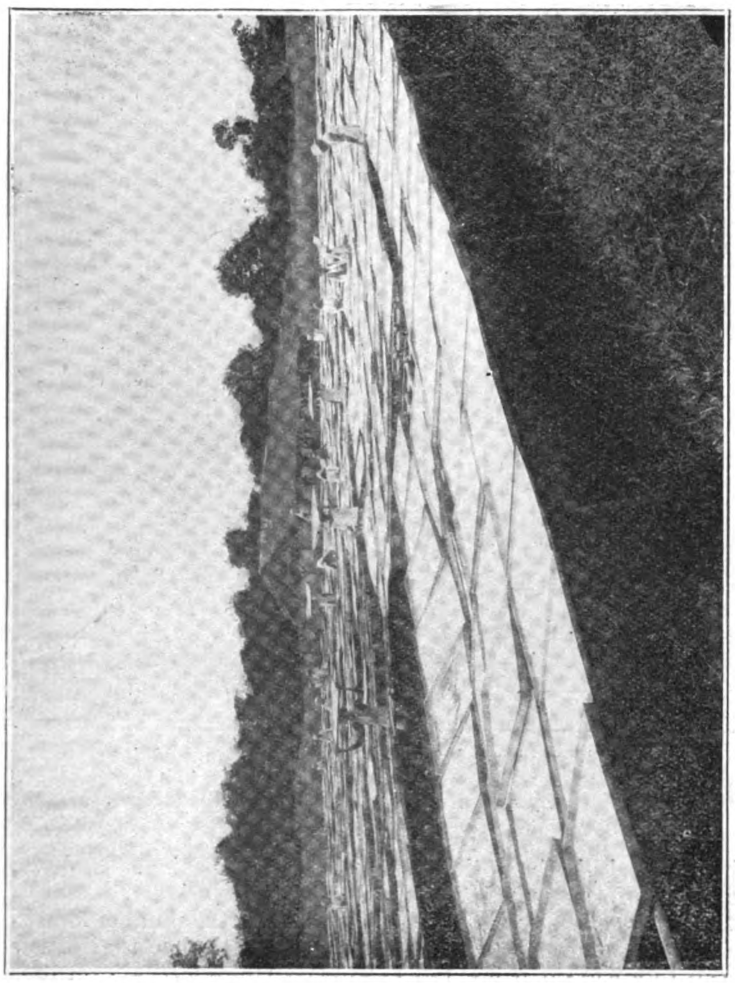
The many existing varieties of the cassava (technical name: Manihot utilissima, Pohl.) are commonly classified as bitter and sweet, and these are also frequently regarded as two separate species. The specific differences between the two, however, are very slight and some botanists consider it more than probable that the sweet cassava is only a variety of the bitter, derived from centuries of cultivation under the most varying conditions.

In Java, the number of forms and varieties of cassava is very great, while the characteristics, with respect to duration of growth as well as power of production, differ considerably. Although the native farmer has special names for most of these varieties, these give absolutely no assurance of distinguishing them, since the names are subject to local changes, and besides they are apt to be rather arbitrary.

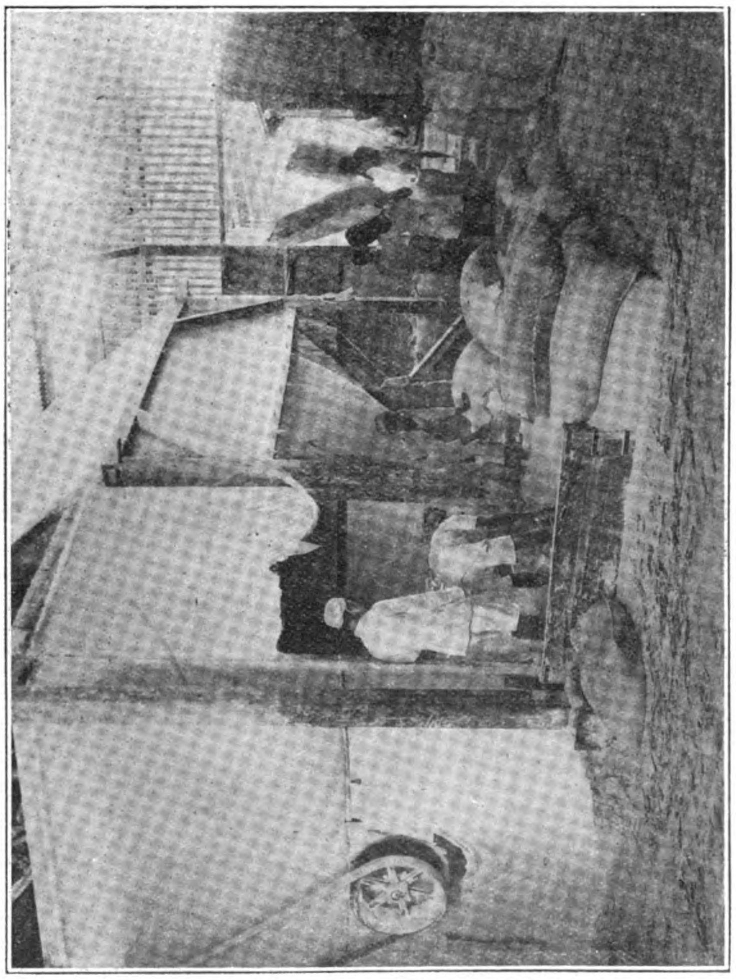
In general it can be said that the varieties with dark-colored bark have a greater productiveness than those which have a light-green bark. Some varieties yield a considerable crop already at an age of from five to six months, in others, on the contrary, the tuberous formation first begins at the age of about eight months or later. In some varieties the roots are bitter, hard and unpleasant in taste, in others sweet and tender. In the preparation of flour, etc., this factor is, of course, of little importance, as in this case only the standard of starch is considered, which, next to the yield, determines the value of the variety. Various tests have demonstrated that not only does the productivity of the different kinds vary considerably, but that the standard



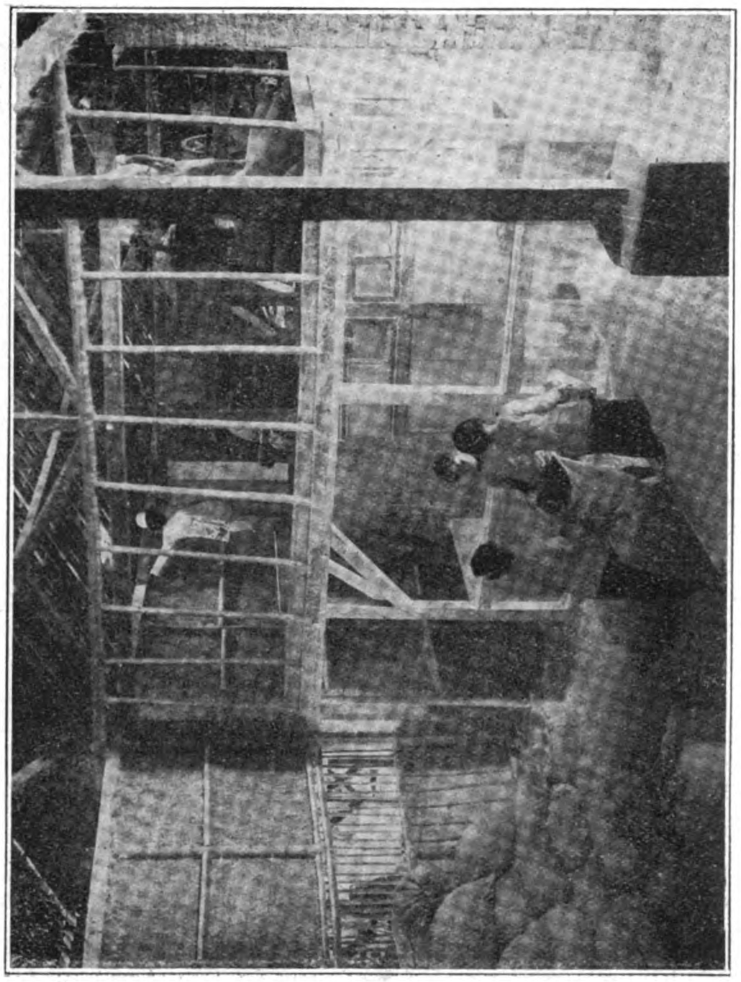
Settling tanks (cement basins) to separate the starch from the strained liquid or starch milk, after settling in these basins the starch is transported to stirring tubs—shown on left of picture.



Drying tapioca flour in the sun.



After being dried, the tapioca flour is treated in mills or disintegrators.



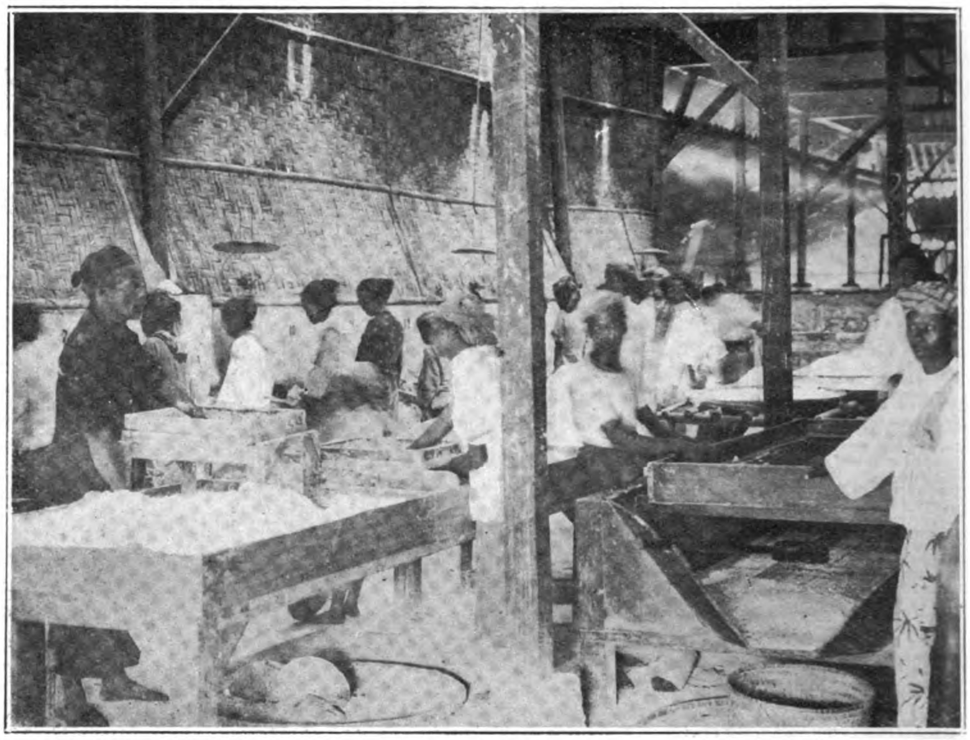
And after being sieved and sorted the flour is packed up in bags and ready for market.

of the starch is not always alike; in cultivation, therefore, it is of the utmost importance to pay attention to this factor.

As to soil, the cassava plant makes few important demands; the best results are usually obtained from soil with a moderately loose structure. However, the plant will generally thrive well in a more or less stubborn and barren ground, providing the soil is sufficiently porous, as cassava cannot endure any standing water. It is true that in soil of great fertility the plant grows luxuriantly, often forming much leaf and thick stalks, mostly, however; at the expense of the root production.

The harvest time of cassava, in contrast with that of other crops (rice, maize, etc.) is not narrowly limited; the longer the roots are allowed to develop, the more produce is obtained in proportion. There is a time, however, in which the roots contain their maximum amount of starch, and although after this time the volume of the tubers increase, this takes place at the expense of the starch content.

The yield of the plants varies considerably in Java as well as in various other countries, and depends principally on the variety cultivated, but also on the composition of the soil, on the climate and the tilling of the ground. In plantings on level unirrigated fields in the Preanger district, using the varieties generally planted by the native population, a yield of from five to ten tons of unpeeled roots per acre can be counted on, in case the crop is harvested at the end of one year. In the Kediri district it appears that from seven to ten tons of unpeeled roots per acre are obtained, although it is known that good varieties can produce much more, even up to seventeen tons.



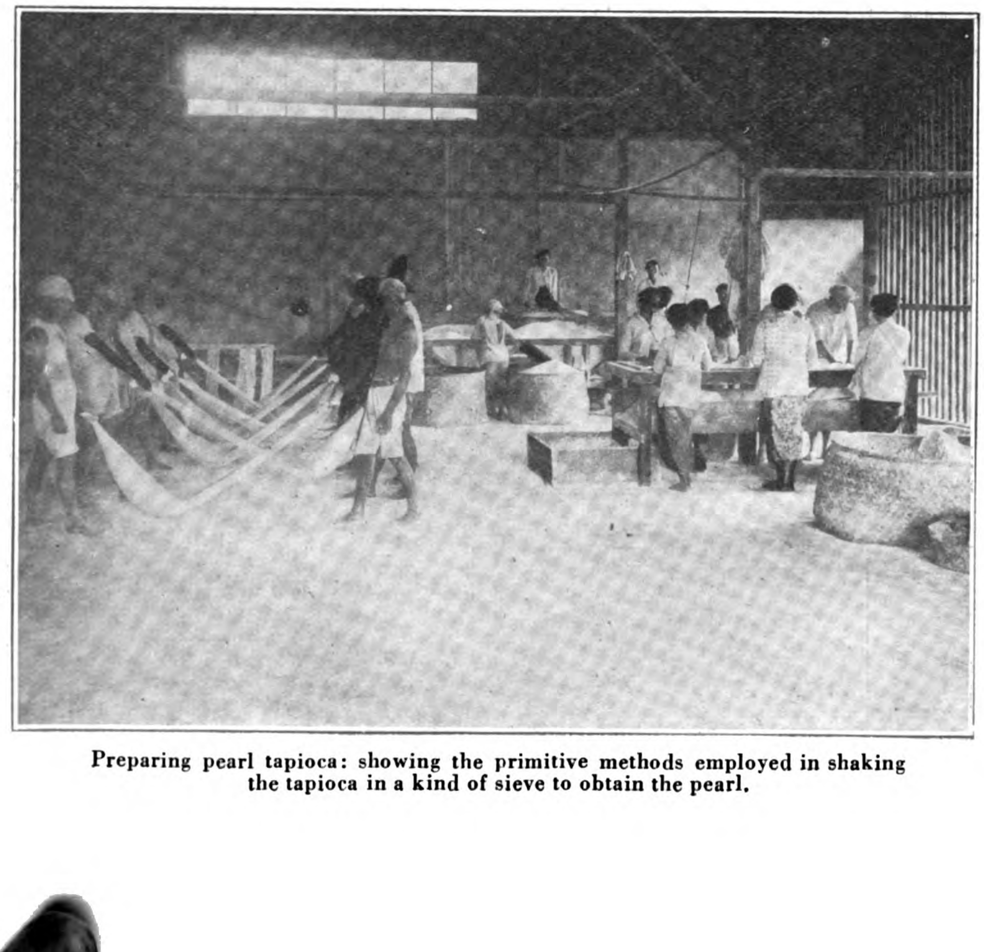
Sorting "flake" and "siftings" by means of sieves. Tho women on the left are preparing flake tapioca in iron pans, which are immersed side by side in a row in a sort of furnace, heated separately by a small fire on the outside of the structure.

With a minimum production of about five tons of roots per acre, therefore, it is possible to count on a production of from 1 to 1.3 tons of flour per acre. Expenses for planting and upkeep are small, so that it is not surprising that wherever suitable grounds and good, pure water are available, as for example in the Preanger district, special attention is paid to cassava culture and the manufacture of tapioca products.

The preparation of tapioca flour is based on opening the cell walls of the roots and so liberating the starch. This can take place under two entirely different methods, i.e., *mechanically* by means of grating, or *biologically* as the result of bacterial action. In Java, however, the former method is made use of exclusively.

Speaking generally, the process of preparing the product followed in the "kampongs" (native villages) is identical to that of the factories to a certain point, but as already mentioned above, it is carried out in a most primitive way, whilst in the factories power-driven modern machinery is used. In either case, however, the first essential to success is a plentiful supply of pure, soft water, and that the roots be freshly dug.

As a rule, the roots are peeled by the natives before being delivered to the factory. Only when a factory has its own plantations and the peeling is difficult on account of lack of laborers, are the roots sometimes grated unpeeled. This method, however, requires greater running expenses, so that it is usually avoided, the more so because it is then more difficult to obtain a perfectly white flour, a factor which must be carefully taken into consideration, as the market value of the product depends mainly on the pure white color.



Preparing pearl tapioca: showing the primitive methods employed in shaking the tapioca in a kind of sieve to obtain the pearl.

There are several types of machines employed for the preparation of tapioca flour, and, speaking generally, all the machinery used in a potato starch factory can be employed for cassava milling, although slight modifications in the character of the grating or pulping machine and of the sieves is necessary: cassava roots being more fibrous than potatoes and the starch grains smaller.

In the most elementary case, the native flour manufacturer has little else than a grater, constructed from a piece of tin, in which a number of holes have been made; the upstanding edges of these holes then form the grater. Sometimes the native graters are so constructed that small pieces of copper or iron wire are stuck close together at equal distances into a small board. It goes without saying that with these primitive tools much starch remains in the pulp, i.e., in the form of unopened cells, and that moreover it is possible to manufacture only small quantities of cassava per day. A relatively great improvement, as far as capacity is concerned, is the mill- or tread-grater, used by the natives in the Kediri district. This consists of a hollow cylinder, attached by wooden spokes to a centre axle, in the

same way as in a cart wheel. The cover of the cylinder is made by strips of tin, which are provided with teeth in the same way as the tin grater described above. The wheel is set in motion by a tread arrangement whereby the pedals constructed on both sides of the centre axle are turned around by the laborer's feet. At the same time he presses the cassava root against the grater, while a stream of water out of a reservoir placed above the arrangement runs the pulp into a basin or trough underneath the wheel. To prevent spashing during the work, most of the grater cylinder is provided with a wooden cover.

Here also, as in the case of the hand graters, a very incomplete opening of the cells takes place, so that much starch is left behind in the pulp.

The grating machine or pulper used in tapioca mills may consist of a revolving box or drum, running at high speed and covered with perforated sheet iron. As a rule, under the box is found a so-called recrusher to complete the disintegration of the cells and ensure the maximum yield of starch. No matter how thoroughly the roots are grated, however, it has been found that it is impossible to draw all the starch from the cells with a single operation, so that from 10 to 15 per cent. of it remains behind in the pulp. In order to save a part of this starch also (which, however, gives an inferior quality), in some factories the pulp is treated once more in a so-called pulp mill. As this necessitates a special sieve, however, and as an installation of this kind costs considerably and requires a great deal of motive power, this reworking is omitted in most factories.

After leaving the grating machine, the pulp is washed away to the straining machines, in which the starch must be separated from the cell walls, unopened cells, etc. The mesh width of the sieves is therefore chosen in such a way that the starch grains are able to pass through the meshes, but not the other parts of the pulp.

As a rule, two or three sieves of different meshes are used to facilitate the process. That which remains in the sieves is called "ampas" (waste).

Of the three types generally used in Java, namely: cylinder sieves, fixed sieves and shake sieves, the first seem to give the most satisfaction. The shake sieves must be repeatedly repaired and besides often hinder the work because the sieve openings become stopped up. The fixed sieves, which are mostly used in factories where only a limited amount of space is available, are very good to use for separating the starch from the fibre, but are less satisfactory for refining the starch. They have the advantage, however, of being cheap and needing little repairing.

The flat brush washing sieve is used only in a few factories in Java. In this the pulp comes into the middle of the sieve, where brushes which wash the pulp and at the same time keep the sieve holes open, gradually push it in a spiral line to the circumference; the pulp in the meantime being continually sprinkled with numerous watersprays from an annular sprinking pipe. The residue which comes to the edge of the sieve is swept into a traphole by the outer brushes. With these machines, which have a steady motion, the work is under good control, as the process remains entirely visible throughout.

Upon the care bestowed on the sieving depends the yield of first and second quality flour. Sieves which work insufficiently, not only give flour which still contains fibre residue and becomes gray when dried, but also hinder the settling process, so that much starch lands in the waste.

In order to separate the starch from the strained liquid, the starch milk is carried off to the settling tanks, troughs or tables. The first are by far the most in use. They consist of cemented basins, furnished with an arrangement by which, after the starch has settled, the overstanding water can be run off as completely as possible. As this water still remains a slight amount of starch which one does not wish to lose, it is allowed to run into the outer basins, where it can once more quietly settle. This sediment, together with the dirty material mentioned later, is manufactured as an afterproduct.

After settling in the basins, the starch which is cut out in blocks with a wooden spade, is least clean on the upper and lower sides. The blocks are therefore scraped off above and below and the scrapings collected separately in order to be manufactured as an afterproduct together with the sediment from the outer basins.

The starch is next transported to stirring-tubs, in which by means of a stirring apparatus (consisting of an axle with two spokes), and with the addition of as little water as possible, it is stirred into a thick pulp. As soon as the flour is mixed with the water into a homogeneous mass, the broth is again carried to the settling tanks to resettle, after which the standing water is again allowed to run off. In this way, two qualities are obtained, each of which must be treated further separately.

To hasten the settling process a little sulphuric acid is sometimes added.

Instead of letting the pulp from the stirring-tubs settle, factories with modern equipment generally use the centrifugal process. The aim of this operation is to remove the water as much as possible and to sooner dry the flour. Not only does the centrifugal method act more quickly, but a better separation of the qualities of flour is also obtained, while the product separated contains less water (about 40 per cent.) than the flour obtained by settling (about 50 per cent.), which naturally is an advantage in the drying.

As a rule, the wet flour is dried in the sun. Only under unfavorable conditions (cloudy sky, rain) is use made of the drying apparatus designed for this purpose. When the flour is dried in the sun, it is spread out on flat baskets, made of bamboo or tinplate, which are set on bamboo scaffolds, and as the drying necessitates, made fine by hand. In large factories, and where hand labor is scarce, mechanical drying is used exclusively. This method requires much more care, especially since in the sun drying process the flour is also bleached, which is not the case with mechanical drying. Before being dried, the flour blocks are broken into small pieces. This is done so as to give the flour a greater surface area and so hasten the drying process, and also to prevent the forming of small pieces or so-called grits.

In the factories in Java the most varying systems of drying apparatus are used. The simplest are those which consist of galvanized iron plates under which a small fire is built. During the process of drying the flour is continually stirred with a spade. There is also drying apparatus made according to the tunnel system and a kind with moving strips of cloth, in which a steam-heated element is placed between the strips, which are placed horizontally and which run on both sides over movable rollers. Some of the advantages of these machines are: no danger of the flour turning yellow as this does not come into contact with hot metal plates; the small amount of space required; quick drying; good observation of the work and small cost of operation. Moreover the arrangement needs no continuous supervision, as the wet flour is brought automatically from above and the dry product is carried off in the same way.

After being dried, the flour is worked in mills of disintegrators; then, after being sorted and strained through a sieve, it is ready to be placed on the market.

In factories where unpeeled roots are made into flour, it seems to be very difficult to obtain a product which is entirely free form bits of peeling, and here the flour is generally bleached. As a bleaching medium, sulphuric acid is used, or sometimes natrium bisulphate. Tapioca flour bleached in this way, however, begins to discolor somewhat after a few months.

Tapioca flour intended for export, is packed in gunny bags holding about 75 to 80 kilos.

The chief consumers of the article are Great Britain and the U.S., though important quantities are also shipped to France, Holland, Singapore, Hongkong, etc.

Cassava starch can be utilized for almost all the purposes for which other starches are employed. In addition to its emplyment in the manufacture of alcohol and glucose, it is used for laundry purposes, for sizing yarns and fabrics and for the manufacture of dextrin or British gum. For laundry purposes the starch is inferior to rice starch, but it is said to be much better than either maize starch or potato starch, giving a smoother surface and a finer gloss.

Cassava starch is stated to be inferior to other kinds of starch for sizing cotton yarn, as it yields a paste of somewhat feeble adhesive properties. For medium and heavy sizing it may be mixed with some other material with stronger adhesive power, such as wheat flour or maize starch.

The fine white color of the better quality of tapioca flour, as well as its freedom from odor, makes it more practicable, however, than potato flour for use in many industries, i.e., in the manufacture of biscuits, etc.

For a number of years past, in many cassava flour factories in Java much attention has been paid to the preparation of tapioca flake and pearl, which sometimes find a better market. These cassava products are being made by means of a stiffening process while the flour is still damp. Only pure white flour of first quality is used for their manufacture, as a yellowish product is less in demand.

For the making of flake tapioca the damp flour is spread in thin layers on large rectangular tables, three sides of which have raised edges. The mass is then rolled by wooden rollers, pressing the flour grains together into flat blocks. The latter are taken out and put into round iron or copper pans, about 24 inches in diameter. These pans are placed in one or more rows and heated either over a smouldering fire or, in the case of large factories, by steam under pressure.

After a few minutes the starch grains begin to adhere to the metal ; they are loosened with a spatula to prevent sticking and to hasten the drying. Finally they gelatinise and take on the semi-vitreous appearance which characterises this product. After being cooled off the process is completed by drying in the sun, in order to become bleached.

The pieces of flake, which naturally are of unequal dimensions, are ultimately sifted into various sizes, while the largest pieces are crushed in mills designed for this purpose. The very finest grains come upon the market as "siftings."

Flake and siftings are packed in the same way as the flour, though some importers want it packed in wooden barrels for better protection of the contents against moisture during the voyage. This packing also protects the flake better against crumbling.

The mechanical preparation of pearl tapioca takes place by pressing the damp flour through a perforated plate. In this way strings are formed, somewhat resembling vermicelli. These strings fall on heated plates (the heat being produced by steam), which are mechanically held in a rocking motion. The granules then roll over and over each other and finally gelatinise in the form of pearls. The process is complete as soon as the pellets are hard enough, which the experienced worker can tell from the sound they make when rolled.

In small factories in Java the pearls are still prepared primitively by rolling the damp flour grains in cotton bags. This method is demonstrated by the annexed photograph.

As with the flake, the tapioca pearls are also sifted into various sizes, whereby three or more kinds are obtained, which are known under different names (bullet, medium, small pearl, etc.) on the market.

Another article made by the cassava mills forms the "ampas" or factory waste, already briefly mentioned above. It consist of the pulp retained by the sieves, and in the wet state this material contains about 90 per cent. water and for the rest cell walls, unopened cells, etc. After being dried, it is exported either in pieces or ground.

Few accurate tests of the feeding value of cassava waste have been recorded, but in view of its excellent mechanical condition and its high nutritive value it seems to be chiefly used in the cattlefood industry. Like the roots, the waste forming essentially a carbohydrate food, it is necessary to mix it with materials containing fat and proteins, and should it be poor in lime, phosphate of lime should be added.

Until the first years of the present century, the Straits Settlements practically monopolized the world's trade in tapioca products. Brazil and Reunion, it is true, produced considerable quantities, but the exports from these regions were of comparatively little importance.

As a result of the increasing competition in the world's markets and in consequence of the rubber boom during 1910, when great stretches of land were withdrawn from the growing of cassava, the production of the Malay archipelago sensibly decreased. Exports from Java, on the other hand, have materially increased as may be seen from the tables below, and this island is now by far the largest producer in the world.

According to the official statistics, exports of tapioca products from Java since the year 1912 totalled as follows :—

Unit : Tons of 1,000 Kilos.

| Years. | *Cassava flour.* | *Flake and pearl.* | *Factory waste.* |
|---|---|---|---|
| 1912 .. .. .. | 41,600 | 12,200 | 12,600 |
| 1913 .. .. .. | 53,200 | 11,200 | 14,100 |
| 1914 .. .. .. | 48,500 | 9,600 | 6,500 |
| 1915 .. .. .. | 43,800 | 5,900 | 2,600 |
| 1916 .. .. .. | 59,600 | 7,400 | 900 |
| 1917 .. .. .. | 50,300 | 17,800 | 100 |
| 1918 .. .. .. | 19,800 | 8,200 | 10 |
| 1919 .. .. .. | 93,400 | 31,400 | — |
| 1920 .. .. .. | 64,100 | 11,200 | 247 |
| 1921 .. .. .. | 62,400 | 16,800 | 632 |
| 1922 .. .. .. | 63,300 | 17,800 | 930 |
| 1923 (6 months) .. | 28,900 | 4,400 | 110 |

Exports of cassava flour, which in 1906 only amounted about 21,600 tons, have trebled since and amounted to 63,300 tons in 1922.

Of the various ports of shipments in Java, Batavia and Sourabaya are by far the most important : Samarang, Cheribon and Tegal coming next.

A feature of the trade is that in spite of the abnormal conditions, continually increasing freight-rates and lack of shipping facilities during the war-years, business has done very well, chiefly as a result of increased exports of cassava flour to the United States. Owing to limitations of imports in the U.S.A. during 1918, only 7,578 tons were shipped to that country, against 31,473 tons during 1917, but after lifting of the embargo on tapioca products in January 1919, shipments have materially increased. As may be seen from the following tables, showing quantities and destinations of exports of tapioca flour since 1912, Great Britain and the U.S.A. are the largest consumers of this produce :—

EXPORTS OF CASSAVA FLOUR.

Unit : Tons metric.

| Year | Great Britain | Holland | U.S.A. | Singapore | Hongkong | Total incl. other destin. |
|---|---|---|---|---|---|---|
| 1912 .. | 15,173 | 1,964 | 14,606 | 5,780 | 1,869 | 41,616 |
| 1913 .. | 15,056 | 4,498 | 22,371 | 5,918 | 1,710 | 53,236 |
| 1914 .. | 14,749 | 5,460 | 21,258 | 4,823 | 1,251 | 48,546 |
| 1915 .. | 14,693 | 7,279 | 13,344 | 2,606 | 1,847 | 43,849 |
| 1916 .. | 13,261 | 79 | 37,665 | 4,854 | 2,313 | 59,630 |
| 1917 .. | 7,549 | 228 | 31,473 | 5,618 | 2,896 | 50,298 |
| 1918 .. | — | — | 7,578 | 5,630 | 2,780 | 19,792 |
| 1919 .. | 16,146 | 20,401 | 44,020 | 6,766 | 1,602 | 93,374 |
| 1920 .. | 18,824 | 6,600 | 30,354 | 4,827 | 2,419 | 64,140 |
| 1921 .. | 17,064 | 8,685 | 18,026 | 6,681 | 2,379 | 62,447 |
| 1922 .. | 13,343 | 3,805 | 31,018 | 4,755 | 2,608 | 63,374 |
| 1923 .. (6 months) | 4,489 | 1,135 | 16,505 | 3,138 | 1,350 | 28,862 |

# Japanese Machinery Trade

The commercial counsellor at Tokio states that the total value of the imports of machinery in 1922 was Y.114,371,000, as compared with Y.119,882,000 in 1921, whilst the total for the March quarter of this year was Y.30,891,000. A large proportion of the machinery came from the United States and the United Kingdom, whose shares in 1922 amounted to Y.57,310,000 and Y.42,203,000 respectively, as compared with Y.63,612,000 and Y.43,983,000 respectively in 1921. The bulk of the machinery imported was textile machinery, which accounted for nearly one-third of the total. Out of over 30 million yen for spinning machinery, the shares of the United Kingdom and the United States were 20 million and 8 million yen respectively. Most of the balance was worsted machinery from Alsace. As regards weaving and finishing machinery, two-thirds came from the United Kingdom and one-third from Germany, and nearly all the card clothing was British.

A very large proportion of the electrical machinery—sewing machines and printing machines—came from the United States. The machine tool trade is divided between the United States, the United Kingdom and Germany in the order named.

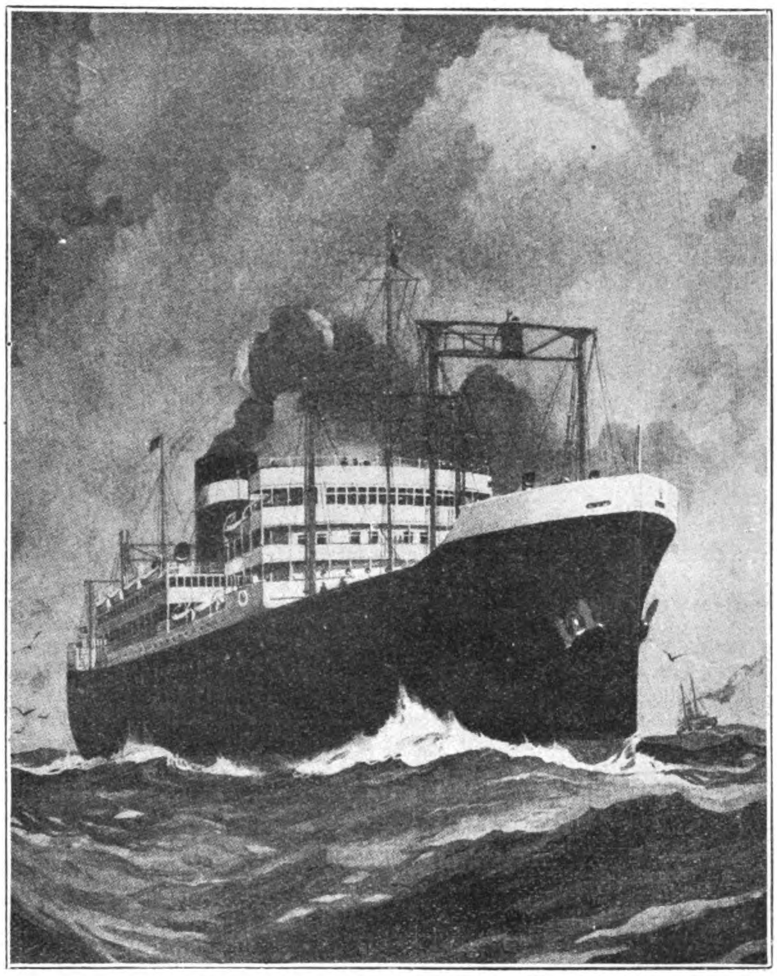
# Robert Dollar and Admiral-Oriental Lines are Combined

AN announcement of interest to world-wide shipping centres was made in Shanghai recently by Robert Dollar, the veteran steamship operator, when he told of the merging of the Robert Dollar and the Admiral-Oriental lines. This merger became effective in Shanghai on December 4, 1923.

The combined fleet has forty-six passenger and freight vessels, making it the largest shipping concern in the Pacific. Under the new arrangement, the Admiral-Dollar interests will have a passenger ship in Shanghai every five days and a freighter every four days, with a corresponding service in all of the other great ports of the world.

Among the ships of the fleet, particular interest attaches to the seven new "522" type vessels, the *President Garfield*, *President Hayes*, *President Harrison*, *President Monroe*, *President Adams*, *President Van Buren* and *President Polk*. Formerly these boats were in the Atlantic service where they proved to be very popular.

The "President" boats have been commended, first, for their exceptional strength and safety, and, secondly, for the expert attention given to the arrangement of the cabins and the public room accommodations. Passenger accommodations are placed amidships and all above the steamer's main deck, resulting in better light and air and the minimum of motion.



**The new "522" type President boats that are being introduced to the Orient by the Admiral-Dollar Lines**

Formerly, the Dollar lines specialized in freight while the Admiral-Oriental line featured the passenger service and also handled a large freight business. By combining the offices of the two lines throughout the Far East, business interests and travelers will receive more efficient service and with a considerable decrease in operating expense. The extra expense of maintaining two offices in each port has been eliminated. At each port the staffs of the two companies were combined at one headquarters.

The Dollar lines will continue to have their general offices in Shanghai from which the 46 ships of the combined service will be operated. In addition, the Shanghai general offices will maintain affiliations with other Dollar interests on the Pacific coast which will, in reality, give them a fleet of over one hundred vessels with which to transport passengers and freight to almost any point in the world.

According to tentative plans, the personnel of the combined staffs will be unchanged. The passenger and freight offices, however, will be operated separately in Shanghai. All passenger business will be managed from the old Admiral line offices on Nanking Road, and all freight business from the old offices in the Dollar building on Canton Road.

Mr. Earl F. Townsend, Oriental manager for the Admiral line, will retain his present position and in addition take charge of traffic for the Dollar line with offices in the Dollar building. Mr. George J. McCarthy, assistant general passenger agent for the Admiral line, will take charge of the passenger business of the combined lines, and freight traffic will be handled by Mr. C. A. Perkes and Mr. Don Tinling.

In regard to the organization in Japan, it was announced that in Yokohama the Admiral line will act as agents for the Dollar line with Mr. F. C. Thompson in charge of the temporary office on Satsuma-cho, constructed since the old offices were destroyed in the earthquake and fire. In Kobe the former offices will be combined under the management of Mr. E. W. Latie as agent. A separate lumber office will be maintained by the Robert Dollar Company.

As to Hongkong, the combined office will be in charge of Mr. E. L. Matteson, formerly agent for the Admiral line there. Mr. Ray Gunn will have charge of the separate lumber office. Mr. H. M. Cavender will manage the combined offices in Manila, and Mr. T. J. Cokely, the former Dollar agent in Singapore, has charge of the combined offices there.

In addition to the seven President liners, recently purchased by the Dollar company, the combine will operate five passenger vessels and twelve freighters to Seattle, formerly operated by the Admiral line; five freighters to Los Angeles, San Francisco and Puget Sound, formerly operated by the Dollar line; seven round-the-world passenger and freight vessels and five round-the-world freighters, formerly of the Dollar line; and give freighters to New York via Panama, and seven freighters to Continental Europe and the United Kingdom, formerly operated by the Admiral line for the Barber Steamship Company.

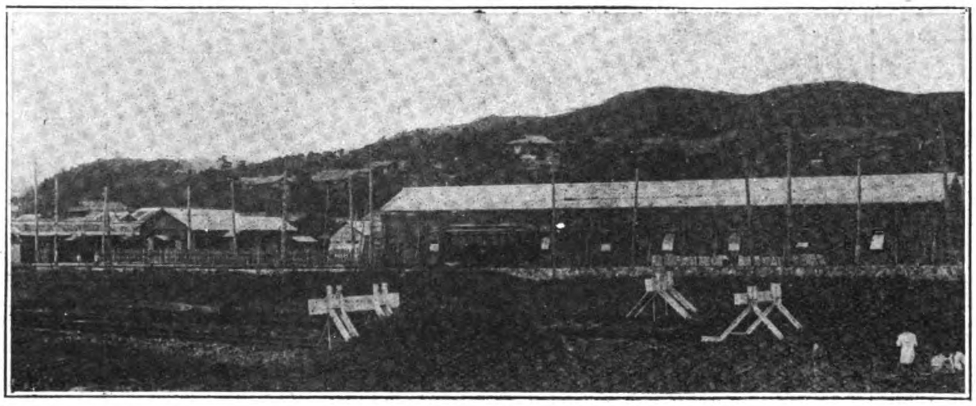
## Metro-Vick Turbines for Japan

AN interesting Japanese contract has been secured for Manchester. A large destroyer, which is being built to the order of the Japanese government by the Urga Dock Company, is to be fitted with Metropolitan-Vickers impulse turbines, and the order, which has been placed with Messrs. Vickers, Barrow, will be executed at the Trafford Park works. Japan herself manufactures other forms of turbines, but not this particular type, in which the Japanese naval experts have for some time past been displaying considerable interest, and this explains why the contract has gone to England. The casings and gears are being made at Barrow.

# Rapid Expansion of Electric Railways in Japan

THERE has always been a demand for rapid and economical transportation in Japan, especially along interurban lines, and this requirement was at first met by the development of light railway steam lines which now number over 200, and which form a net work covering practically the whole of the Islands of Kyushu and Honshu, comprising the major portion of Japan proper.

The gauge of these roads varies from 2-ft. 6-in. to 4-ft. 8½-in., the larger number being of the standard narrow gauge, *i.e.*, 3-ft. 6-in. The 2-ft. 6-in. gauge has of late years practically disappeared. Along with the development of the steam railways some electric roads were developed, but it is not until the last five years,—known as the post-war period, that electric railways have taken the front rank in transportation. In this period not only were a number of new electric interurban railways built or contracted for, but also a considerable number of the more important steam railways were electrified.



A suburban electric line out of Nagasaki

There are at present seventeen electric railways of importance in Japan, and out of this number eight are electrified steam road. All but one of these were electrified in the last five years, and of the remaining nine roads, three are new electric railways, built during the past three years.

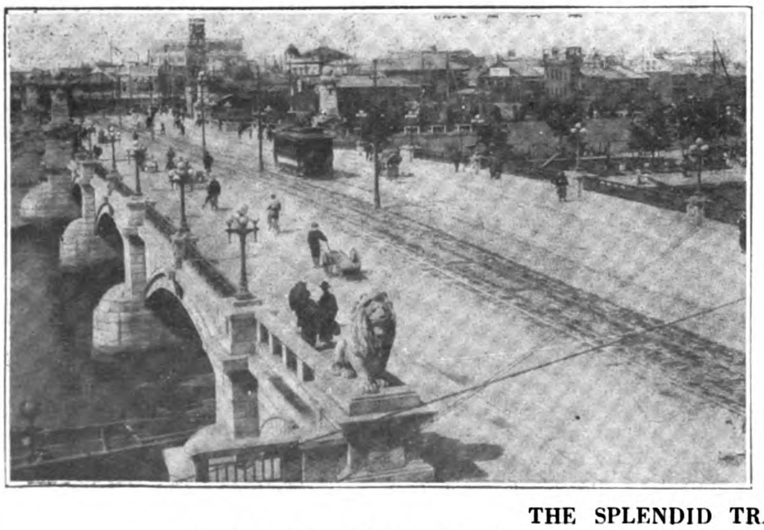
The equipment which has been installed is the result of mature investigation by Japanese engineers and naturally represents the latest and best in electric interurban equipment. In practically all cases multiple train operation has been provided for making use of the latest type of 1,500 volt electro-pneumatic control.

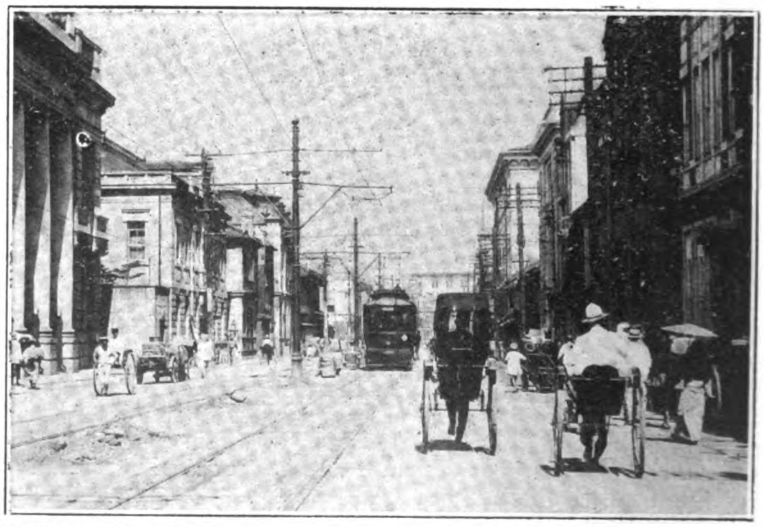
Motors of sizes from 60 h.p. to 100 h.p. have been used with preference being given to the larger motor. Air brakes are, of course, included, and these are generally of the straight air emergency feature type, which is quite familiar in American practice. While the recent catastrope in the Tokyo district of Japan may hold up development for a short time, there is no doubt that the cheapness and reliability of electric transportation will allow a rapid expansion of electric lines. Gasoline will always be expensive in Japan and the high import duties and excessive taxation (on automotive vehicles) will practically eliminate the gas driven car as a competitor. The present day tax in Tokyo on a Ford car is approximately $300 U.S. gold per year.

As the electrifications mentioned above represent the practice which will no doubt be followed in Japan in the future a short description of some of the more important roads is given herewith.

THE AICHI ELECTRIC RAILWAYS.—This line replaced their old equipment, consisting of British motors and single truck cars, in 1919, with the latest type of 27 M.C.B. Brill trucks with Westinghouse 646-J., 65 h.p., 600 volt, quadruple equipments. H.L. electro-pneumatic control was purchased together with Westinghouse air brakes. The operation of this equipment was so satisfactory and profitable that additional orders were placed, bringing up the total equipment to 14 cars, operating between Nagoya and Shin-Maiko—a distance of 19 miles. This number of cars enabled the company to put in operation a schedule speed of 20 miles per hour, to be maintained with 20 minutes headway.

In 1921, the Aichi Railways absorbed a projected line, called The Tokaido Railways, which contemplated high speed operation between Nagoya and Toyohashi, paralleling the main steam line of the imperial government railways. This line being about 40 miles long, naturally favored 1,500 volt operation, and had already purchased their sub-station equipment consisting of eight 250 k.w. Westinghouse rotary converters, each 750 volt, and insulated for operation two in series on 1,500 volt. These rotaries with their necessary step-down transformers and the high voltage switch equipment, were to be installed in two sub-stations, located about





THE SPLENDID TRAMWAYS OF JAPAN

Crossing the Haniwa Bridge, Osaka

On the Sakai-machi, Kobe

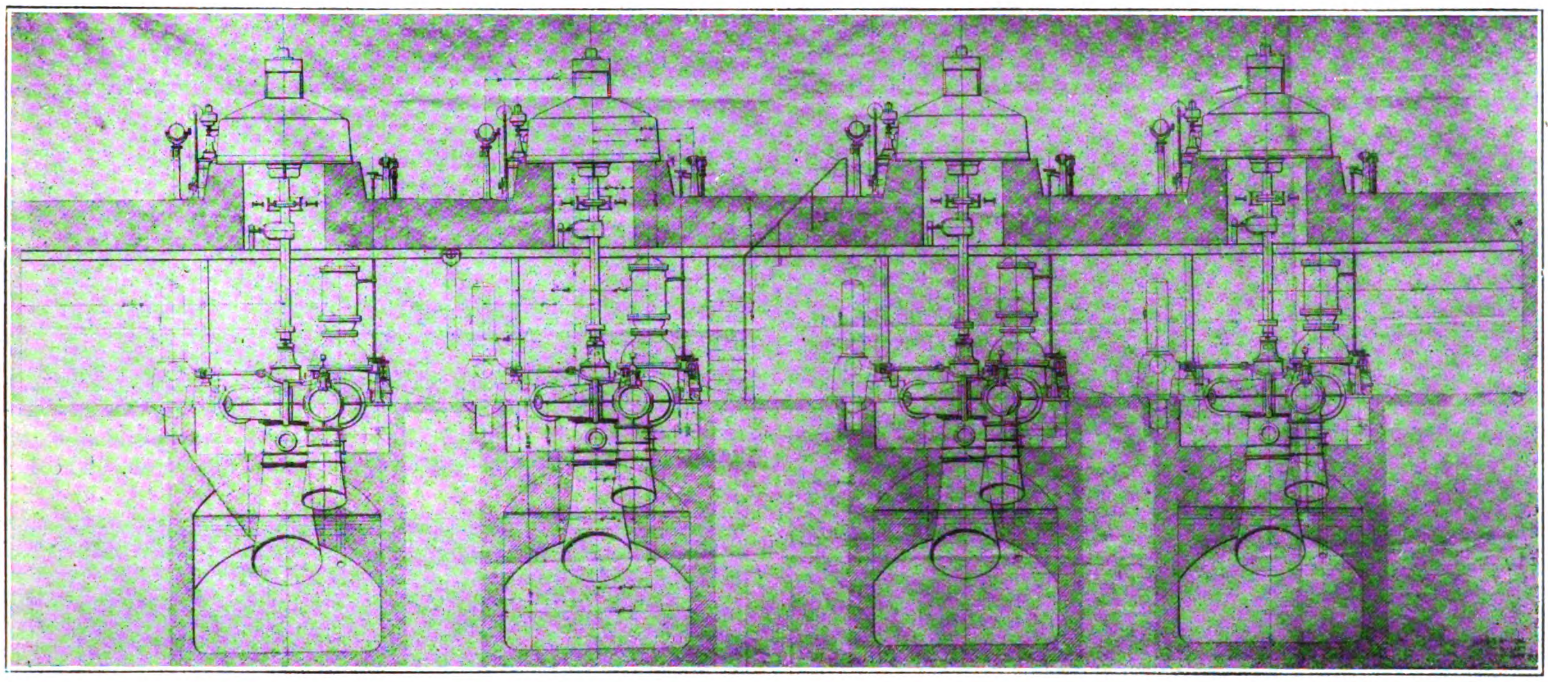
20 miles apart. The line construction is of standard double track catenary design.

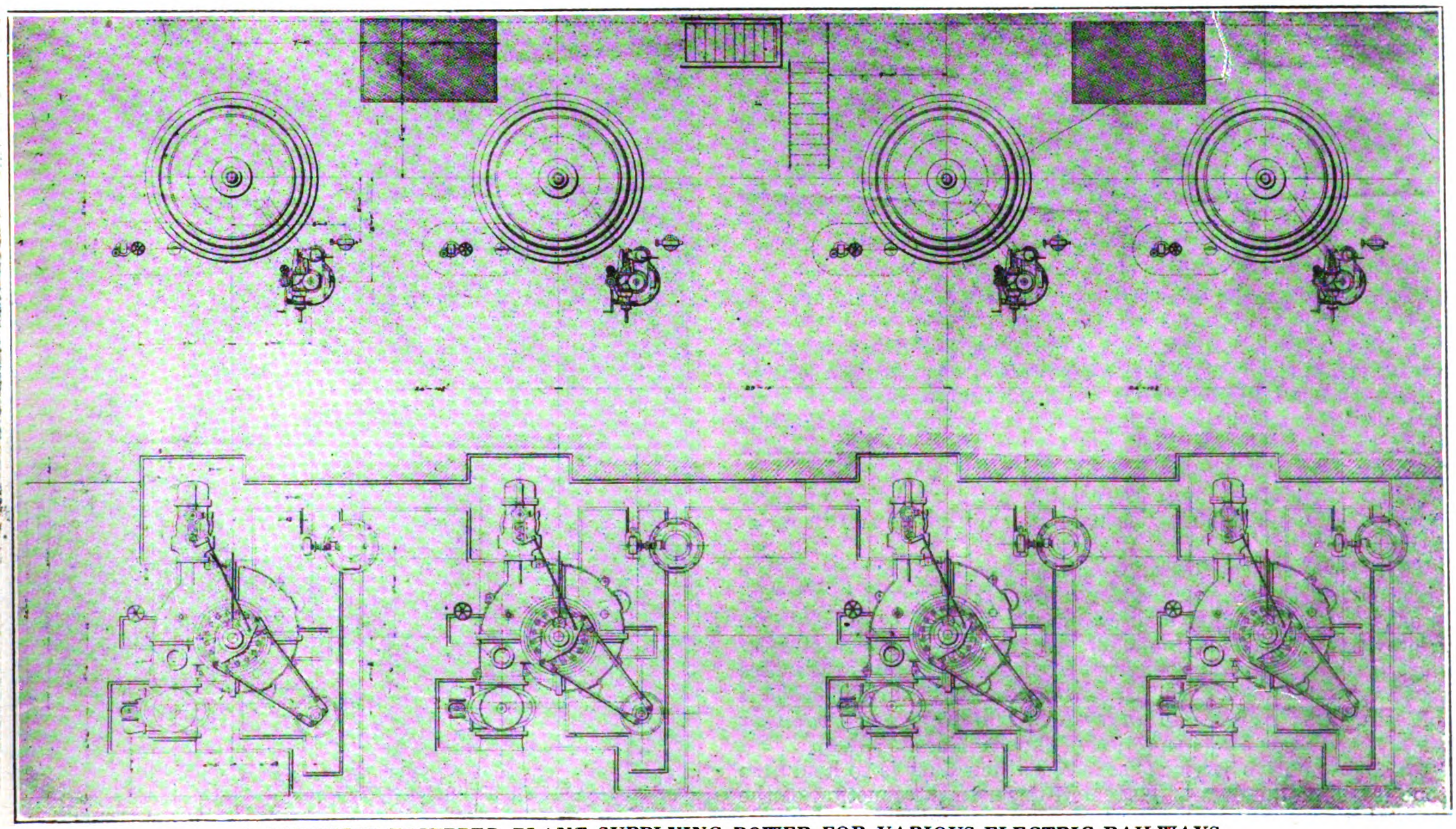
On the amalgamation of the Tokaido Railways with the Aichi Railways the general manager, Mr. Eijiu Tashiro, decided on a 35 tons high-speed interurban car, to give a schedule speed of 28 miles per hour, with stops every mile.

After a careful study he purchased 14 quadruple equipments of Westinghouse 556-J.-6, 100 h.p., narrow gauge, interurban motors complete with H.L. 1,500 volt electro-pneumatic control, and Westinghouse automatic air brake with governor synchronizing system. The current collectors are of pantagraph construction, especially built for high speed interurban service, type S.-514-A. They are held on the trolley by heavy springs and are lowered by the application of air. A small hand pump is provided to lower the pantagraph in case of failure of the air supply.

As this company still maintains its 600 volt shore lines, provision was made on five of the 1,500 volt cars to operate at eighty per cent. (80 per cent.) of normal speed on 600 volt. This is accomplished by an electrically operated change over switch, located underneath the car.

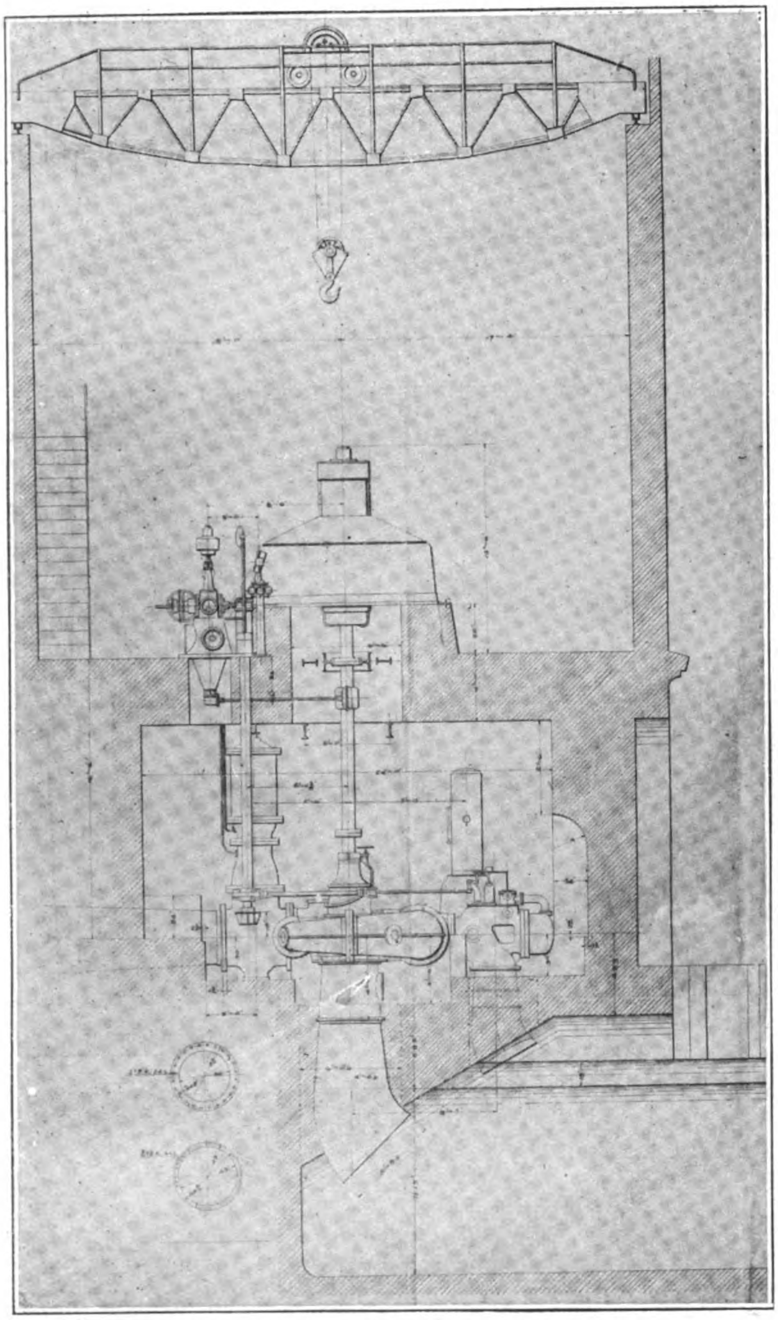
CHICHIBU RAILWAYS.—The Chichibu Railways, operating between Kumagaya and Kagemori, a distance of 31 miles, and situated about 60 miles north of Tokyo, is of peculiar importance, as it was the first independent steam road in Japan to electrify its lines. This pioneer work was begun in 1920, when orders were placed for five 41 tons Baldwin-Westinghouse locomotives, with three





A JAPANESE EQUIPPED PLANT SUPPLYING POWER FOR VARIOUS ELECTRIC RAILWAYS

Plans of the Tone Hutsuden Power Station equipped with four 5,400 H.P. vertical water turbines and generators made by the Hidachi Engineering Works, one of the foremost manufacturers of electrical machinery in Japan, controlled by the Kuhara Company



Side elevation of the Tone Hatsuden Power Plant

quadruple equipment, Westinghouse 546-J.-6 railway motors with 1,200 volts h.l. electro-pneumatic control.

These locomotives were especially designed for narrow gauge service, equipped with quadruple type 586-J., 125 h.p. field control, forced ventilated motors giving a high continuous capacity. They have ideal characteristics, giving heavy torque during the starting period and operating on short field with resulting high speed after the locomotive has accelerated to its balancing speed.

Two sub-stations were purchased, each consisting of three 250 k.w., 600 volt rotaries, insulated for operating two in series on 1,200 volt.

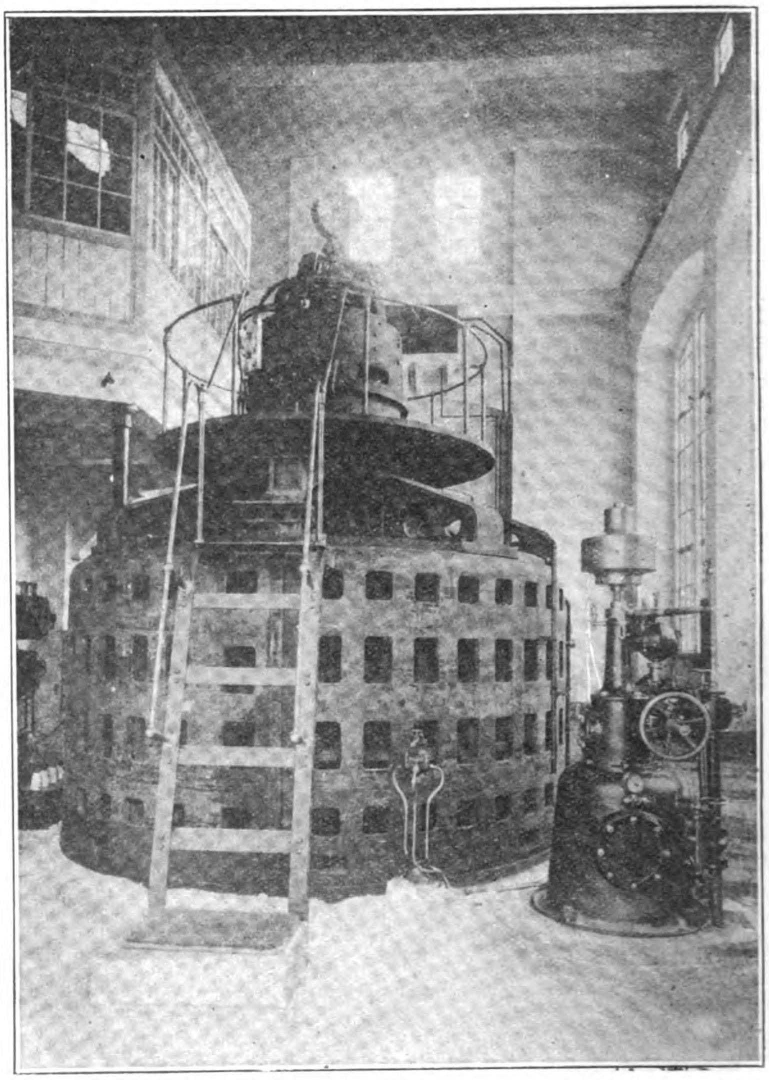
The 1,200 volt switching equipment was the first high voltage direct current switch gear seen in Japan, and it serves as a model for subsequent practice in high voltage electric railway sub-stations. It provides for the maximum of protection to the operator by isolating the 1,200 volt switches and operating them by handles placed upon the dead front panel. The switching arrangement is unique in that the three control rotaries can be interchanged quickly at will, permitting easy inspection of the machines.

The locomotive service is severe, as their duty is to haul lime stone from the quarries at Kagemori down to the junction of the imperial government railways at Kumagaya, and the greater proportion of the line is of 2 per cent. grade.

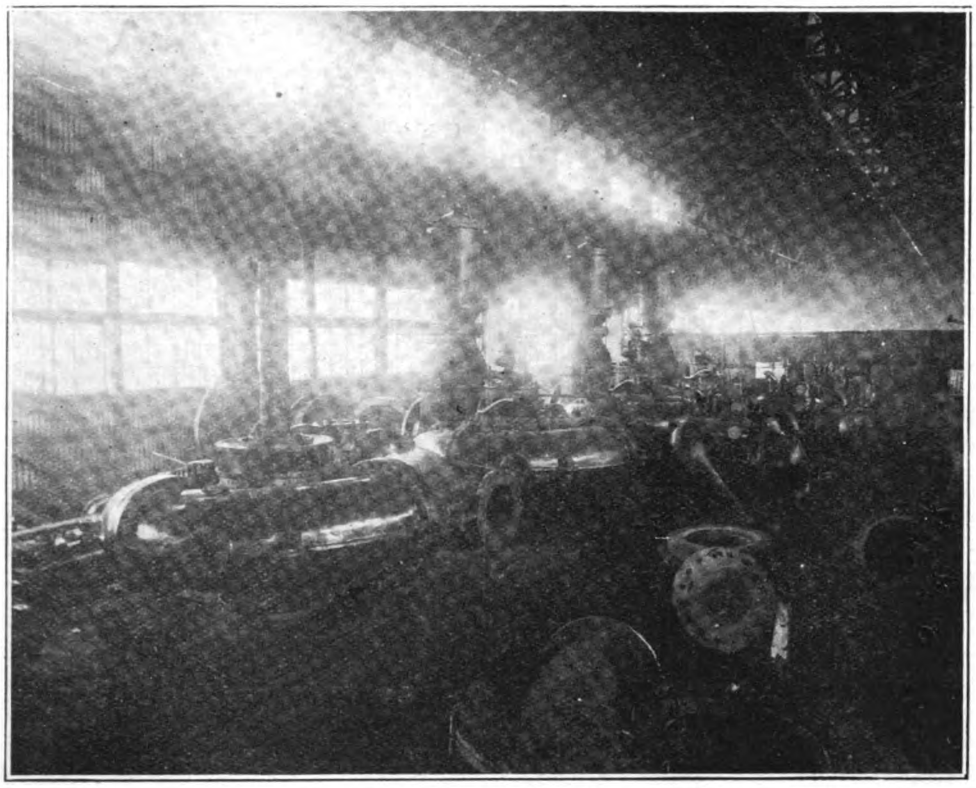
This road aroused such interest throughout Japan that in 1922, special trains were arranged to carry members of the Japanese imperial railways association to witness the operation of this line. The line was inspected from one end to the other and the smooth acceleration and deceleration of the 41 tons locomotives aroused much interest. In view of the highly satisfactory operation of their electrified road the directors of the Chichibu Railways purchased additional equipment in 1922 for the electrification of an additional 10 miles of line, consisting of four additional motor cars and a duplicate sub-station.

Osaka Railways.—The first 1,500 volt line to be placed in operation in Japan was that of the Osaka Railways, over a stretch of 20 miles from Tennoji, Osaka, to Nagano. This road had long been laboring under difficulties as their steam equipment was overloaded and the traffic was increasing every year. After careful study the company decided to accept the recommendation of the Westinghouse engineers and install a 1,500 volt electric railway equipment. Accordingly, thirteen car sets of 100 h.p., 556-J. motors of the same general type as that described above, were purchased. Adequate direct current power is supplied by four 750 k.w. Westinghouse rotaries connected two in series for 1,500 volt service. The switching equipment embodies all of the latest feature for high voltage switch gear, and makes the safety of a 1,500 volt station equal that of a 600 volt equipment.

Yoshino Railways.—An interesting steam road electrification was made not far from Osaka in 1922 by the Yoshino Railways. This road operates between Yoshino junction and the city of Yoshino, where the famous mountain of cherry blossoms is located. When the cherry trees bloom, there is naturally great congestion on this road, and it was decided that the best way to take care of the pilgrims was to electrify. Accordingly eight quadruple equipments of 540-J.-6, 60 h.p., 750 volt motors, were purchased with 1,500 volt h.l. control, arranged for train operation. The high



**Japan is forging ahead in making her own electrical machinery: A 4,444 K.V.A. alternator installed at the Takezawa plant of the Kinugawa Water Power Company: made and erected by the Hidachi Engineering Works**



Vertical water turbines for the Tone Hatsuden Company being erected at the Hidachi Engineering Works

schedule speed of the new equipments enable the eight cars to do the work formerly expected from four steam trains.

It is expected that further expansion of the railways in this district will be made and they will no doubt be of 1,500 volt design as that voltage has now been officially adopted as standard by imperial government railways of Japan.

The island of Kyushu, with its numerous collieries and steel mills needs electric transportation fully as much as the main island.

KYUSHU RAILWAYS.—The most interesting electric road in Kyushu is the Kyushu Railways, running between the twin cities of Hakata-Fukuoka and Kurume. This line follows the latest practice, being equipped with 16 quadruple equipment of 85 h.p. type 545 broad gauge interurban motors, with 1,500 volt electro-pneumatic control equipment, which cares for the passenger service. The freight service will at present, be taken care of by four package cars, each being equipped with four 60 h.p., type 306 railway motors, also supplied with unit switch control, power is supplied to this high speed road bytwo sub-stations, each containing three 500 k.w. 750 volt rotaries, arranged to be connected in pairs to give 1,500 volts. The third rotary in each station is a spare, which can quickly be thrown into service if desired.

This road is of special interest as it is the first line in Kyushu to order 1,500 volt, and it is expected that it will be extended to connect with other roads, so that eventually one can go from one end of Kyushu to the other by high speed interurban cars. The president of the Kyushu Railways is Mr. Momosuke Fukuzawa, who also controls the Aichi Railways, previously mentioned in this article. He is the electric power king of Japan, being the president of the Daido and Toho Electric Power Companies.

HAKATA BAY RAILWAYS.—The latest development in Kyushu is that of the Hakata Bay Railway near Fukuoka. It will operate over the historic battle ground where the invasion of Kublai Khan, the famous China emperor, was repulsed in the thirteenth century.

An initial installation of 6 sets of 1,500 volt equipment has been ordered comprising 24-type 540-J.-6 interurban motors and h.l. control duplicate of that supplied to the Yoshino Railways. The car body and trucks follows American practice and will be made by the Kawasaki Dockyard of Kobe. Suitable sub-stations consisting of 1,500 volt rotary converters with transformers and switchgear will be supplied and power will be obtained from the 60 cycle Nojima power station of Toho Electric Co., which recently ordered a 25,000 k.v.a. Westinghouse turbine generator.

As the cities of Hakata and Fukuoka have a combined population of about 400,000 people the possibilities for additional interurban railways in this vicinity are very great.

MUSASHINO RAILWAYS.—One of the most interesting steam electrifications near Tokyo has already been described in a previous issue of THE FAR EASTERN REVIEW—namely that of Musashino Railways.

This road runs from Ikebukuro to Hanno, a distance of 27 miles, and three trial equipments were ordered in 1921, consisting of quadruple equipments of Westinghouse type 546-J.-6, 600-1,200 volt, 60 h.p. motors, with h.l. control. The operation has been so successful that additional orders were placed in 1923 for four more equipments and three 31 tons Baldwin-Westinghouse locomotives. These locomotives are built for high-speed freight service, each being equipped with four 100 h.p. field control railway motors. As this is a narrow gauge railway, it will be able to haul standard freight cars of the imperial government railways to all parts of its territory. The deciding vote in favor of completely electrifying this road was the neglible maintenance of the electrical equipment with consequent reliability, coupled with the reasonable power rates which are obtained from the Tokyo Electric Light Company. A marked improvement in scheduled speed was also obtained with the electric equipment which corresponding increased the revenue of the road.

JOSHIN RAILWAYS.—Another company which was convinced of the merits of steam road electrification is that of the Joshin Railways. In 1923 they ordered three locomotives, each of 36 tons, and five car sets of quadruple equipment, 68 h.p. motors, with 1,500 volt control. Four 300 k.w., 750-1,500 volt rotary converters will supply the current. The equipment is in contrast to all other steam road electrifications, in that the equipment, even to the air brakes, is of German manufacture.

TOBU RAILWAY.—The latest and one of the most important developments in steam electrification is that of the Tobu Railways, running from Tokyo ninety miles north to a junction point with the imperial government railways.

This road has recently decided to electrify 6.6 miles of line near Tokio, to try out electric operation, and has ordered eight car sets of equipment similar to that purchased by Aichi and Osaka electric railways. Power is supplied from a sub-station consisting of four 250 k.w. rotaries of the same design as those supplied by Aichi Railways. It is expected that the Tobu Railways will gradually extend their electrified zone until they reach the juncture with the imperial government railways and the Chichibu Railways.

In spite of the recent disaster in the Tokyo district, plans for electric railways are going foward, there being at present three active interurban propositions for 1,500 volt lines, and it is easy to foresee the time when Japan will be bound together not only by a superpower system but by railway system which will link government and private roads together at a common voltage, and with uniform equipment.

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The board of the South Eastern & Chatham Construction & Power Company, Limited, have intimated to The English Electric Company, Limited, Queen's House, Kingsway, and the Metropolitan-Vickers Electrical Company, Limited, Trafferd Park, Manchester, that their two tenders for motors and control gear respectively have been accepted. Those equipments are required for the electrification of the first section of the South Eastern & Chatham division of the Southern Railway, and will cover the conversion to electrical operation of the suburban services within a 15-mile radius of Charing Cross. The equipments consist of no less than 508 traction motors each of 300 h.p. with the appropriate controlling apparatus. The two contracts are possibly the largest for multiple unit equipments for main line railway electrification which have ever been placed. The work, which will give employment to many thousands of people spread over a period of nearly two years, forms part of an expenditure of £5,500,000 which was the subject of a guarantee under the trade facilities act.

# Rubber Factories on Estates

## Paper Read Before the Engineering Association of Malaya

*By W. J. Nicoll, Assoc. M. Inst., Mar. E.*

### Buildings and Foundations

FACTORY sites are generally selected to suit the convenience of the estate with regard to being in a central position, near a road, river or water supply, with the result that the foundations are not always of the best nature. In fact the majority of factories in the F. M. S. are built on unsuitable soil, but as this, in many cases, cannot be avoided, the foundations have, therefore, to be designed to suit the conditions. If " bukits " (small hills) are available they are often selected as suitable factory sites. However, factories should never be built on the face of a steep hill as this interfers with the free circulation of air in the drying sheds, which may be detrimental to the rubber therein, as the air to a certain extent ie closed off from the hill side of the buildings. The top storey of a factory built on such a site became filled with the smoke of burning refuse of the other side of the bukit—the wind blowing on behind the hill—and as there was no smoke in the lower storeys of the building, it is obvious that the free circulation of air was interfered with by the wind blowing in that direction, the current passing over the bukit and in at the jack roof of the building and causing an eddy current over it. The foregoing remark applies to a building, the walls of which were open round the bottom for about one foot from the ground as in modern factory construction. If a low hill or hard level ground is available this forms an excellent site when well cleared of trees for about a 50-yard radius round the buildings. This allows of a free circulation of air in all directions. The first consideration should be given to the nature of the soil although the water supply may require to be pumped from soms distant source.

On soft soil it is necessary to pile the column foundations, while on firm ground such procedure is avoided by building an ordinary masonry base. The foundations for the machinery, on soft ground, must be piled with hardwood piles from 10 to 20 feet long, but this is also unnecessary on firm ground. On the latter a deep foundation is preferable, while on soft soil a floating grillage and wide foundations are adopted to reduce the pressure per sq. ft. on the soil. Some soils may only carry safely 1 ton per sq. ft. while others will carry six tons or more.

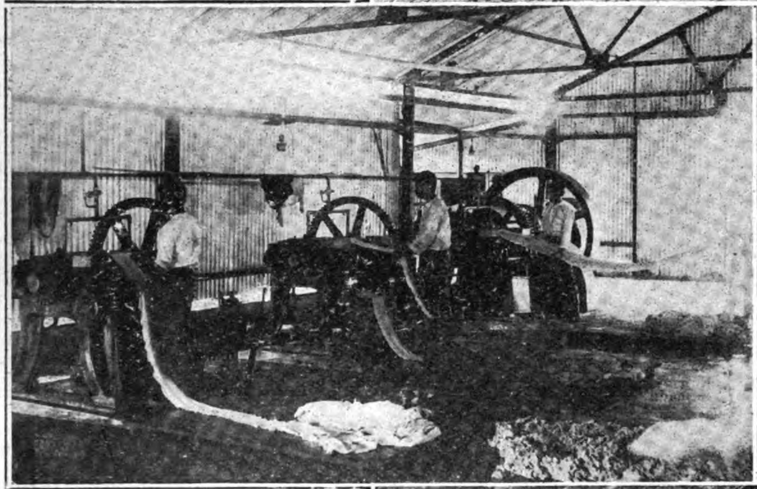
Where possible, in rubber factory construction on soft ground, all machines and line-shaft pedestals should be built on reinforced foundations, and this reinforcement—I beams preferably—to be continuous through all machine and pedestal foundations. With such reinforcement a shallow bed of concrete can be laid say about 18-in. thick under heavy machines, while 9 to 12-in. thick under light machines is ample. The area of the foundations should be varied to give a uniform soil pressure the whole length of the plant, thus avoiding any undue stresses in them. A common error on soft soil is to provide each machine with a deep bed of concrete coupled together with a thin slab, with the result that the soil is squeezed up against this slab by the weight of the machines, which ultimately breaks the concrete between the machines and upsets the entire alignment of them and the line shaft. This also applies to engine foundations which should be shallow, of a large area, reinforced and coupled to the line shaft foundations thus giving extra resistance to vibration and avoiding any turning of the engine bed due to belt pull. Floors are generally laid about 4 to 6-in. thick, 1-2·5 concrete, and should be cambered to allow water to run off. Drains of a large size are necessary to carry off factory and rain water, and if the roofs are not provided with gutters there should be a concrete apron laid 4 or 5-ft. out from the edge of the drain to catch roof water which would otherwise tend to wash away the soil from the foundations. Such aprons are also useful for the purpose of washing and drying factory utensils.

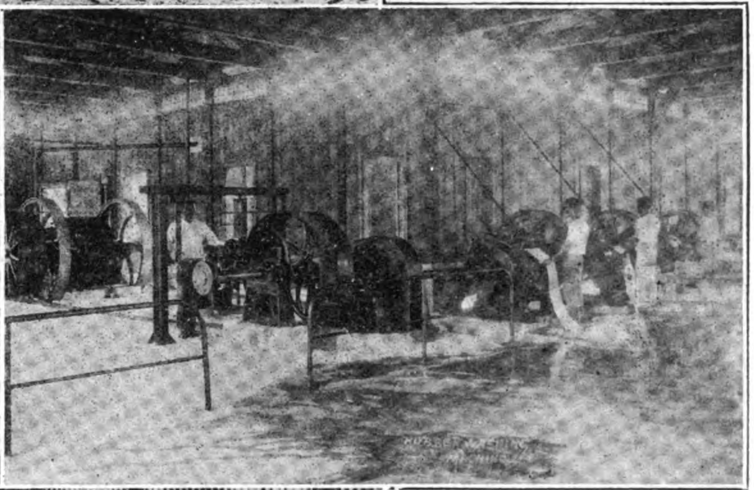
Tapping Rubber Trees in Singapore

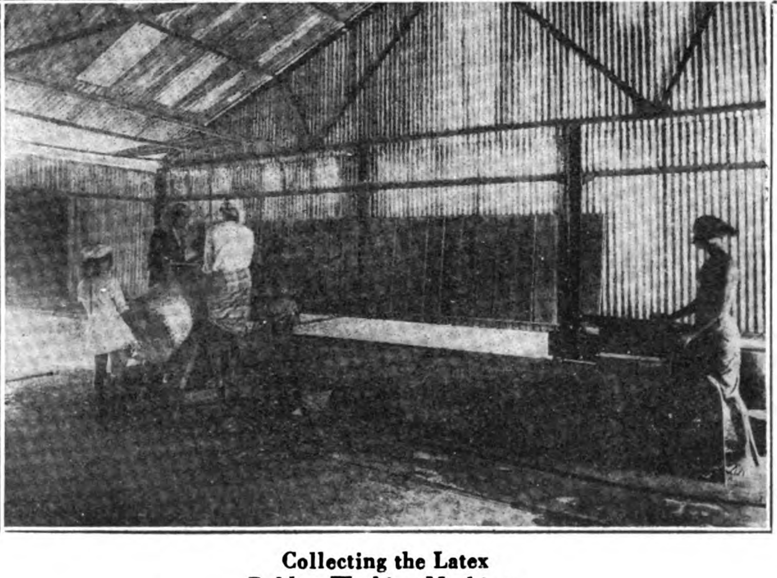
The factory buildings are generally constructed of corrugated iron on a steel framework. There are, however, buildings of wood and brickwork with tiled roofs, which give a much lower interior temperature than the iron structure. The most common fault with iron buildings is that they are too low—10 or 12-ft. to the eaves —lack of a jack roof, and are not left open round the sides, i.e., not covered with expanded metal instead of corrugated iron for about 5-ft. from the floor. At the same time the direct rays of the sun should not be allowed to enter the factory. High buildings should be constructed, say from 15 to 20-ft. to the eaves, and fitted with a jack roof to facilitate the free circulation of air. They also have the advantage of not being so hot as low buildings. Windows should open from the bottom outwards. If the interior of the factory is painted white the lighting effect is much improved. Factories should have ample space for machinery and utensils required in the manufacture of rubber. At least 2-ft. clear space should be left between each machine to facilitate the repair of machines, which should also be from 6 to 8-in. above floor level. The floor space around the machines should be tiled, as dirt and grit are less liable to get into the rubber than with a concrete floor, which in time disintegrates through the action of acids. For tables, the reinforced tile table has superseded wooden tables, as the former are much cleaner and have a longer life. When the producer gas engine is used the generater room should be paritioned off from the rest of the factory to aviod dust entering herein. This is also advisable with the engine, but is in many

cases impracticable, the reason being that all machines should be in view of the driver.

With regard to necessary crepe drying accommodation the size of shed is governed by the quantity of crepe manufactured. A reasonable allowance is from 6 to 8-lb. per month per sq. ft. of floor space, but again this depends on location of shed, its design and extra space required for further estate development. If possible they should be built at least two or three storeys high with an opening of about 2-ft. round the bottom of the walls to allow a free inrush of air. This opening can be covered with expanded metal also. An adequate jack roof should be fitted the whole length of the building. Windows should also be provided at intervals. Although they should always be kept shut during the drying of the rubber, they are necessary to allow of the examination of the rubber. To facilitate the drying of the crepe in the upper storeys, the ground floor of a crepe shed should be left clear, but may be used as a packing room or store. The floor should be of concrete and from 1 to 2-ft. above ground level. Ample provision should be made to carry off rain water, and on very high buildings gutters should be fitted to prevent the roof water from washing away the foundation soil. Crepe drying sheds should be built at least 50-ft. away from the factory, as insurance companies now insist of 50-ft. clear space between all buildings.







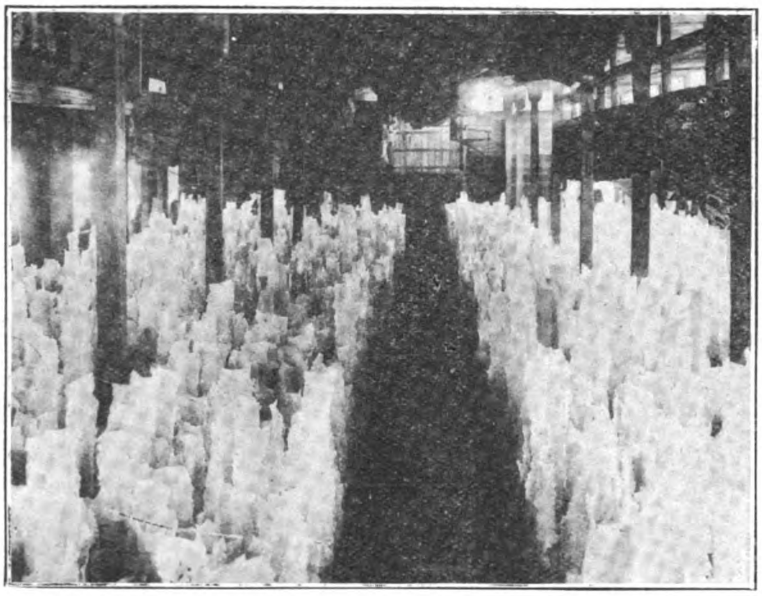
**Collecting the Latex**
**Rubber Washing Machines**
**Coagulating Tanks**

Smoke house foundations need careful attention on soft soil, and should always be piled. The size of smoke house depends on the crop of the estate, but with an "ordinary" type 60 sq. ft. per 1,000-lb. per month is a reasonable allowance. With the "Double Devon" type this allowance can be halved, for with this smoke house one gets continuous smoking, and there are no passage ways required in the smoke room between the racks, as the latter are drawn out on to a verandah for loading and unloading. This type allows of the work on the rubber in a much cooler temperature than with the former, while no smoke escapes during loading operations, as the inner end of the rack forms a door when the rack is drawn out. This latter type is now the most common in use, as it is economical in fuel. Fire boxes may either be mounted on rails for withdrawal or sunk in the ground and charged inside the smoke room. With the latter, care must be taken that the bottom of the fire box does not go down to the high water level in the ground; otherwise in wet seasons the smoke house would become full of saturated air. This can be avoided, however, by having the boxes watertight, or, even better, by laying them in a mason-work cylinder with a closed bottom, and with a space of about 6 to 12-in. round the fire box to allow the heat to radiate up into the smoke room. All fire boxes should be covered with perforated covers, and in addition should have hoods hung above them to prevent dust and flames rising into the rubber. The first and subsequent floors in the ordinary type smoke house should be "spar-floored" and covered with gauze. In the double Devon type this is only necessary on the first floor, or may even be omitted, as there is no work done on the rubber inside this smoke room. Smoke houses are generally constructed of a steel framework, corrugated iron and brick-work, brick walls to the first floor and corrugated iron for the remainder. In modern practice, however, brick walls are carried up the whole height of the building, as they tend to retain more heat and therefore facilitate the drying of rubber. Floors should be of concrete so that any collection of dust can be easily removed. With the earth floor particles of dust tend to rise with the air and settle on the rubber. Roof coverings may be either of tiles, genasco, wood or corrugated iron. The latter does not have the lasting qualities of the former three owing to the action of heat which causes rapid corrosion.

## Water Supply

In the manufacture of rubber a good water supply is essential. This may either be drawn from an open well supplied by a catchment area, public supplies (i.e., town mains), rivers or bores. The

water from town mains and rain water wells is the most preferable of these sources although bore water when chemically treated for hardness suits the purpose well, provided it is not in any way polluted with vegetable or organic matter. Field surface drain and river water has generally to be filtered, and although the initial expenditure of a mechanical filter may be high, it is well warranted, as such water usually contains a high percentage of impurities which are detrimental in the manufacture of rubber. The water obtained from a river supply should be avoided, however, where possible. Storage tanks should always be provided at from 10 to 30-ft. above the factory level, or even higher if convenient to give the water additional head, and should contain about a full day's supply. In order to allow the water to settle one night before using and to be undisturbed by the pumping in of water when using, it is preferable to have two similar tanks where one can be filled while the other is running off. Unless in gravity systems these tanks are filled by means of pumps, which should be duplicated in case of a breakdown. Where the storage tanks are some distance off, the pump delivery pipes at the factory can be led into the return pipe from the tank. This system does not only save considerable expenditure in pipeline but is also useful when cleaning or painting the



Drying Crepe Rubber

tanks, as the factory can still be run directly off the pump, while any surplus can be allowed to overflow. A fair average consumption of water for a battery of six heavy machines, one scrap-washer and four small machines is approximately 1,200 galls. per hour. In addition to this, allowance must be made for cooling water for the engine and for a gas producer—if a suction gas plant is installed. A safe allowance for the latter two is from 800 to 1,000 galls. per hour, which applies only to plants in these tropical climates.

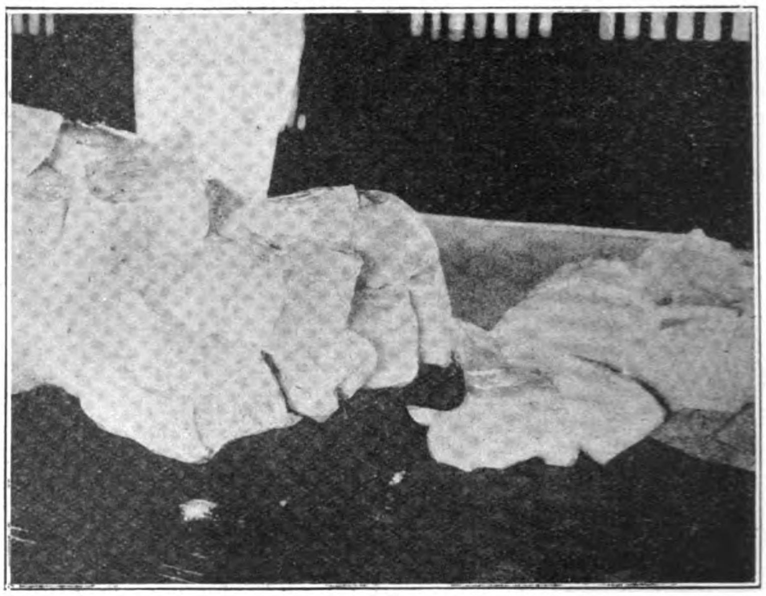
## Machinery

PRIME MOVER AND RUBBER MACHINEC.

Prime Mover { Steam Engine. / Internal Combustion Engine.

After generally reviewing steam versus the internal combustion engine and finding the latter to be the more economical, it will be considered as the usual prime mover in the preparation of rubber in the F.M.S. The producer gas engine is more commonly used than the oil engine, as charcoal can be made cheaply and gives very cheap power. Wood-burning plants are in operation which convert all the fuel into heat, unless some tar deposits. This applies to plants with the "updraught" system. The improved Ackroyd plant, however, is designed to burn all the tar. The principal feature of this generator is the down draught in the fuel combustion chamber. A certain amount of heat is wasted in making the charcoal for the charcoal-burning plant.

The selection between the wood-burning plant and the charcoal plant entirely depends on the convenience of wood supplies and their likely duration. Where a large quantity of wood is procurable within easy reach of the factory or road, the wood plant may be favorably considered, while on well matured estates, where jungle timber is scarce and only fallen rubber trees to rely on, at some distance away or often a distant jungle, the charcoal plant is generally accepted. This plant is also much cleaner than the ordinary wood-burning plant as a tar extracting device is unnecessary. In addition to field-made charcoal, charcoal from the smoke house can go a long way to supply the plant. A fire box 4-ft. deep by 4-ft. diam. will produce from rubber wood at least 1,500-lb. of charcoal per month, while the average consumption of an engine developing 40 to 45 B.H.P. is 50 to 54-lb. per hour (1-lb. charcoal=12,000 B.T.U.). Therefore six such fire boxes will provide fuel for 160 to 180 hours' run per month. It must also be remembered that this as firewood has already been paid for and has done its work in the smoke house, while the cost of cleaning the fire boxes and charcoal is very little. Thus the cost of fuel from this source may be as low as 4 cts. per hour for the engine under consideration. The decisive factors with regard to the coal-burning plant are the cost and transport of the coal, and considering a tar extracting device is necessary with this fuel, the running cost may be greater than that of the crude oil engine.



Ready for Shipment

On many large estates where charcoal consumption would be heavy and in excess of available timber, either kerosene or crude oil engines are used. At the present time the latter have superseded the former to a very great extent owing to the high fuel costs of the kerosene engines, although in small factories or as pumping engines they are still in use. That applies to engines up to about 8 horse power. Small kerosene engines are more suitable for such purposes. However, above that rating, the crude oil engine, either Diesel or semi-Diesel, is generally installed. The average consumption of fuel oil is about 0.5-lb. per H.P. per hour; therefore, with oil at a reasonable price, the user may have power at a price between 1.5 and 2 cents per H.P. per hour. However, as the running costs of the crude oil engine depend mostly on the price of the fuel, which latter varies with the supply and demand, the costs at any time become very high, whereas with the producer gas engine fuel costs remain at a very level figure, at from 7 cts. to 1.0 ct. per H.P. per hour with ordinary field-made charcoal. With the gas engine there is also the upkeep of the producer plant in addition to the engine, and when "all-in" running costs are considered they may ultimately be much in favor of the crude oil engine. However, a producer plant will run a long time burning coal or charcoal when carefully handled.

On account of the high efficiency of the modern crude oil engine, the planting community generally give it the preference without much consideration to the fluctuating prices of fuel and available local fuel products, which in many cases would give cheaper power.

The size of the engine selected depends on the number of machines it has to drive and likely to drive, and a fair margin of power must be made for further extensions according to estate developments.

As rubber in a coagulated condition is perishable, and also in case of break-downs, it is necessary to have a stand-by engine which, if possible, should be a duplicate of the other so that one set of spares will only require to be stocked.

As the installation of plant on a rubber estate has to be carried out on as economical a basis as possible—from a financial point of view—at the commencement of rubber production of the estate, a primemover of sufficient capacity only to deal with the existing requirements—immaterial of developments—is generally installed. This is rather contrary to my previous remark, but the former alludes to estates which are in a sound financial position at the commencement of rubber production, and which are able to take into consideration the ultimate development of the estate. For estates up to 1,000 acres an engine of 35 B.H.P. is sufficient, while for larger acreages an allowance of about 20 B.H.P. per additional 1,000 acres is ample.

As it is necessary to have a water-circulating system round the cylinder of the internal combustion engine, this may either be of the "run-through" or "syphon" system. With the run-through system it does not necessarily mean that the water runs to waste, as it may either run back into a reservoir or be used direct in the factory for washing rubber or tanks, etc. If an ample supply of water is available, this is the more preferable system, as the engine cylinder remains at a more even temperature than with the other, where the water circulates through a series of tanks, and at the end of a day's run may be very hot. The temperature of circulating water should not be more than 150 degs. F. Beyond this the temperature in the cylinder *would be too high* for ordinary cylinder oil which would carbonise instead of doing its allotted work, with the result that the piston would become seized in the cylinder.

## Rubber Machines

In the manufacture of sheet rubber, light machines are used with rolls 6-in. diam. by 18-in. long running at a speed of about 30-ft. per min. A battery of these should consist of three machines with smooth rolls and one with grooved or marking rolls. Some small estates still use hand rolls with good results. Where afternoon rolling is in practice this number is essential, as the coagulum then is much softer than on the following morning, and it should be reduced in easy stages to avoid its breaking up. The marking machine is necessary to give the sheet a rough surface in order to facilitate drying, improve surface appearance and aid in the unpacking of the rubber. This machine also impresses the estate name on the sheet, which is useful when examining the various estates' rubber on the market, as in some cases it may be the only means of detecting the rubber, should the packing case be broken up. These machines are light to drive and for a whole battery in good order an allowance of 4 B.H.P. is ample. A good supply of water is essential in the manufacture of sheet, and should be distributed evenly over the rolls. The purpose of the water is to wash the serum off the rubber. For creping purposes heavy machines are necessary. A battery should consist of one heavy macerator, one crepe machine, two smooth roll machines and one scrap washer. Such a battery would be sufficient for a crop of 15,000 to 18,000-lb. of crepe per month including all low grades, while to drive this battery a 40 B.H.P. engine would be necessary.

When the coagulum is removed from the tanks it is passed through the macerator mill (that applies only when the coagulum is being made direct into first latex crepe) the rolls of which are generally diamond grooved ·10-in. pitch, $\frac{1}{2}$-in. centres and about $\frac{1}{4}$-in. deep. These rolls are usually 12-in. diam. and may be 15 or 18-in. wide according to the type of machine, while their speed is about 60-ft. per min., and the ratio of the speed of the back roll to the front roll is as $1\frac{1}{2}$ to 1. This variation in speed is necessary to assist in the washing and mixing of the rubber. The rubber leaves this machine in blanket form, and is passed on to the creping mill, the rolls of which are not so deeply grooved, usually about $\frac{1}{8}$ by $\frac{1}{8}$-in. The crepe is thinned out in this mill prior to passing to the first smooth roll machine, which may have even speed rolls, while the second smooth roll machine has a surface speed ratio of $1\frac{1}{2}$ to 1. The latter machine is the finishing one, and the crepe should leave this mill about .02-in. thick in order to facilitate drying and thus check disease in the rubber. The output of crepe is governed by this machine, and if the rolls are 15-in. wide this will be about 60 to 80-lb. dry rubber per hour. The mills should never be allowed to run empty as the rollers grind on one another and destroy their surface, while they also give the crepe a streaky appearance thereby.

When installing machinery in a factory a type of machine should be selected which is easy to operate and with no unnecessary or complicated gear to get out of order. All operating gear should be easy of access, bearings large in diameter and a good system of grease lubrication provided for the rolls. Main shaft bearings should be ring-oiled if possible, and provision made against water entering them, otherwise the oil would soon be washed out, with bad results to the bearings. Various types of machines should not be installed in a factory as each type generally has a different back-shaft speed, and the machines fitted with their standard gears would give uneven roll surface speeds. There is another important reason why machines of various types should not be installed, that is, spares are required for each type, and their combined value may be a considerable amount. With a battery of machines, say six of one type, all the spares that are necessary to stock, are two pairs of rolls, one spur wheel, two roller pinions, two shaft pinions and sundry cluth details which are liable to excessive wear.

All machines should be fitted with friction clutches, as it is impossible to declutch a dog-clutch when the machine is loaded.

To wash low-grade rubber scrap washers are employed. These many either be of the single or double rotar type. In the double rotar washer, the two rotars are provided with helical vanes which mesh with each other when revolving, while the scrap passes between them. Behind each rotar is a concave fluted cast iron plate, which is about $\frac{1}{4}$-in. clear of the rotar. In the bottom of the casing is a grating to allow the water and the bark shavings to run off. In the single rotar machine a series of fluted discs are mounted on a shaft with spacing collars between them. Stationary webs are fitted in the casing opposite the spaces between the rotar discs. The scrap rubber when put into the machine is forced between the discs and the webs and round the face of the discs. The rotar travels at a speed of about 25 R.P.M. and the machine with a rotar 18-in. long will wash on an average 100 to 150-lb. per hour with a plentiful supply of water plying on the scrap rubber which is removed in lump form. The single rotar machine is the one most generally used on small estates, while, where a large quantity of rubber has to be dealt with, the double rotar type has the preference, in fact, is superseding the former very rapidly as the rubber is washed faster, is less liable to damage by a heated rotar, and is easier to drive.

Scrap washing machines should be partitioned off from the other machines in order to avoid the conveyance of dirt into the interior of the factory, which should be kept absolutely clean. This may entail a belt drive or extra line shafting. With the latter it would be necessary to carry a heavy shaft right out to the end, whereas if a belt drive is employed the scrap washer can be driven off the main shaft near the main drive. The most common situation, however, is on the main shaft, thus avoiding any belt transmission, but it is imperative that a reasonable space be left between the scrap washer and other mills.

If cost is a secondary consideration when selecting mills, machines with cut gears should first receive attention, although there are many good mills on the market without such gears, and give equal results if properly manipulated. Rolls of good, hard and close grained cast iron are necessary as soft rolls may destroy the rubber by the disintegration of the soft cast iron. It might be mentioned that any streaks on crepe are very detrimental to its value. Provision must also be made to prevent the rubber passing the ends of the rolls by means of close fitting side guards or wooden blocks lying between the rolls. The latter method is dangerous as the block may spring out and strike the operater in the eye, as has already happened.

## Main Drives

Some engineers consider that the engine geared to the main shaft gives the best results. However, the engines are generally placed behind the machines, and for the purpose of having an "open belt drive," it is necessary to do either of the following :—(*a*) drive by belt to a countershaft geared to main shaft, (*b*) drive direct to main shaft by belt with breech end of engine in towards machines, or (*c*) reverse the rotation and position of the engine with the breech end out from the machines and with a drive as in (*b*).

Reversing the engine is not to be recommended. The method adopted in (*a*) is very satisfactory as one can move freely round the

breech end without coming into contact with the belt. The most common method, however, is that adopted in (*b*), although this may entail a heavier belt than that used in (*a*) owing to its slower speed. The clutch is generally fitted to the main shaft, although in some cases it is fitted to the engine. With the latter method a smaller cluth can be used for the same horse-power owing to the engine's speed being higher than that of the main shaft.

Where there is only one engine the ordinary type of clutch is used—i.e., the pulley runs on the main shaft and has fixed to it a shell or rim into which the clutch engages. The pull of the belt is transmitted to the shaft bearings on each side of the pulley. If this belt is heavy and long the pull may be considerable, and if the bearings are not sufficiently large there is the tendency of excessive bearing pressure resulting in heat. To avoid this, however, a quill shaft can be installed with independent bearings to take the belt pull. The main shaft in this case runs through the quill and only carries part of the clutch, the other part being fitted to the quill. This method also avoids any tendency to bend the main shaft when running.

Where two engines are installed this latter type of drive is much to be recommended, for when one engine is working the belt pull of the idle engine is transmitted to the stationary quill, and not to the shaft, as is the case with the ordinary loose pulley, incurring heavy wear and frictional losses unless the belt is removed. Of this type of cluth there are few in the F.M.S.

In compliance with the machinery enactment it is essential to have a safety declutching device which can be operated from any machine. This can be accomplished by having a cast iron weight sliding on a vertical standard and coupled to the main drive clutch hand-lever by means of a wire rope running over a pulley fixed to the standard. The weight can be hung by a trigger to which is attached the wire rope that extends over all the machines. If properly arranged a 4-in. depression on the wire should be sufficient to release the trigger which in turn releases the weight and ultimately the clutch. If the machines are loaded when the safety device is tripped the main shaft will not revolve more than one rev. which means a very small movement of the machine rolls. The wire should be placed just in front of the operator's chest, as the most common accidents are that of his hands being caught in the rolls, and by endeavoring to release his hand or hands he will fall forward on the wire and automatically stop the machine.

As already mentioned the individual machine friction clutch may prove of service in case of accidents, but it is very unlikely that an operator whose hand is caught can catch the operating lever with the other especially if the opposite hand. Hence it is essential to have a device which can be operated with the body.

## General

In the manufacture of rubber, cleanliness is absolutely necessary. Machines should be periodically washed with a solution of caustic soda and water, all surplus grease removed from ends of bearings and finally washed with clean water. All shafting and brass work should be cleaned daily. To some this may seem unnecessary and a wasting of money and time, but if carried out systematically can be done on an economical basis. By keeping the machine clean the coolies develop clean methods of working with the rubber and utensils in the factory. The engine valves and combustion chamber should be cleaned once per week, or after running about 100 hours, while the water jacket scour cock should also be opened weekly for say a quarter of an hour.

If using charcoal as a fuel the scrubber should be thoroughly washed out yearly and fresh coke put in, while the old coke can be laid out and put back the following year.

In order to compare daily consumption, records should be kept showing the number of hours run, fuel and lubricating oil used, and remarks. These can be summarised as for any period. Should fuel consumption be increasing one can immediately start to trace detects in valves, leaks in pipes and generator (in gas plant), or in the generator brick work which may have fallen in.

Cleanliness also applies to the exterior of the buildings. Drains should be kept clean and occasionally disinfected with Jeye's fluid. Weeds should be eliminated so that the seeds cannot blew into the factory and settle on the rubber. Machine and engine stores should be kept in a separate shed, dried and occasionally oiled. Records of these spares should be kept—i.e., when received, when issued and balance in stock. Similarly repairs to machines should be entered in a log book, so that to trace the result of any adjustment and the fitting of any new part would not be a difficult matter.

Fuel stores, especially charcoal and firewood, should be clear of the factory buildings in order to obviate dust entering them. Charcoal stores should have a watertight roof to keep the fuel dry in order to avoid spontaneous combustion.

In conclusion, the data in this paper is not to be considered as hard and fast, but general, with suggestions which may be of use to those engaged in the construction of rubber factories and carrying on the manufacture of rubber.

# Japanese High Voltage Power Transmission Systems

(*Continued from page 739*)

22,000 volts through three 1,500 kv-a, three-phase transformers, 11,000 to 22,000 volts, at the Noe No. 3 substation. Power for the Osaka-Koya Railroad is supplied at 11,000 volts by the Dotombori substation. The other important customers and connections can be seen from the diagram shown in Fig. 11.

The Ujigawa Electric Co. is contemplating the installation of a 30,000 kv-a transformer station, stepping up the voltage from 11,000 to 22,000 volts, as they intend to change over some of their longer or more heavily loaded circuits to the higher voltage.

The Nippon Power Co. with which the Ujigawa Electric Co. is affiliated, contemplates the installation of a new steam station in Osaka. This station will deliver 20,000 kv-a at 11,000 volts through the Kujo switching to the Ujigawa system and will deliver the balance of its power to a transformer station where it will be stepped up to 55,000 volts. At this voltage, 35,000 kv-a will be supplied to the Yamatagawa substation and 15,000 kv-a will be delivered to other points of the system. The main connections proposed for this plant are shown in Fig. 12, which indicates the immediate installation of two units of about 25,000 kv-a capacity each and the ultimate installation of four units.

Each generator is provided with its own exciter, but provision is made for utilizing a spare exciter in case of emergency. The neutral of any or all of the generators can be connected to a neutral bus, grounded through a resistance. Each generator is connected through a circuit breaker and two sets of disconnecting switches to either of two 11,000 volt busses. These busses are so sectioned that units No. 1 and 2 are on the left end ; and units No. 3 and 4 are on the right end. House transformers of 2,500 kv-a capacity connect each end of the 11,000 volt main bus to corresponding ends of a 3,300 volt house service bus and there will be a house turbogenerator connected to end each of this house service bus. The house service bus in turn feeds the turbine room auxiliary bus, and the boiler room auxiliary bus. The ultimate plant will have four 5,000 kv-a feeders at 11,000 volts, four transformer banks stepping up to 55,000 volts and two 50,000 kv-a, 50,000 volt outgoing feeder circuits.

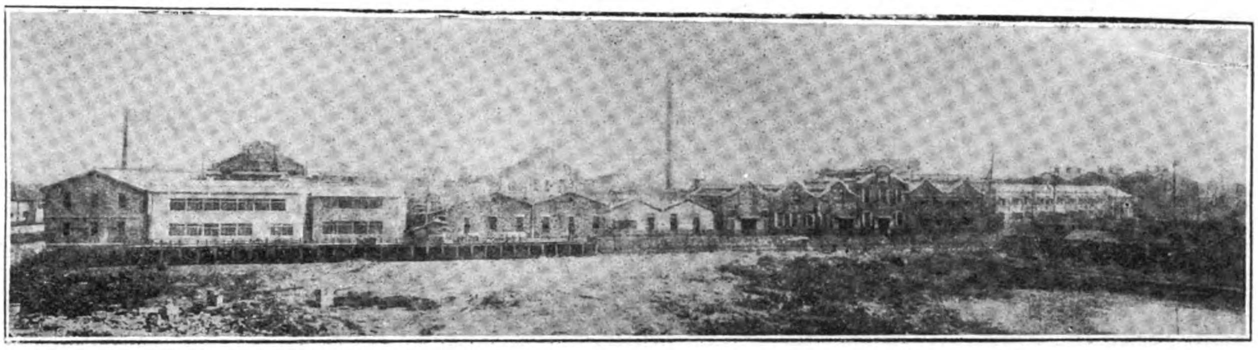
(*To be continued*).

# Signalling Practice on the Federated Malay States Railway

(*Continued from page 767*)

39. Outlying sidings are controlled by a tablet lock fitted to the lever operating the points. In the lock is a receptacle for a tablet. When the tablet is inserted in this receptacle and the lid which confines it closed the lever is freed and can be pulled over. The instant the lever moves the lid becomes locked and remains as until the lever is returned to its normal position, when the lock on the tablet is released and it can be removed. Without the tablet the points affording access to them cannot be moved and until the points have again been set for the main line the tablet cannot be abstracted to permit the train to proceed.

40. Finally, provision can easily be made for switching through sections where required. In this manner the sections can be arranged to cover two or more ordinary tablet stations thus reducing the staff that ordinarily would be required to be on duty solely to manipulate the instruments ; on long stretches of line where mostly though goods trains are run during the night such an arrangement besides being economical assures perfect safety in the working of trains.



The Great Electric Wire Works of the Furukawa Company at Yokohama, destroyed by the fire

# The Rubber Industry of Japan

## Extent of Japanese Rubber Manufacture

ALTHOUGH the importance of Japan as a market for rubber goods has been recognized for several years, few realize the extent of her rubber manufacturing industry. This business has grown so rapidly during and since the war under the protection of high customs duties that exports of rubber goods now greatly exceed imports. In 1919 exports amounted to $9,689,922 against imports amounting to only $1,422,966.

On the outbreak of the war rubber goods shipments from England and Germany to Japan, China and all Far East countries were soon curtailed or stopped. The opportunity and need thus presented were quickly seized and met by Japan. New companies were organized, new factories were erected, old ones were enlarged, and the production of numerous rubber goods not formerly made in Japan was undertaken for home consumption and for export to other countries throughout the Orient where the use of rubber goods has become widespread in recent years.

Tires for bicycles, jinrikishas and automobiles, which formerly were largely imported, are now supplied to meet virtually the entire home demand and also extensively exported. The same is true of insulated wire and cable, which are playing such an important part in modernizing the Far East. Toys, balls and balloons have become important Japanese manufactures and exports, and considerable quantities of hose, sheeting, insertions, various types of shoes and druggists' sundries are also being produced.

In 1914 there were in Japan sixty general rubber companies having an aggregate capitalization of $2,500,000 and employing 4,000 hands, and eight insulated wire companies having a capitalization of $3,000,000 and employing 3,000 hands.

The following table shows the rapid development of Japan's rubber manufacturing industry in recent years:—

| Year | Factories | Employes | Output in Yen* |
|---|---|---|---|
| 1915... ... ... ... ... | 265 | 5,043 | 6,703,796 |
| 1916... ... ... ... ... | 154 | 7,137 | 11,240,169 |
| 1917... ... ... ... ... | 166 | 6,618 | 15,028,864 |
| 1918... ... ... ... ... | 188 | 8,245 | 22,955,559 |
| 1919... ... ... ... ... | 327 | 11,543 | 32.432,324 |

*One yen equal $0.4985 at normal exchange.

There were also 28 insulated wire factories in 1919, employing 3,654 persons, the value of the output being 26,554,500 yen, as compared with 17 employing 1,134 persons, and having an output valued at Y.4,357,643 in 1915.

The next table illustrates the magnitude of the tire industry.

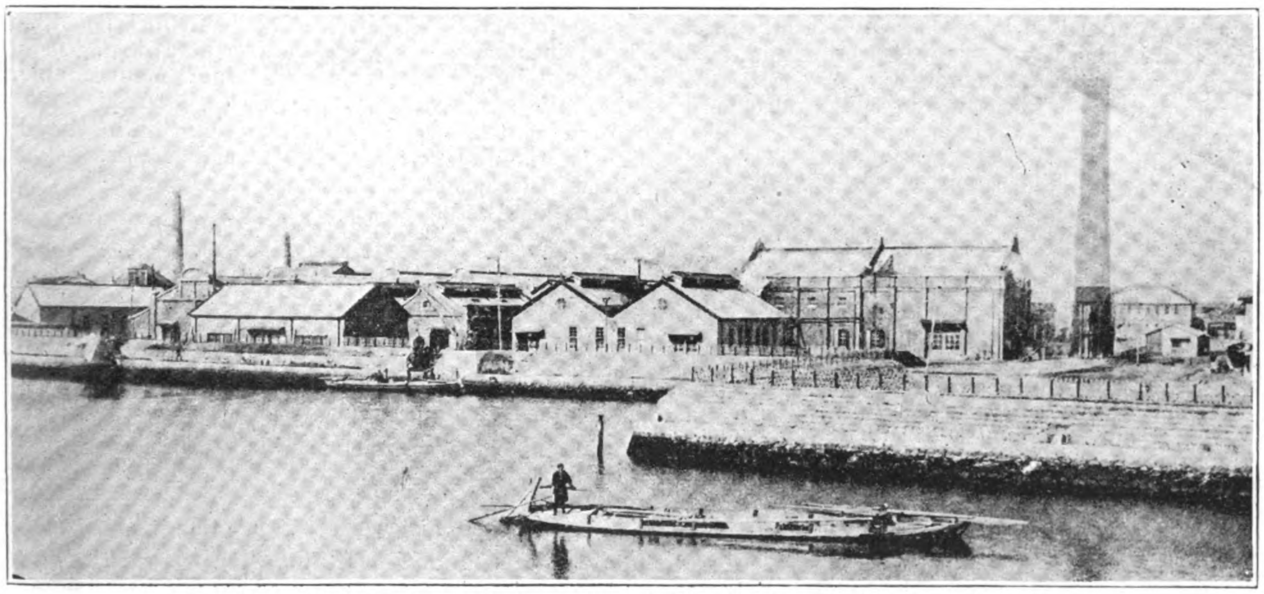
| | 1917 Yen | 1918 Yen | 1919 Yen | 1920 Yen | 1921 Yen |
|---|---|---|---|---|---|
| Rubber tires ... | 2,176,225 | 4,506,000 | 7,114,037 | 8,018,064 | 4,478,426 |
| Various rubber goods | 614,230 | 1,225,000 | 2,510,000 | 1,527,000 | 771,979 |
| Rubber toys, etc. | 228,420 | 766,540 | 1,339,734 | 2,574,665 | 1,248,621 |
| Insulated wire ... | 3,118,000 | 8,324,000 | 8,411,700 | 8,043,332 | 3,273,092 |
| | 6,136,875 | 14,821,540 | 19,375,471 | 20,163,061 | 9,772,118 |

### Two Rubber Centres in Japan

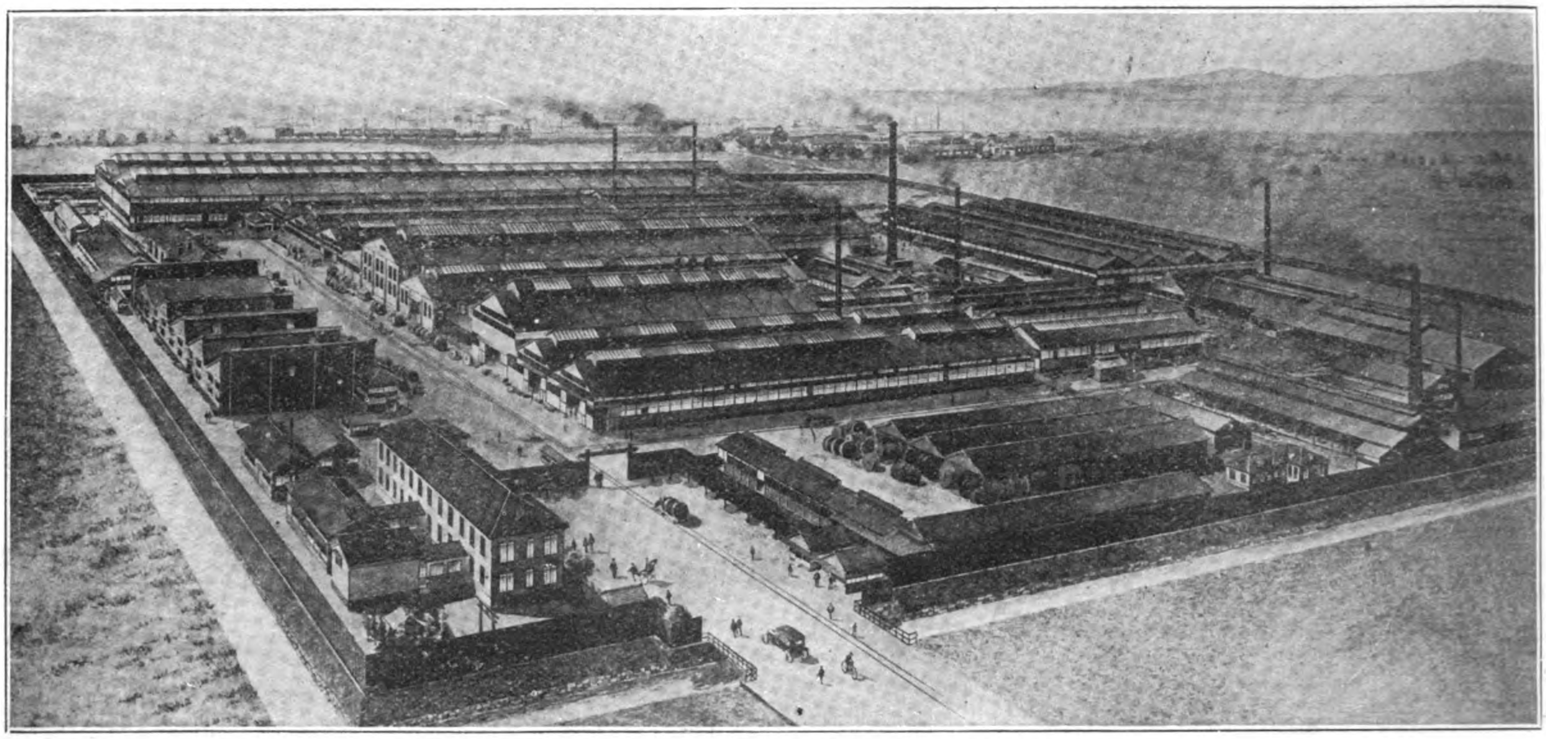
The Japanese rubber manufacturing industry has grown up in two districts about 250 miles apart, the first centring in Tokyo and Yokohama, and the second and larger in Kobe and Osaka.

The rubber plants in the latter district are intact and at capacity production can meet much of the immediate demand developed by the disaster. While many of the destroyed Tokyo plants will undoubtedly be rebuilt, several had branches in the Kobe-Osaka district which will probably be enlarged at once and in some instances may replace them permanently.

As a result, the Kobe-Osaka district, already in the lead because of its better shipping facilities and situation with respect to export markets, now promises to prosper more than ever in commerce and industry and to become the unquestioned centre of the Japanese rubber industry. It already outstrips the Tokyo-Yokohama district in imports of crude rubber, and in both imports



Osaka Branch Works of the Yokohama Electric Wire Works of the Furukawa Company



The Sumitomo Electric Wire and Cable Works at Okjjima, Osaka

and exports of rubber manufactures, although the rubber manufacturing industry of Japan began in Tokyo. As compared with crude rubber imports in 1912 of 1,023,052 pounds at Yokohama and 970,897 at Kobe, the corresponding imports in 1920 were 9,933,520 pounds at Kobe and only 3,028,855 pounds at Yokohama, these amounts being only a little over half the total imports in 1919.

Osaka is the commercial and industrial centre of the southwest half of Japan, and the chief trading place with Korea, Formosa, Manchuria, China and the South Sea Islands. Kobe, situated near Osaka, is the largest open port in the western half of Japan, and the biggest trading port of the empire. Tokyo is commercially the centre of the northeast half of Japan, and Yokohama, its port, was formerly Japan's greatest trading port.

## History of the Tokyo Rubber Industry

Of the 130 rubber factories said to have been located in Tokyo in 1920, the earliest rubber manufacturing enterprise in Japan was the Tsuchiya Rubber Works, established in 1880 at Kamiyoshicho, Asakusa, Tokyo, by H. Tsuchiya and T. Tasaki for the manufacture and repair of divers' suits by primitive methods. In 1884 this business became the Mitatsuchi Rubber Manufacturing Co., and in 1889 a line of bulbs and packing was added to its product. In 1892 the factory was removed to Narihiracho, Honjo, Tokyo, steam vulcanization was introduced and a year later the manufacture of ebonite and suction hose was begun. The business expanded greatly under government support during the Chinese-Japanese war of 1894-5 and is now one of the most important rubber firms of the empire with a diverse product including tires, footwear and mechanicals.

The Nippon Rubber Co., Limited, another large concern, was established in 1900 by the consolidation of two firms with W. Yamasaki as director. One was the Yoshida Rubber Works, which had been established at Hisakata-cho, Tokyo, by S. Yoshida and W. Yamasaki in 1896, the other the Motohashi Rubber Works established at Hashibacho, Asakusa, by R. Motohashi. The plant was burned and rebuilt in 1911 and enlarged in 1915. Tires, mechanicals, especially hose, gloves, balls, belts and dolls are the principal products.

The Meiji Rubber Manufacturing Co., Kitashinagawa, Tokyo, one of the oldest and largest rubber factories in Japan, was established in 1892 as a partnership known as the Tokyo Rubber Manufacturing Co., by G. Matsumoto and S. Morita, but soon suspended business owing to the death of its engineer, Mr. Saito. In 1896 the plant was purchased by K. Kamijo, and with K. Kamada business was begun under the name of the Tokyo Rubber Factory. In 1901 the late G. Yonei bought the factory, changed the firm name to its present form and introduced European methods and machinery under the technical direction of A. T. Ferguson, an Englishman. Mechanicals, tires, balls and ebonite are the principal products.

The above companies, with the Tokyo Rubber Co., Limited founded in the early eighties by Mr. Ogiwara for the manufacture of mechanical rubber goods, are the four oldest and largest in Tokyo, and in 1920 were parties to a selling combination to complete against the Dunlop Rubber Co., Far East, Limited, in Siberian and other foreign trade.

In the production of rubber covered wire the Fujikura Insulated Wire & Cable Co., of Tokyo, was the pioneer and is now the largest producer in Japan. The business was founded in 1884 by the late Zenpachi Fujikura, who had previously been engaged at Kanda in making cotton braids and silk and cotton flexible lamp cord. Not until 1892, however, did the firm succeed, after much experiment, in producing a rubber-like insulating compound in the factory at Shinjiku, to which the business had been moved in 1886. Much credit for this development is due to Tomekichi Matsumoto, a younger brother of Mr. Fujikura and the present head of the concern. Further technical progress was largely due to the study of American methods by Kenzo Okada, a nephew of Mr. Fujikura, who returned to Japan in 1899 and installed up-to-date machinery in a new and larger factory at Tokyo. This plant was demolished by a hurricane in 1903 and rebuilt double size, only to be half burned in 1911 and again enlarged. The firm has prospered as the approved manufacturer of insulated wire and cables for the Japanese government and has succeeded in the export trade through close adherence to the standards of the British cable makers' association.

## The Yokohama Rubber Industry

The principal rubber factory in Yokohama is the Yokohama Rubber Co., Limited, in which The B. F. Goodrich Co., of Akron, Ohio, is heavily interested. While the exact amount of loss sustained by this company has not been definitely stated, it is understood that the plant, one of the largest of its kind in the Orient, is practically ruined. The works cover nearly eight acres, and nearly 3,000 people have been employed. The general manager is Frank R. Carroll, former Goodrich branch manager in Los Angeles, California, who, with his family, escaped the great disaster.

The buildings of the Yokohama Rubber Co. were entirely of brick, one and two stories high, and were used for the manufacture of tires, shoes, mechanicals and othe staple rubber goods. It has a

large athletic field and various organizations for promoting the welfare of the workers. The works were established about five years ago, and, as is customary in Japan, in the directorate were included several native capitalists who were heavily interested in mining, shipping, and manufacturing. That the damaged plant will soon be rehabilitated is a foregone conclusion. It is understood that, owing to the fact that the works were situated in a low section of the city, convenient to tide-water, more injury was done by the tidal wave than by fire or earthquake.

Next in importance, and once the largest insulated wire plant in Japan, is the Yokohama Electric Wire Works, Limited, of Yokohama, which was organized in 1895 with a capitalization of $100,000 by five prominent Japanese business men of that city. Under the expert direction of German, English and American engineers the business has made remarkable growth and the works have undergone successive enlargements, despite serious fires in 1907 and 1912. In 1908 the firm became heavily interested financially in the Furukawa Copper Co., from which it had been buying its copper wire. The main works of the company are situated at Ura-Takasnimacho, Yokohama, and there is an Osaka branch. All told, there are some five acres or more of buildings comprising one of the large insulated wire works of the world with an extensive business at home and a large export trade in the Orient and Oceania.

### Rubber Plants at Kobe

A little after the Russo-Japanese war, English capital became interested in the Japanese rubber trade, and the Dunlop Rubber Co., Far East, Limited, was organized in 1907. At first it imported rubber goods from the Dunlop company in England and J. G. Ingram & Son, of London, but after the revision of the customs tariff in 1911 established a tire and tube factory at Kobe. In 1917, owing to financial difficulties, the firm was placed in voluntary liquidation for the purpose of transferring the business to a new corporation under the style of the Dunlop Rubber Co., Limited, Corporation to take over all assets and liabilities of the old company and continue under the same management. Over 500 hands are employed.

The Ingram Rubber Manufacturing Co. was also established at Kobe by the son of Arthur Ingram for the manufacture of rubber goods, especially druggists' sundries.

Numerous native Japanese rubber companies have been organized in the Kobe district. One of the pioneers was K. Suzuki, founder of the Suzuki Rubber Co.

### The Osaka Industry

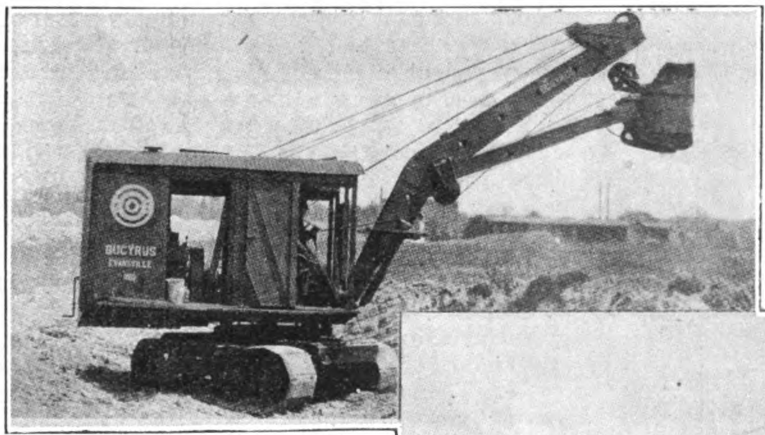
The Osaka rubber industry began in 1887 with the making of hot water bags by K. Yoshida and his associates. In 1917 there were 58 factories employing 416 men and 355 women. One of the largest of these is the Kakuichi Rubber Co., Limited, which was established in 1906 as the Kakuichi Rubber Works and in 1910 registered as a limited partnership with a capital of $100,000. Messrs. Kinjino and Ilikotaro Abe, belonging to one of the wealthiest Osaka families, are the owners. The plant was enlarged in 1917 and is equipped with American and English machinery for the manufacture of rubber rolls, plates, tubes, ebonite, tires, mechanicals, surgical and electrical goods.—*The India Rubber World.*

# A New ¾ Yard Gasolene Shovel

A new ¾-yard gasoline rope-thrust revolving shovel, known as the 20-B, has just been announced by the Bucyrus Company, South Milwaukee, Wisconsin, U.S.A.

This shovel contains the same unique features which are embodied in their 30-B gasoline machine which has been on the market for the past year.

Like the 30-B, the feature which makes this machine unique among shovels of this type is the foreign ingenious rope-thrust arrangement patents on which are held by the Bucyrus Company, which not only does away with the necessity of engines, gears, clutches, chains or complicated shafting on the boom, but at the same time gives this shovel a drive behind the thrust more powerful than it is possible to obtain with a steam shovel of the same size, since the whole power of the main engine is behind it.



Bucyrus ¾ yard Gasolene Dipper Shovel: high-lift and extra high-lift booms

Bucyrus ¾ yard Gasoline Dragline Excavator

This device has proved itself on the 30-B shovel under the toughest digging conditions in all parts of the world, and its manufacturers believe that it has literally created in itself a new era for the small shovel, driven by an internal combustion engine.

Briefly stated, the shovel is driven by a single, rugged, slow-speed gasoline engine. The motions of the dipper handle are controlled by a small drum on a shaft under the boom, which shaft has keyed to it pinions for engaging with the racks on the handle. The drum is turned either way by two ropes wound around this drum in opposite directions, both ropes leading to drums in the main machinery.

The striking fact about the performance of this shovel is the ease with which the operator can control the motions of the dipper, even to shake it to relieve it of sticky material.

This shovel may also be had with high lift or extra high lift booms, or with dragline, clamshell excavator or crane attachments.

The control is exceedingly simple, and the machinery arranged with convenience of the operator in mind. Whatever clutches are necessary are sufficiently large to obviate the danger of burning. The caterpillars and frame in general are the same as the 20-B steam machine, which is well known for unusual strength and its ruggedness.*

An illustrated bulletin describing this new machine may be obtained by writing to the Bucyrus Company, South Milwaukee, Wisconsin, and asking for Bulletin F-201-S.†

*This shovel is also offered electrically driven.

†Or any of the following agents: D. Couper-Johnston & Co., Bangkok, Siam; McLeod & Co., Calcutta and Bombay, India; The Borneo Company, Ltd., Singapore, S.S.

# Signalling Practice on the Federated Malay States Railways

## Paper Read before the Engineering Congress at Batavia

*By F. A. Punter*

These notes are written with a view to explain briefly the system of interlocking in use.

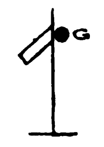
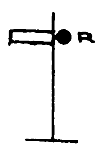
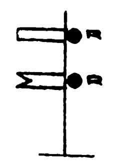
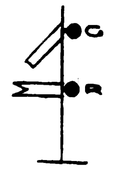
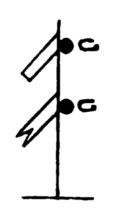
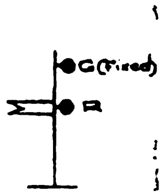
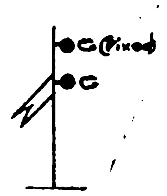
1. On double line sections of the railways.
2. Single line working.

As the system of signalling is based on the Indian scheme of signalling, it is necessary that we give the kinds of signals and their indications.

There are eight different kinds of signals. These are:

| | | | |
|---|---|---|---|
| Outer | Home | Starting | Shunt and |
| Warner | Routing | Advance starting | Draw ahead or calling on. |

The semaphore indications are as follows:

| Indication. | Meaning. | Explanation. | |
|---|---|---|---|
| (*a*) Square-ended arm "off" single green light. | Proceed | |  |
| (*b*) Square-ended arm "on" single red light. | Danger. | Stop dead, and do not pass till the arm is lowered or (at night) till the light is changed to green. |  |
| (*c*) Upper (square) arm "on" lower (fish-tailed) arm horizontal; red over red. | Danger. | Stop, and do not pass till the upper arm is lowered or (at night) till the upper light is changed to green. |  |
| (*d*) Upper (square) arm "off" lower (fish-tailed) arm horizontal; green over red. | Proceed with caution | Proceed cautiously, and be prepared to stop at the next stop signal or where required. |  |
| (*e*) Upper (square) arm "off" lower (fish-tailed) arm "off" green over green. | All right | Proceed. |  |
| (*f*) Signal (fish-tailed) arm horizontal; fixed green light red. | Proceed with caution | Proceed cautiously, and be prepared to stop at the next stop signal or where re-required. |  |
| (*g*) Signal (fish-tailed) arm "off" fixed green light over green. | All right | Proceed. |  |

The fish-tailed semaphore is termed a "Warner Signal" and is similar in its function to the distant signal as used in England. The term "Warner" is distinctly appropriate inasmuch as it is intended to warn the engine driver of the condition of the block section ahead. The horizontal position of the warner signal, or the showing of two lights, one through the arm spectacle, indication "Red" and the other six or seven feet above it indication "Green," constitutes the "proceed with caution" signal. The lowered position of the arms or the showing of two green lights one above the other, constitutes the "all clear" signal, and signifies that the next block section ahead is clear. The exhibition of a red over a green light, or the corresponding position of the arms by day, or the absence of one or both lights, shows that the signal is out of order and it must be treated as a danger signal.

2. The outer signal is really a repeater of the home signal worked by an independent lever and so interlocked that the home signal must be "off" before the outer can be lowered. Where a warner signal exists it is placed on the same post. This is a stop signal.

3. The home signal is the first stop signal of a station at which a warner is provided, and the second stop signal of a station at which an outer is provided.

4. The track or routing signal is a special bracketed signal used to indicate, to an engine driver, which of the two or more diverging tracks he is to travel over when the home signal is, in consequence of its position, inconvenient for that purpose.

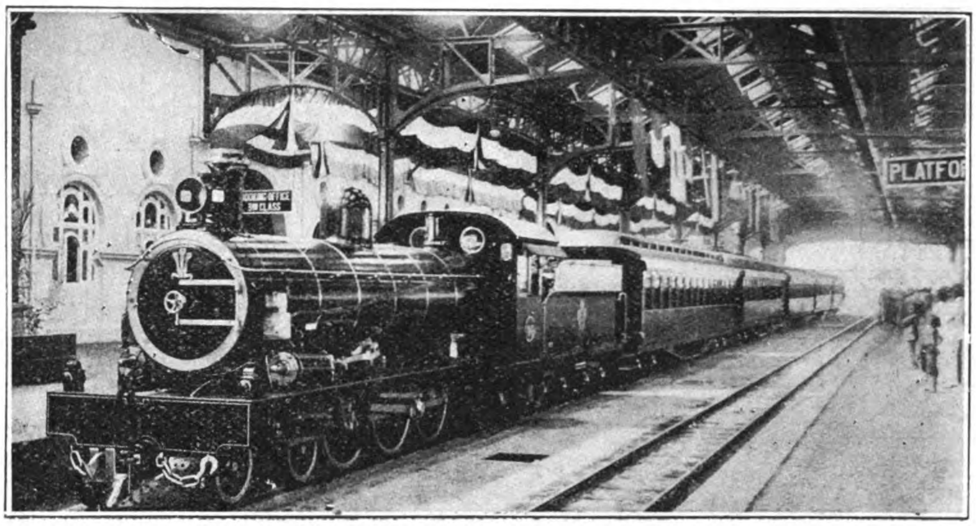
5. It is not permissible to place home signals for diverging routes one below the other. They must be placed on separate posts or they can be on short posts termed "dolls" carried by a bracket or signal gantry. In arranging signal arms on a bracket or gantry "Stepping" is employed as much as possible; the relative height of each doll is an indication to the engine driver of the number of turnouts he has to take and the speed at which his train must be controlled. In principle the more important signals are higher than the less important ones. This "Stepping" of signal arms is a great advantage in enabling an engine driver to pick out his signals as at night should there be a row of lights all on the same level it is by no means easy to decide at a glance to what direction any particular signal reads. Practice in "stepping" varies on different railways, but a difference in height of 3-ft. or even of 2-ft. where there are many signals to deal with makes a good and readable distinction.

Figures 1 is an example of such a signal bracket and gantry.

6. The stop signals which control the movement of trains leaving a station are of two kinds "Starting" and "Advance Starting" signals. If only a starting signal is used it will control the entrance of a train into the section ahead. When, however, in addition to the "starter" an "Advance Starting" signal is provided at a station the "starter" loses its importance to a great extent and becomes on intermediate STOP signal, and in this instance it is the advance starting which controls the entrance of a train into the section ahead. A train having passed the advance starting signal comes under the direction of the signalman ahead.

7. Draw ahead or calling on signals are short semaphores placed on the same post and below a starting or advance starting or home signal arms, and when lowered indicate to the engine driver to "draw ahead" although the main signal is in the "on" or danger position, for shunting purposes only.

8. The movements of trains or engines between sidings and the main tracks and between one main track and another are controlled by ground signals. There are several types of ground signals. It is the practice on these railways to govern all such movements by miniature semaphore signals which conform to the indications exhibited by running road signals.



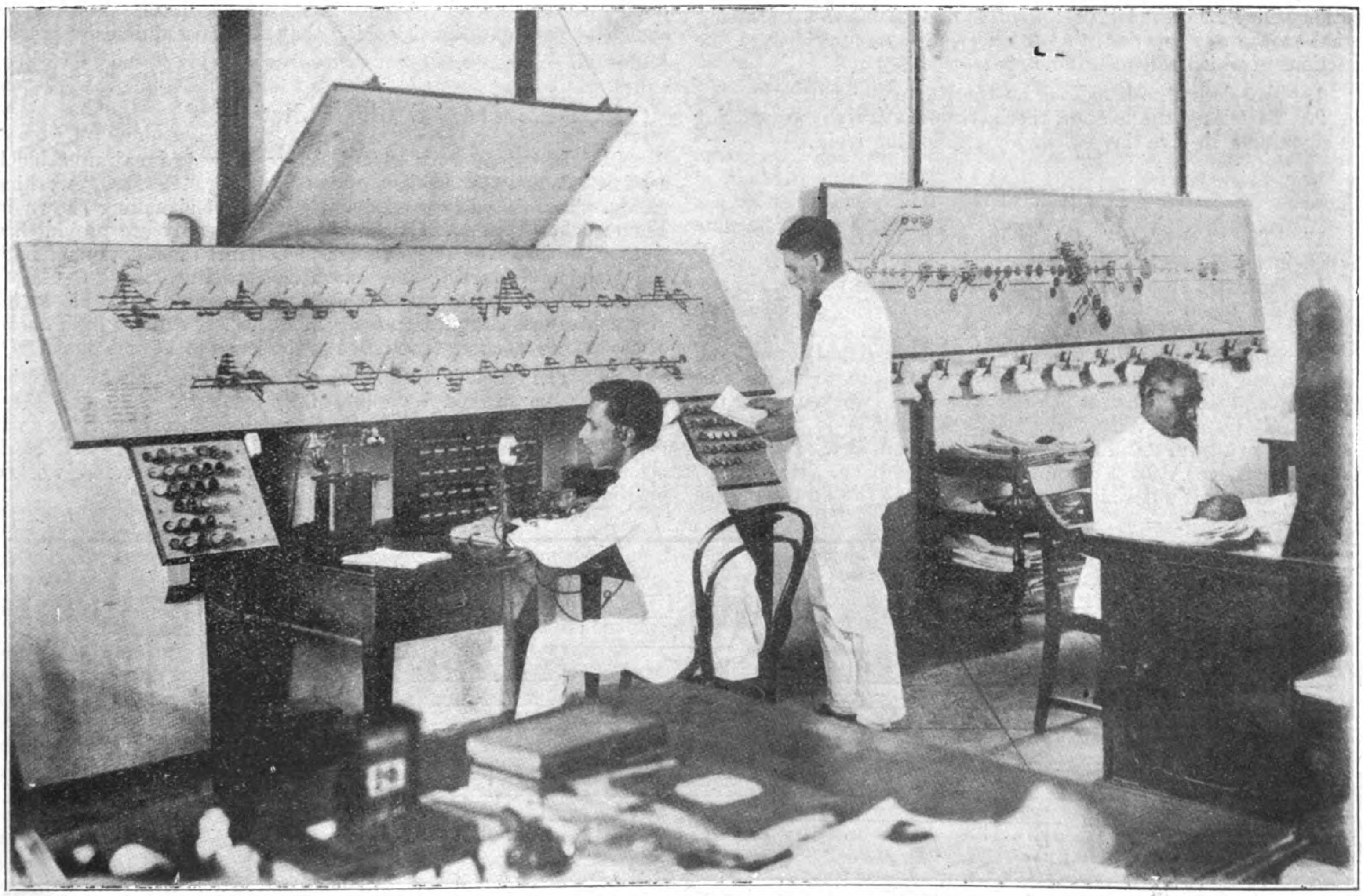
Royal train on the F.M.S. Railways conveying H.R.H. The Prince of Wales on his visit to the F.M.S. in March 1922

9. The foregoing are the signals commonly used for main line working. Occasionally, however, the names used are not sufficient to classify all the signals employed and in the circumstances special names have to be assigned to the signals to meet the situation. In all signals the semaphore is placed on the left-hand side of the post and the "proceed" position is given only when the arm is inclined downwards from the horizontal.

10. The system adopted is that known as the "manually controlled." Figure 2 is an illustration of a type of a signal cabin. It will be observed that exhibited in front of the cabin are two plaques inscribed "S" and "T" denoting respectively "Signals" and "Telegraphs." It is the duty of signalman when a failure takes place to reverse the plate and so attract the attention of the linesman or signal fitter as the case may be should he be in a passing train. The failure of course is reported to the section headquarter in prescribed form at the same time.

11. Lower quadrant indicators are used with the semaphores working through an angle of 45 to 60 degrees with the horizontal. The majority of the interlocking frames are of the direct or lever locking pattern that is, the pulling of the lever operates the locking. Another type is known as catch handle locking, in this type of frame two driving plungers or tappets, are fitted one above the other in the locking box. One plunger is connected directly to the lever, but very low down. The upper plunger is connected to the catch handle, and this plunger actuates the locking. If the lock cannot move, the catch cannot move, hence the lever is locked. The bottom plunger registers the correct position of the lever.

12. Figure 3 depicts a view on one of the large station yards. The principle of interlocking is so well known as to need no repetition; it is sufficient to state that all positions of signals are in accordance with board of trade requirements, and the interlocking in the lever frame in the words of the board of trade is such, "that the signalman shall be unable to lower a signal for the approach of a train until after he has set the points in the proper position for it to pass; that it shall not be possible for him to exhibit at the same moment any two signals that can lead to a collision between two trains, and that, after having lowered the signals to allow a train to pass, he shall not be able to move any points connected with, or leading to, the line on which the train is moving." Under Indian signalling practice there are three distinct classes of stations:—A, B and C.



Train Central Office, F.M.S. Railways, Kuala Lumpur

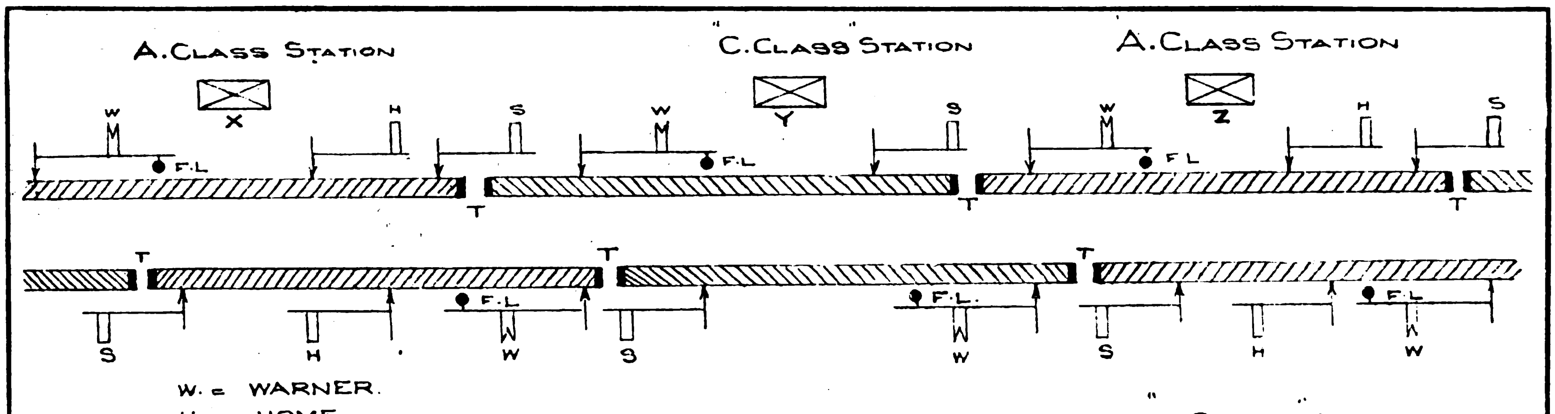



FIGURE 4 A SECTION OF LINE WITH A CLASS CABINS

## "A Class" Station

13. The absolute block system is the only system used for working traffic, and may be defined as a method by which the traffic on a line of railway is so regulated that one train or engine only shall be in any one section, and upon the same line of metals, at the same time. To effect this it is necessary to devide the line into two lengths, each such length is termed a block section.

14. In "A Class" stations there are three essential signals, warner "with fixed green light above it" the home, and the starter.

15. Figure 4 shows a section of the line with three "A Class" signal cabins at X. Y. Z. As the purpose is to denote the several block sections only, points and crossings which would ordinarily intervene between the home and starting signals are not shown on the diagram.

16. The block section is shown by the etched lines and is the section of line from the starting signal at one station to the starting signal at the next station. At T on electric treadle is fixed the functions of which when actuated are :—

1. To release the back lock on the starter.
2. To release the lock on the instrument thereby permitting the signalman to give line—clear for a following train.

## "B Class" Station

17. The "B Class" station Figure 5 differs from the "A Class" in two important respects.

1. An extra stop signal is provided above the warner arm.
2. The block section extends from the starting signal in the rear to the starting signal in advance.

18. The provisions of this additional stop signal termed the "outer home" or, for short the "Outer" enables more traffic to be worked over a section than is possible with traffic worked under the "A Class" system. With "B Class" working it is permissible for B to have a train standing at his platform and, at the same time, give line clear to A for a second train to approach. He cannot, however, lower his outer signal to admit it until the first train has left his station and passed over the treadle in advance of his starting signal. In long sections this is a distinct advantages looked at from a traffic point of view. The section between the outer and home signals is always "dead" as the outer is released by the home.

19. Circumstances, of course, will decide whether "A Class" working or "B Class" working will prevail. Although, from what has been written, it is shown that "B Class" working is preferable. "A Class" may have to be adopted where the stations are so close together that a long train standing at an "Outer" would foul the section in rear.

20. There are many ways in which the locking of levers can be arranged in lock and block working. In the diagram Figure 5 both the home and starter levers would be provided with electric locks, and, if necessary, reversers on the signals as well, so that the train in passing over the treadles T & T 2 would put the signals to danger as well as releasing the locks on the levers working the signals. Any conditional locking that may be required can easily be arranged for.

## "C Class" Station

21. Instances occur when it is necessary to break up a block section between two stations operating under "A Class" working ruling. To meet this condition the type of signalling shown in Figure 4 has been introduced. Two signals only are provided, a warner and a stop dead signal, which combines the functions of both the home and starting signals. This constitues the "C Class" station. The signals are mechanically operated and block instruments of similar pattern are provided. A treadle is fixed ahead of the starter to effect the release of the instrument and signal.

22. The block instruments used are of the one wire three indication type worked by momentary currents. Although these instruments are arranged for lock and block working it was not considered necessary for the full complement of lock and block signalling being installed at present. Trains are therefore worked on the block system.

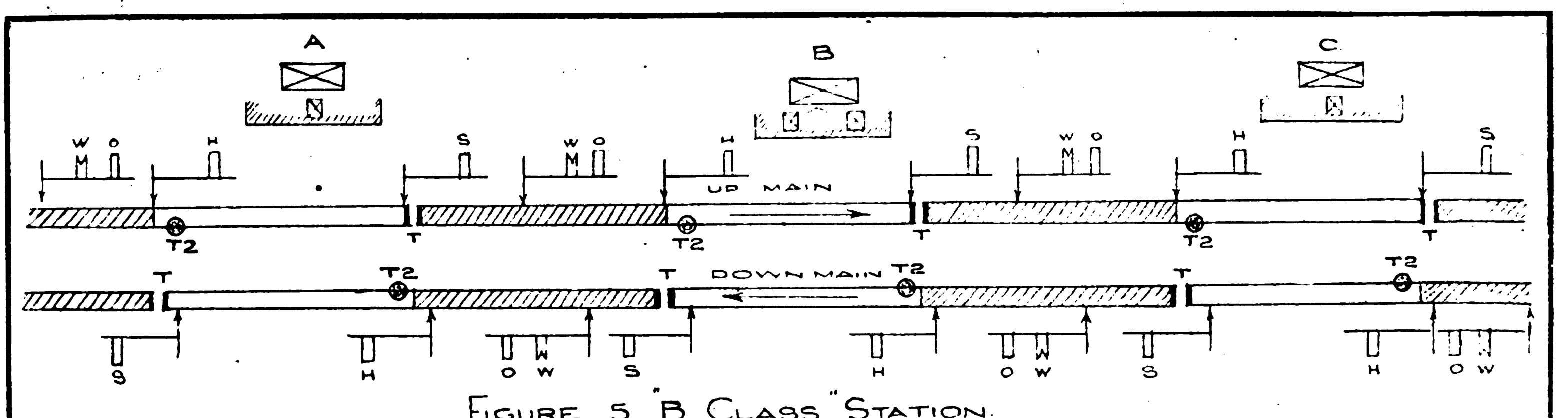



FIGURE 5 "B CLASS" STATION.

23. Figures 6 and 7 illustrate the instrument and connections. The working is as follows: In the normal position of the instrument the needles show "Line Blocked" and the first commutation from this position sends a current of full strength to the line. This causes the needle to traverse the full distance and show "Line Clear" at the same time operating the armature of the line relay which closes the bell circuit.

24. The next commutation sends a current of reverse strength to line, which also operates the armature relay fully but does not allow of a complete traverse of the needle in the reverse direction, owing to the cave of small locking coil checking the cylinder and allowing the needle to occupy a central position showing "Train on Line."

25. The third and final movement of the commutator splits the current, short-circuiting three-fourths of it through the lower locking coil and operating the armature, allowing the needle recording "outgoing" currents to show "Line Blocked" at the same time the remaining current of one-fourth full strength is sent to line, this current being too weak to operate the armature the full distance attracts it to the moveable arm; this, in addition to closing the bell circuit, operates the upper locking coil, the armature of which engages with the cylinder of the "receiving" needle is lifted, the needle is freed, thus allowing it to traverse the remaining distance and show "Line Blocked."

26. The commutator is interlocked with the plunger and is so arranged that when the commutator is turned from one position to another no further movement can take place until the plunger is pressed home and the signal recorded, when the commutator is again free. The commutator can only be turned in a clockwise direction. A small plunger is fitted below and to the left of, the commutator; this plunger requires to be momentarily depressed in order to free the commutator when the latter is turned, as the commutator is locked in each position against a retrograde movement. In the illustration, the upper needle mounted on the dial plate is the block signal governing trains proceeding to the next station and is worked therefrom. The lower needle is operated by the outgoing current of the station at which the instrument is fixed, and forms a reflex of the signal last sent for trains approaching. The commutator has a segment painted to correspond with the inscriptions on the dial, which appear at the operature above the commutator, and form together with the position of the lower needle and index of the condition of the instrument.

## Single Line Working

27. Plate 8 shows the layout of a yard and signals at what we term a wayside station. The signalling is on the same principle as that employed throughout the system. Instead, however, of a signal cabin controlling the working of the points and signals we substitute a platform ground frame (Figure 9) which is operated by the pointsman under the supervision of the station master.

28. On reference to the diagram it will be observed that a starting signal for each direction is not provided. Inasmuch, however, as the tablet is the engine driver's authority to proceed into the section ahead a starting signal, if provided, would only amplify that authority; it was therefore decided by the general manager, railways, that at wayside stations starting signals should be dispensed with. Under these circumstances and to avoid the risk of the trailing points being run through, the locking is so arranged that, supposing a down train is to be accepted into the loop line, it is necessary to "set" the trailing points to the loop line before being able to lower the incoming signals. Such a procedure is, in the absence of starting signals, necessary to avoid over-running and consequent damage to the switches.

29. Point indicators of special design are fixed at the fouling point of the main and loop lines to indicate the "lay of the road" and to determine the point at which a train must be brought to a standstill. The indicators are connected to and work with the rods actuating the points.

## Tablet Working

30. As in the case of double line block working so with single line working. The object must be to prevent more than one train or engine being in the block section between two stations at the same time. Tyer's tablet instruments are used throughout the railways. The "Line Clear" authority to proceed is handed to the driver in the shape of a metal tablet. So that the driver may know he has the correct tablet the section governed by the instrument is engraved thereon and numbered, the latter for registration purposes in the train register book.

31. The tablet is automatically released by the instruments by the mutual consent of the operators at either end of the section. After a tablet has been withdrawn the instruments remain automatically locked and incapable of issuing a second tablet, until the tablet already issued is restored to one or the other of the issuing instruments by which means the instruments are released by electrical impulse and again capable in th ordinary course of issuing another "Line Clear" tablet. It is thus ensured that two "Line Clear" authorizations for trains to proceed in the opposite or following direction cannot be issued. A matter which it is impossible to ensure when paper "Line Clears" depending on the intelligence of the operator are used.

32. In the pattern of Tyer's tablet instrument shown in Fig. 10 are two drawers or slides. The top one which receives the tablets and the bottom one which issues them. Normally both slides are in the closed position and the visual indication of both the instruments at "A" and at "B" is "Line Closed." In this position it is open to the operator at either the one or the other end to ask for line clear, and the operator if he is ready to receive a train signifies his assent by repeating the "Is Line Clear" signal on his bell. Assuming a train to be going from "A" to "B" the sequence of operations is as follows:

33. When the "Is Line Clear" signal is repeated "A" depresses his bell plunger for a few seconds, this causes the needle in "B's" instrument to deflect and "B" must then hold down his switch plunger and at the same time withdraw his lower slide half way. The withdrawal of the slide halfway changes the visual indication from "Line Closed" to "Up Train Approaching." "B" then intimates on the bell to "A" to release his switch plunger. Next "B" will depress his bell plunger, keeping it depressed for a few seconds "A" then depresses his switch plunger and at the same time withdraws his bottom slide right out to the full extent and so obtains a tablet. The visual indications is again altered and now reads "Up Train On Line."

34. On the arrival of the train at "B" the tablet is restored to the instrument tablet chamber by pulling out the top slide inserting tablet thereon and pushing the top slide in. This movement unlocks the bottom slide, which is forthwith put back. Putting back the lower slide restores the visual indication to "Line Closed." The train out of section is then given on the bell to "A." "A" on receipt of this signal depresses his switch plunger and at the same time closes his lower slide, thus changing the visual indication in his instrument to "Line Closed." "A" signifies to "B" on the bell that he may let go his bell plunger. This ends the operation and the section is again closed as indicated by the visual signals on both instruments.

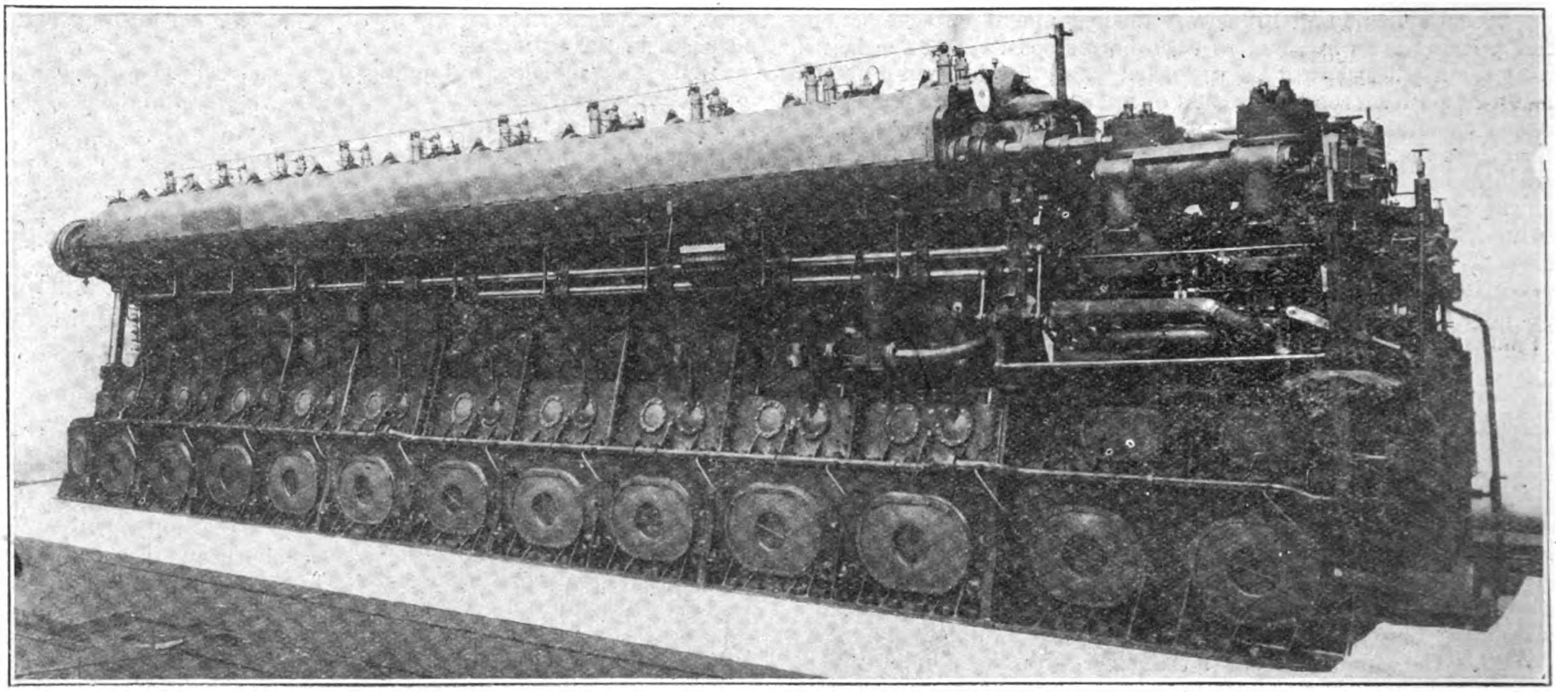
35. It will be observed that the instruments ensure by means of the visual indications a record of the condition of the tablet at each end of the section. Such a record is undoubtedly of great advantage. The operator is inspired with confidence when he sees what is passing at the other end of the section.

36. The tablets for the instruments are made to template in order to ensure perfect fit and avoid friction in the tablet chamber. Their configuration, however, differ. The object is to prevent all possibility of a wrong tablet being inserted in an instrument. The notches in the rim of the tablet are those which are required to correspond with the instruments to which they apply.

37. From the diagram of connections Fig. 11 it will be seen that currents of opposite polarity are used in the manipulation of the instruments thereby eliminating any risk of a tablet being snatched from either instrument by a breach of regulations governing block working.

38. The utmost precaution is taken in providing a separate "earth" for each instrument. It is the practice to have common "earth" for various telegraphic instruments, but block instruments are things apart from ordinary telegraphic instruments, and the first requisite in dealing with an instrument that depends upon the receipt of an electric current for so vital a function in railway working as the automatic release of a "line clear" is to see that such instruments are properly insulated and not subject to receive currents not intended for them. Where this is done, and it should be done, a "bed earth" could result in nothing further than the breakdown of the instruments in that particular section, rendering the instruments powerless from harm, though delaying the traffic.

*(Continued on page 760.)*



3,000 B.H.P. Ten Cylinder Four-cycle M.A.N.-Diesel Marine Engine

# The Diesel-Engine Meeting of the Verein deutscher Ingenieure, Berlin

On June 29 a meeting much frequented by visitors from abroad took place in the house of the association of German engineers under the management of its scientific council and its chairman Dr. *Lippart* Geheimer Baurat of Nuremberg; the topic of the meeting having been the discussion of the present status of the Diesel-engine and the problems connected with its development. The great importance of the Diesel-engine as a prime mover has been reflected at this meeting not only by the mere arrangement of it through the verein deutscher ingenieure but also by the rich contents of the chief lecture and the reports annexed to it. These reports representing a true picture of the present status of our knowledge on this territory, might be of great interest to numerous engineers.

At first Prof. Dr. *Nägel* of the Dresden technical high-school delivered his lecture on

## The Diesel-Engine of the Present Day

Starting from the paper, which has been delivered by the speaker in 1911 on the chief meeting of the verein deutscher ingenieure in Breslau about the status of the development of the Diesel-engine at that time, he traced the further development of this prime mover in meantime to four principal directions which have been discussed in detail by the aid of characteristic examples principally from the German machine building industry. Those four fundamental lines of development refer to:

(1) The design of the engine and its adaption to economy of material and high number of revolutions.

(2) The introduction of the two-cycle-process instead of the four-cycle-process.

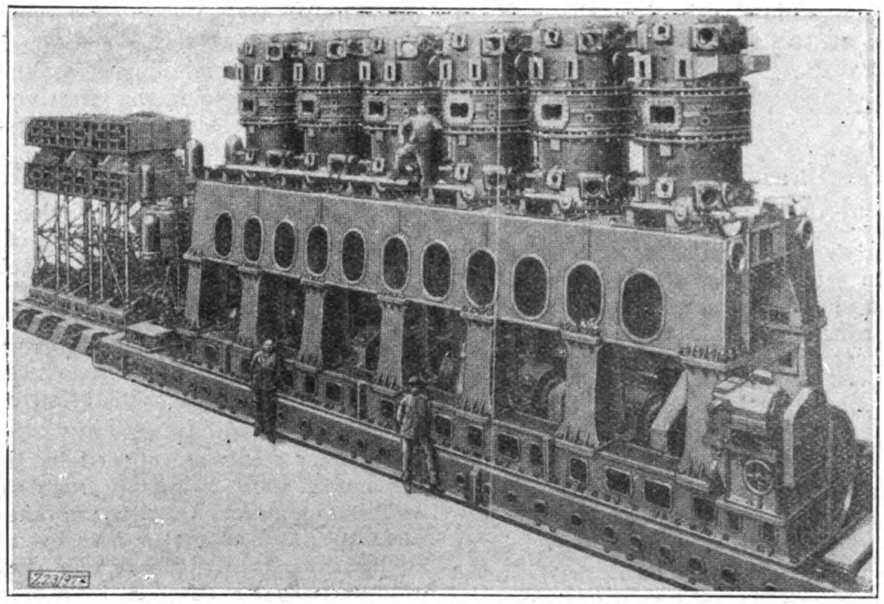
(3) The change from the compressed-air injection of fuel to the solid injection in the Diesel-engine without compressor.

(4) New measures for realizing an irreproachable combustion of heavy combustibles in the Diesel-engine.

Referring to the first point, the paper discussed the new design of the *engine frame*; valuable experience has been gained about that with the high-speed engine of the submarine which has been more or less utilized in the construction of all present-day Diesel-engines. In the construction of the Diesel-engine care must be taken very often of the cheap production in great lots; this point of view being for instance decisive in the building of the small powered engine which is made in series. As far as the great Diesel-engine is concerned which in first line is used as a marine engine to a steadily rising degree, the economy of construction materials and space maintaining at the same time security on service and thermal efficiency being of paramount importance. By the aid of examples supplied by the firms of Maschinenfabrik Augsburg-Núrnberg, Gebr. Sulzer of Winterthur and Ludwigshafen, Fried. Krupp A.-G., Gemaniawerft, of Kiel, Werft Kiel of the Deutsche Werke A.-G., Allgemeine Elektricitats-Gesellschaft of Berlin among others, the features of construction of the engine in question have been discussed and finally the Michel-Motor has been mentioned built by the Michel-Motor-Gesellschaft m.b.H. of Kiel, representing a new form of the Diesel-engine with stare arrangement of cylinders capable of great development.

In adapting the *two-cycle-process* to large engine-units the two-cycle-valve-scavenging engines have been the starting point, followed by the slot-scavenging two-cycle engines which as marine engines are expected to supply sufficiently large cylinder units. For the first time mention has been made of the 12,000 h.p. two-cycle engine built by the Nuremberg workshop of the Maschinenfabrik Augsburg-Nürnberg for the German admiralty in 1910 after much pioneer work, which engine has been destroyed on account of the peace treaty after successful and highly promising trial runs. In the construction of the valve-scavenging engines the Germaniawerft joins as well; this shipyard has constructed the well-known tankship *Zoppot* and has equipped it with two 1,700 h.p. two-cycle engines; this vessel has given much result in this line after many years' experiences. In changing over to the slot-scavenging engine Messrs. Gebr. Sulzer of Winterthur and Ludwigshafen have rendered pioneer's services; they have supplied till now many marine engines of this design up to 3,000 h.p. of effective output. Excellent trial results with an entirely new engine of the Ludwigshafen works of Messrs. Gebr. Sulzer have been made known by the lecturer; by these results the two-cycle process has been placed, as far as the fuel consumption is concerned, with the four-cycle process on one and the same level for the first time. The Augsburg establishment of the Maschinenfabrik Augs-

burg-Nürnberg, after a long trial work, has recently developed a new two-cycle method, which in first line is intended for double-acting cylinders of largest dimensions and has given much promising results on trial engines.



Most powerful Diesel-engine ever built: M.A.N. double-acting, two-cycle, six-cylinder engine of 850 m.m. cylinder diameter; 1,050 m.m. stroke; 160 r.p.m, and 12,000 nominal H.P.

The *compressorless or colid-injection Diesel-engine* has become of an extremely great importance for the present small engine and has taken a corresponding many-sided development. The omission of the compressor has become an economical necessity for the small Diesel-engine and there are even justified views to run the large Diesel-engine gradually without compressor as well. The different designs and methods in question have been compiled by the author in a definite system and discussed by the aid of characteristic examples taken from the Moterenfabrik Deutz, the Germaniawerft of Kiel, the Maschinenfabrik Augsburg-Nürnberg and the firm of Gebr. Sulzer of Winterthur.

As to the utilization of *hard boiling combustibles* in the Diesel-engine the inventive endeavors in Germany has got no economical incitement during the last years because the price of the inland coal tar oil has not been so much less than the price of the gas oil and brown coal tar oil to justify from the economical point of view any applications of the hard boiling coal tar oil. Not till recent days thick oils derived from petroleum have been brought on the market from abroad which might resuscitate the work of inventors on this line. The only step forward besides the knowledge of the two-cycle engines being especially well fit for the safe utilization of hard boiling combustibles without further measures, might be the piston design as has been developed by Messrs. Krupp. During interesting trials made in the Essen works it has proved to be an excellent means to enable to use exclusively coal tar oils even at no-load conditions of the engine.

The lecturer finally mentioned the application of the Diesel-engine to the drive of locomotives and exposed the solution which has given to this problem much discussed before the Linke-Hofmann-Lauchhamer-Werke of Breslau making use of the Lentz hydraulic gear.

After the lecturer Prof. Dr. Ing. W. *Nusselt* of Karlsruhe read about the

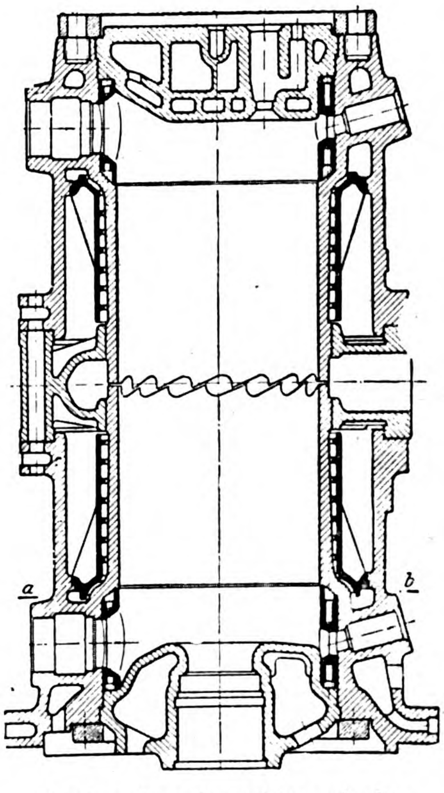
## Transition of Heat in the Combustion Engine

The speaker informed of tests which he has carried out with ball-shaped bombs for studying the cooling of hot gases. The heat passes into the cold wall of the bomb partly by heat conduction and partly by radiation of heat. In order to separate the whole transmission of heat into both elements, the lecturer has made use of bombs blackened on the inner surface on the one hand and of those gilded within on the other hand. The difference of delivery in both cases being proportional to the radiation of heat of the hot gases of combustion. It has been shown that the radiation of heat from hot gases follows the Stefan-Boltzmann law of radiation, that is to say, that it increases with the fourth power of the absolute temperature, but on the other hand it has been also shown that the amount of radiation by hot gases is only about $\frac{1}{15}$ of the radiation by the absolute black body of the same temperature. The heat delivered by conduction depends on the temperature and on the pressure. By making use of the tests of Clerk with a gas engine the influence of the travel of piston upon the heat given up has been taken into consideration. Applying the new formular to the delivery of heat in the combustion engine, it will be seen that radiation of gas does by far not play the part ascribed to it formerly and that it suffers besides strong alteration during one travel. The assumed dependence of the coefficient of heat transition on the mean piston speed is certainly only an approximate, it being desired that more exact tests will soon give further data about the heat transition coefficient in engines.

After this speaker Prof. Dr.-Ing. *K. Neumann* of Hannover reported on

## Comparative Tests about Compressed-air Atomisation and Compressorless Service in Internal Combustion Engines

The speaker treated at first the difficulties which are encountered at the change from air injection to mere pressure injection with heavy oil engines according to the Diesel method and demonstrated by the aid of an example that airless injection under equal conditions requires extraordinarily high pump ressures and very small nozzel diameters. He further reported on trials with compressorless engines of different cylinder-sizes at different numbers of revolutions. The combustion in these engines has been attained by the methods of generation of eddies through the working piston or with the aid of an ignition chamber and the engines ran with light petrol, with gas or with coal tar oil. All figures necessary for judging the working process have been carefully measured at these tests.




Section through working cylinder of 12,000 B.H.P. two-cycle M.A.N. Diesel-engine

In comparing the different methods of operation carried through, on account of the test results, it is remarked that the oil engine of the new institute of internal combustion engines at the technical high school of Hannover has been used throughout the trials and thereby any influence of the engine design on the results of the tests has been excluded. The results of the tests show the speed of combustion of the different oils within the running engine, all phenomena influencing the diagram and their reasons. It is shown that with high-pressure oil engines several ignitions will always occur and further, that it is of high importance that the first partial ignition takes place in due time and at the desired place. By a calorimetrical investigation of the different engines the value of temperature is determined with air injection and compressorless operation during the periods of combustion and expansion and in connection therewith the heat is found out which passes to the cooling water during those phases. It ensues from that that the mean figure of transmission of heat will be greater with compressed-air

atomisation than with compressorless injection, because in operating without compressor at the time of ignition a lower degree of the addy currents prevails.

After this lecture Dir. *F. Schultz* of Cologne-Deutz spoke on the

## Guide Lines for the Series Manufacture of Small and Middle-sized Oil Engines

Growing competition forces to manufacturing engines in great quantities. In order to facilitate the series manufacture, it is necessary to restrict the production to narrow working spheres and to maintain a strict standardization, to use few sizes of cylinders and to try to obtain intermediate output by changing the number of revolutions and the number of cylinders. An important expedient will also be to fit the engine body for different uses, for different kinds of cooling and for different combustibles. All parts of different types must be standardized.

The series engine must be simple of construction, effect and details. Plainness is the equivalent of security on service, easy handling and, above all, of quality. By low weight and short routing through the factory, production is increased. With the series-manufacture the centre of gravity of operations must be placed at the beginning of production and the construction of the engine by the aid of partial units of separate make and control must be aimed at. Wrong measures in design and manufacturing methods which can be repaired at the construction of large engines will be generally of catastrophal consequences with the series-manufacture.

Further, chief-engineer *Alt* of Kiel spoke about

## Combustibles and their Combustion in the Diesel-Engine

This topic treats at first the most important chemical and physical features of the liquid combustibles as the basis for judging their suitability for the Diesel-engine, accentuating the new efforts to adapt the engines especially for the low-valued combustibles. As the utilization of such combustibles is only possible by the Diesel-engine at present, this gains a special importance as compared with other internal combustion engines. This being the reason of its increasing use and especially in the shipbuilding industry.

The speaker then treated *in extenso* the theories on the phenomenon of combustion within the Diesel-engine, based on recent investigations. Our knowledgee gained in this way have not alone a mere theoretical value, but they are of great practical importance as well, enabling us to draw the points of view for the design of the Diesel-engine therefrom, with the aim to burn any liquid fuel imaginable.

All former ideas about the phenomenon of combustion, viz., the ignition of the combustible injected into the strongly heated air being preceded by vaporization to a certain degree and further, the different behavior of combustibles in the engine must be described to the differences of their behavior during the vaporization, opinions, which we find generally adopted to-day, must now be given up. On the contrary, it can be shown that the atomized combustible ignites directly, that is to say ignition is not preceded by vaporization and not even by a vaporization worth mentioning. The behavior of combustibles during those phenomena is due in first line to their chemical (molecular) constitution and to be traced to the self-ignition temperature within the engine defined by that constitution which is decisive in the first line. Combustion must further be carried through in such a way that no vaporization of combustible occurs as far as possible, because decompositions connected with it might cause the formation of soot and therewith a poor combustion.

To prove the correctness of these new opinions the speaker referred to the fact that the Diesel-engine can be driven even with the most obstinate of all combustibles, viz. with unmixed benzole, if conditions necessary for its due combustion be drawn into consideration.

Furthermore, chief-engineer Dr. *Riehm* of Augsburg informed about

## Increase of Output with Four-cycle Engines

Development calls in the construction of oil engines as well for engines of more and more great output. Here mastering of the heat efforts of the large cylinders rises, as it is known, the most difficulties. With regard to the fact that those heat stresses with the four-cycle engine are considerably lower than with the two-cycle engine of equal dimensions, and investigation of the question, whether by increasing the effective piston pressure with the four-cycle engine can lead to greater output will be of special interest.

The effective piston pressure can be increased in a simple manner by introducing a greater quantity of combustible into the regular air charge of the working cylinder. The problem of burning this combustible in the given weight of air as completely as possible requires a greater energy of injection either by increasing the pressure of blowing in or by feeding additional atomisation air through a special valve. Test of this method have shown, however, that with increasing piston pressure both the fuel consumption and the heat stresses increase rapidly. This method, therefore, can be drawn into consideration only for temporary increase of output.

Better views are opened by the method to precompress the air sucked in by which a greater air weight is carried into the working cylinder. Combustion takes place approximately between the same limits of temperature, eventually, between the same limits of pressure, as with the regular engine, as well. The previously-compressed air is supplied by a blower. As tests have shown, in-increase of output of 30 or 50 per cent. can be obtained by this process without a considerable increase of the specific consumption of fuel. Heat stresses of walls increase in a low degree only. Even more favorable conditions result if one succeeds to utilize the energy of exhaust gases for driving the pre-compressor-plant, that is to say to connect the centrifugal compressor directly with the exhaust-gas turbine. This solution which have been tried already with great success with flying engines for great heights might offer good views with the Diesel-engine as well and justify further tests.

Finally Dr. *Geiger* of Nuremberg spoke aout

## Long-distance Actions of Power Engines

Among the long-distance actions issuing from power engines vibrations inside of dwelling houses play a great part, as it is known. Those vibrations are caused by free forces, moments, etc. Although there is no danger of cracks with the regular buildings, men provides with sensible nerves are frequently disturbed of their well being. In order to find out those vibrations as to their nature, besides the very sensible seismograph, the vibrograph of the author is very suitable, which is furnished by Lehmann & Michels of Hamburg-Wandsbeck. Experience has shown that the sensibility of this measuring instrument, the writing pencil of which records vibrations on a continuous paper slip, goes as far as the sensibility of the human nerves that is to say it is adequate for the requirements of practice.

In order to prevent such long-distance actions, engines with great free mass-forces must not be placed in the neighborhood of inhabited houses with several stories on small area, because these fall very easy into resonance with the ossillation of the mass-forces and we have known by experience that the resonance causes the greater part of disturbances. Attention must be paid to the building site as well which must be reinforced by piles eventually.

There are a number of expedients to remove vibrations: removal of the power engine, change of the crank angle, insulation, modification of number of revolutions, reinforcement of the shaken building and compensating devices. These devices can be employed anywhere and consist of creating mass forces by the aid of a device connected with the engine which forces are of equal size but opposite to the mass-forces issuing from the engine.

## Plate Glass Works

The South Manchuria Railway Company will undertake the manufacture of plate glass and has ordered the necessary machines from America. Work will be started in March next year. Cut glass is already being manufactured in big quantities for export, and has a good demand at foreign markets. The success of the new venture is being watched with great interest.

# The King River Irrigation Scheme for the Wei-Peh Plain of Shensi

*By Laurence Impey*

THE Wei-Peh plain is situated to the north of the city of Sian-fu, the capital of the province of Shensi, and is bounded on its south and east by the Wei and the Yellow Rivers respectively, having a length of more than three hundred *li* and a breadth of eighty *li*.

Baron Ferdinand von Richthofen, the well-known geologist, tells us that this plateau is formed by lake deposition, and that its bed, which once contained salt water, has been gradually filled up by the loess and other materials which have drifted thither before the wind.

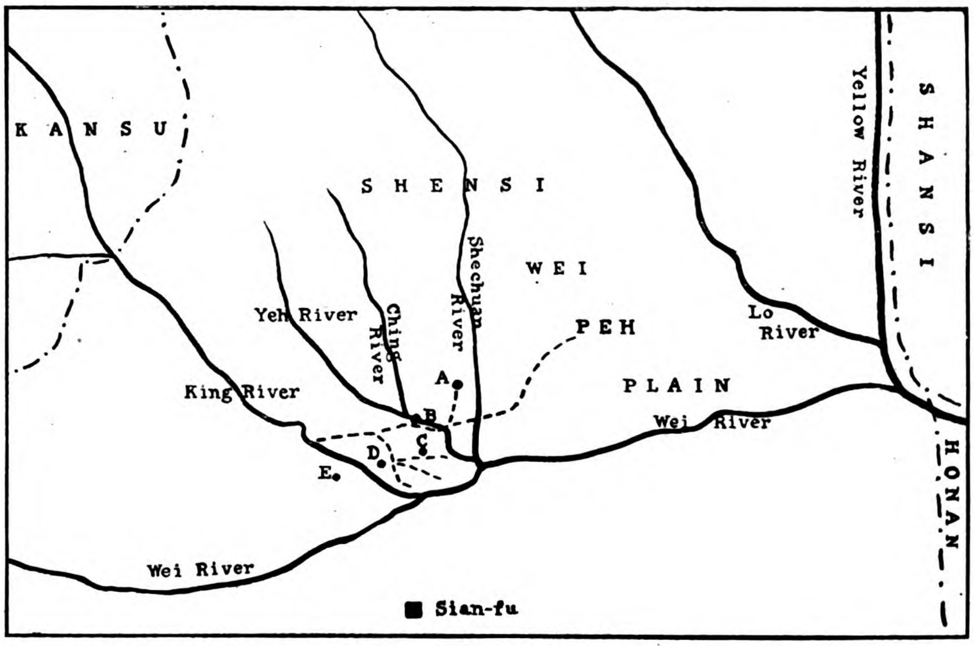
This theory is substantiated by the fact that there is still existing in this plain a small area which is covered with salty soil, while wells dug therein yield saline water of practically no value for either agriculture or for human consumption.

Irrigation, therefore, is of the utmost importance, and this becomes the more evident when it is realized that this Wei-Peh plain produces more wheat and cotton than any other districts in the whole province, and not only supplies the area around Sian-fu but also sends large quantities of foodstuffs into the neighboring provinces of Honan and Shansi.

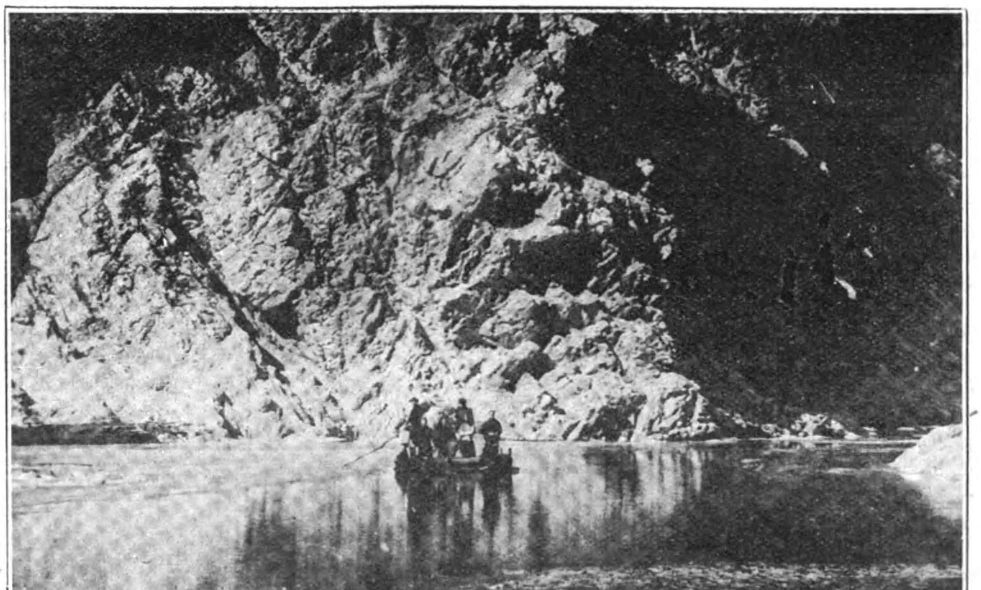
The sub-soil water supply being of this saline nature it is obvious that great importance attaches to the rainfall in those places where there is no regular scheme of irrigation from the rivers, and history shows us that unfortunately there is a drought on an average once in five years and a serious drought once in twelve years.

Chinese records tabulate 162 famines in the province since the time of the Shang dynasty (1390 B.C.), of which eighty per cent. were due to drought, and the remaining twenty per cent. to locusts or floods; but the periodicity has shortened since the time of the Ming dynasty (1363 A.D.) until now there is a famine once in ten years.

This shortage of rainfall being recurrent, the Chinese have since the earliest times endeavored to make use of the five minor rivers which traverse the Wei-Peh plain and eventually flow into the Wei river above Sian-fu, these being the Lo, the Shechuan, the Ching, the Yeh, and the King Rivers, named in sequence from east to west.




SKETCH MAP OF SHENSI. The Wei-Peh Plain Irrigation.
A. Fu Ping Hsien: B. San Yuan Hsien: C. Kao Liang Hsien: D. King Yang Hsien: E. Li Chung Hsien: ----- Old Cheng-Kuo Canal System



A survey party on the King River just above the entrance to the old Cheng Kuo Canal at "E." They are breaking their way through the ice as they make the depth measurements.

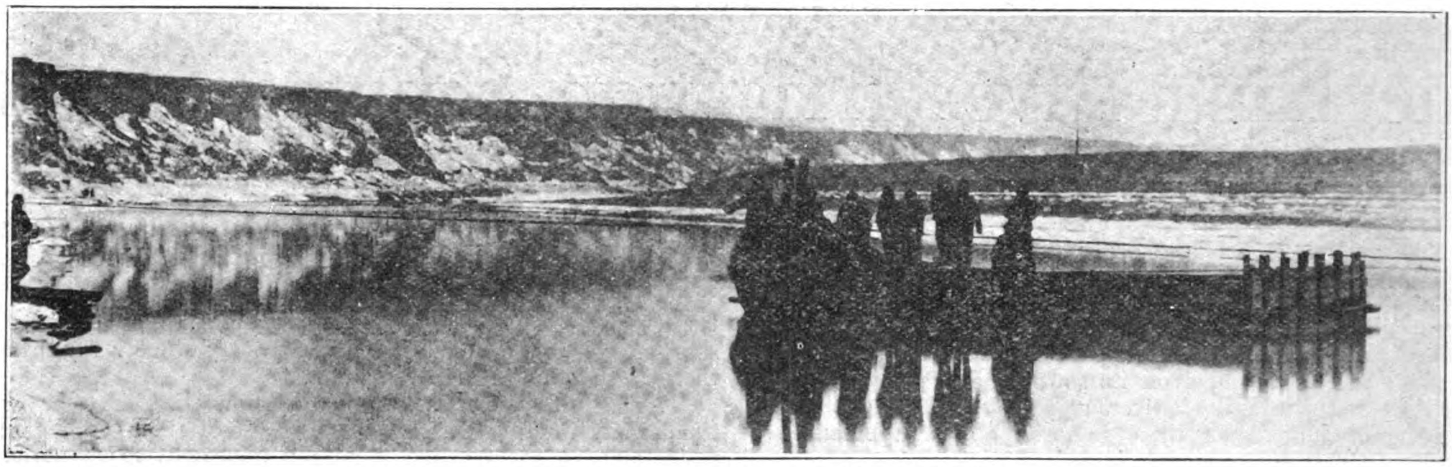
Three of them have been and still are used for irrigation purposes to a certain extent, the attempts to establish conservancy works on the Lo River during the Han dynasty proving a failure owing to the configuration of the terrain; but in actual practice only the King River out of the three has been of any great service in this direction.

The ancient history of this scheme is of considerable interest, and it may not be out of place to relate it briefly as follows:

"In the time of the seven powers, and when the rulers of these seven states were struggling for supremacy (B.C. 276), it so happened that the king of Han was greatly alarmed by the growth of the power of the king of Chin, and was desirous of undermining it by all means in his possession."

"So he called to him a skilful engineer named Cheng-kuo and sent him on a mission to the king of Chin, proposing that he should undertake certain irrigation schemes on the King River and elsewhere, thereby hoping to greatly deplete the exchequer of the kingdom of Chin and thus render it incapable of entering on a war for many years."

"It is uncertain whether the king of Chin fell into the trap or whether he saw his way out on the far side, but at any rate he accepted the proposal,



Another party carrying out discharge measurements on the King River at Pei Tun Li "L" at near its junction with the Wei River above Sianfu. The ice has melted, but the banks are still frost bound.

and Cheng-kuo undertook the canal from the King River, which centuries after was to bear his name as a memorial, and serve to remind us that he was the premier irrigation engineer of China."

"The original construction work comprised a dam across the King River built of baskets filled with stones measuring 1,000 feet in breadth and with a height of over 100 feet, and the Cheng-kuo Canal itself, which crossed the Yeh, Ching and Shechuan Rivers and irrigated nearly 700,000 acres of land."

"This scheme, far from effecting the desires of the king of Han, was an unqualified success, and for a period ot nearly one hundred years served to greatly enrich and strengthen the kingdom of Chin, which eventually became so powerful as to absorb all the other six states and found the Chin dynasty."

Unfortunately, this period of enlightenment was not destined to last, and when the dam broke about 150 B.C. the repair work was so inefficient that only 80,000 acres were watered by the new Pekung Canal, as it was called, the area being that which lies to the south of the Ching river only.

The Pekung Canal lasted some thousand years or more, and the subsequent repairs and alterations have followed the same plan as was originally outlined therein, though it has been found necessary to shift the dam higher up the stream from time to time as the old channel silted up.

As the sides of the valley of the King River are precipitous this alteration necessitated cutting further into the cliff, which consists largely of shales, conglomerates, and breccias, a geological fact which explains the constant slipping of the canal banks and the ensuing destruction of the works.

A number of springs were also tapped at one time or another and now that the former dam has once more been destroyed the people of the vicinity have neglected to rebuild it, relying on this flow from the springs very largely, so that at the present time only about 6,000 acres are supplied with proper irrigation by the canal.

## Conditions on the King River

The King River has its source in the province of Kansu, and flows through mountainous country for the greater part of its course of 250 miles, until it joins the Wei River above Sian-fu, some 40 miles below the commencement of the Cheng-kuo Canal.

The banks of the river are precipitous in many places, while the bed is very uneven and composed of rocks and boulders with occasional patches of gravel or clay; the rock formation being limestone or shale to a large extent. The following statistics have been obtained by various survey parties working from time to time :—

| | |
|---|---|
| Mean width of river .. .. .. | 75 feet |
| Mean depth of river .. .. .. | 6 feet |
| Mean cross section .. .. .. | 450 square feet |
| Mean velocity by floating test .. .. | 4 feet per second |
| Weight o1 water at 60 F. .. .. | 65-lb. per cubic foot |
| Velocity of flood water .. .. | 19.28 feet per second |
| Drainage area of river .. .. .. | 42,000 square kilometres |
| Grade of river bed (approximately) .. | 1 in 500 |

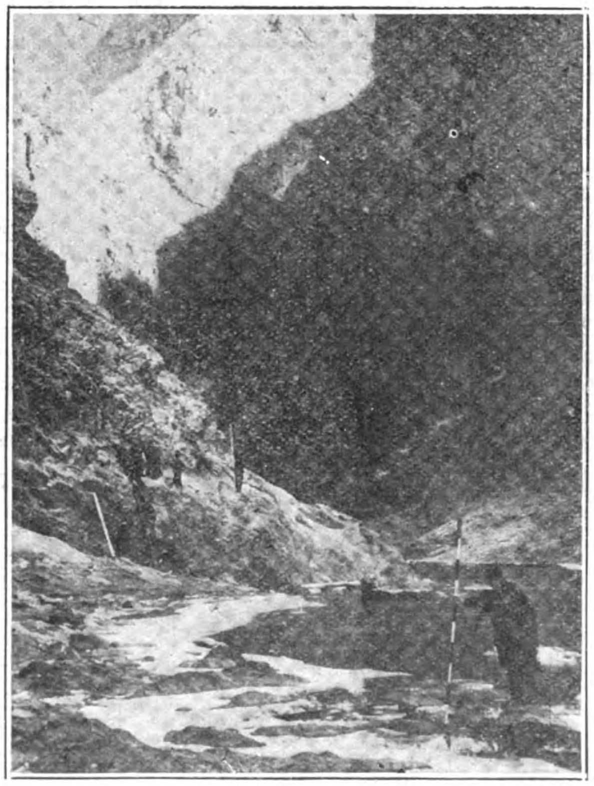
Mean discharge of King River in cu. m./sec.

| 1922 | | 1923 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July |
| 27.4 | 15.5 | 17.0 | 16.0 | 36.9 | 33.1 | 24.1 | 13.8 | 500.0 |

(All measurements taken at Pei Tun station.)

These figures can be compared with the records of rainfall taken in m.m. at Sian-fu during 1923 :—

| Jan. | Feb. | Mar. | Apr. | May | June | July |
|---|---|---|---|---|---|---|
| 5.6 | 5.5 | 9.0 | 60.5 | 44.0 | 70.0 | 105.0 |



At the other end of the proposed tunnel at "G," where the reservoir will be constructed. The transit and surveyor are perched on the cliff at a point only to be rescued by means of a ladder or a rope.

## The Course of the Old Canal System

The main canal leaves the King river at Tiao-er-tsui and runs through rock for a distance of 3.5 kilometres to the Ya-ho bridge, thence through clay cutting for 4 kilometres to Ma-tao bridge, the greater part of this being unusable for irrigation purposes on account of the precipitous terrain.

The first lateral from the canal is at Wong Yi Tao, running nearly parallel with the course of the King River, while the main canal proceeds north-east for about 10 kilometres to Shen Chiao Chen, and thence for seven kilometres more to the village of Liu Hai.

Turning eastward through Han Ti Chen the canal divides into three branches at San Pei Tzu, having covered a total distance of 28 kilometres in all.

The southern branch supplies the city of King Yang Hsien, having a length of 10 kilometres, while the middle branch runs 10 kilometres to Peng Chen Cha in the district of Kao Ling Hsien.

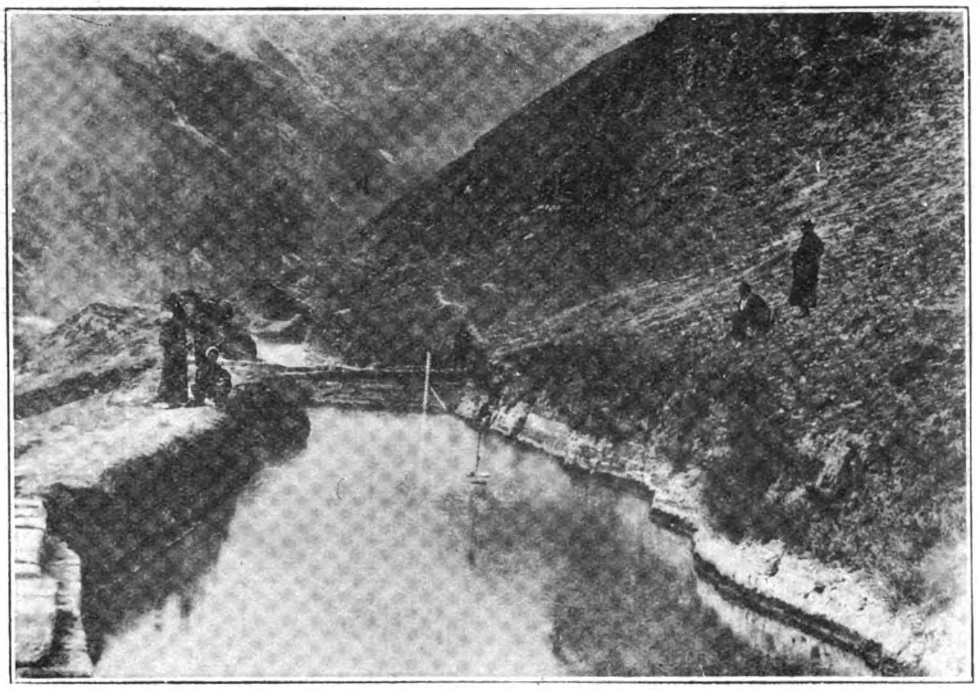
The northern branch runs through the city of San Yuan, beyond which it only proceeds for another 10 kilometres, so that it is estimated that the total length of the canal system with its branches and sub-branches only amounts to 180 kilometres in all.

The following figures indicate the possibilities for irrigation if a proper scheme can be put through, and enable one to realize what a vast undertaking it is to attempt to arrive at a position equal to that attained by the famous Chinese engineer Cheng-kuo :—

| District | Irrigable Land | Now Irrigable | To be Irrigable |
|---|---|---|---|
| King Yang | 46,000 acres | 4,300 acres | 41,700 acrse |
| Li Chuan | 600 ,, | 200 ,, | 400 ,, |
| San Yuan | 30,000 ,, | 600 ,, | 29,400 ,, |
| Kao Ling | 24,000 ,, | 400 ,, | 23,600 ,, |
| Ling Tung | 1,000 ,, | 100 ,, | 900 ,, |
| | 101,600 acres | 5,600 acres | 96,000 acres |

Even when the irrigable area covered by this proposed system is supplied, it will only be one-seventh of the area which was served by the canal built by Cheng-kuo, and but slightly greater than that watered by the Pekung canal of 150 B.C.

Of course there is no reason, topographically speaking, why irrigation should be confined to the above measured area, for a satisfactory scheme of dams, reservoirs, and canals should enable the engineer to supply almost the whole of the districts which were originally supplied by the Cheng-kuo canal, for the costs of extensions will be more than covered by the added value of the land and crops.



**Taking dicharge measurements on the Lung Tung Canal at Er Lung Wang Miao station at "F." Note the precipitous hillside which threatens the safety of the canal by possible landslides in frosty weather.**

It may not be out of place to append here a schedule of crops grown in the area under consideration, together with an estimate of water supply necessary as fixed by the farmers and the irrigation engineers.

The farmers tabulate their rainfalls roughly under three headings :

1. One spade deep of rain, corresponding roughly to 10-20 millimetres.
2. One plough deep of rain, or roughly 20-30 millimetres.
3. One penetrating rain, or from 40-50 millimetres.

and they state that one penetrating rain is necessary before planting crops, with one plough deep of rain per month during the winter months and three times that amount during the summer months.

A closer observation of the various crops was also made and the results were as follows :

| Crops | Seeding | Harvest | Growing Period | Water requirements |
|---|---|---|---|---|
| Millet .. | .. 3rd moon | 8th moon | 150 days | 5 mow-feet |
| Green bean | .. 3rd ,, | 8th ,, | 150 ,, | 8 ,, |
| Rice .. | .. 4th ,, | 8th ,, | 150 ,, | 3 mow-inches daily |
| Canary seed | .. 5th ,, | 8th ,, | 100 ,, | 7 mow-feet |
| Yellow bean | .. 4th ,, | 9th ,, | 140 ,, | 7 ,, |
| Pearl Barley | .. 5th ,, | 8th ,, | 100 ,, | 8 ,, |
| Buckwheat | .. 6th ,, | 9th ,, | 90 ,, | 5 ,, |
| Barley .. | .. 8th ,, | 4th ,, | 250 ,, | 5 ,, |
| Rye .. | .. 8th ,, | 5th ,, | 260 ,, | 5 ,, |
| Cotton .. | .. 3rd ,, | 9th ,, | 190 ,, | 8 ,, |
| Tall Indigo | .. 8th ,, | 5th ,, | 250 ,, | 5 ,, |
| Small Indigo | .. 4th ,, | 6th ,, | 90 ,, | 15 ,, |
| Vegetable Seed | .. 6th ,, | 4th ,, | 300 ,, | 5 ,, |
| Garlic .. | .. 7th ,, | 5th ,, | 300 ,, | 16 ,, |
| Garden Pea | .. 9th | 5th ,, | 230 ,, | 5 ,, |

(*Note.*—1 mow-foot × 1 mow of land covered by 1 foot of water.)

If we now turn our consideration to the average cost and yield of the foregoing crops in a good season we find :—

| Crops | Yield Tou per Mow | Cost per unit in $ | Income per Mow in $ |
|---|---|---|---|
| Millet .. | .. 10 | 0.45 | 4.50 |
| Green bean | .. 6 | 0.50 | 3.00 |
| Rice .. | .. 20 | 1.20 | 24.00 |
| Canary seed | .. 6 | 0.60 | 3.60 |
| Yellow bean | .. 5 | 0.45 | 2.25 |
| Pearl barley | .. 7 | 0.60 | 4.20 |
| Buckwheat | .. 5 | 0.50 | 2.50 |
| Barley .. | .. 10 | 0.45 | 4.50 |
| Rye .. | .. 7 | 0.70 | 4.90 |
| Cotton .. | .. 40 catties | 0.20 | 8.00 |
| Tall indigo | .. 155 ,, | 0.15 | 23.25 |
| Small indigo | .. 200 ,, | 0.20 | 40.00 |
| Vegetable seed | . 5 tou | 0.70 | 3.50 |
| Garden pea | .. 4 ,, | 0.50 | 2.00 |
| Garlic .. | .. 22,000 bulbs | 0.20 per hundred | 44.00 |

(*Note.*—One tou × 10.35 litres, and one catty × 1-lb.)

The figures in both the foregoing tables are from reports submitted by a Chinese engineer who accompanied a survey party through the whole area concerned, and though expert tests carried out over a considerable period of time might lead to slight alterations, they are nevertheless of great interest as being one of the first estimate of this nature prepared in China.

Having thus reviewed the most important factors in the past history of the King River irrigation, and briefly considered the agricultural necessities and possibilities in the area concerned, we must now turn our attention to the terrain as indicated in the accompanying maps and endeavor to decide on the form of scheme which is likely to be most effective, and, other things being equal, least expensive.

The first plan put forward by the engineering party responsible for the inspection of the site covered the restoration of the old canal together with improvements and extensions of the existing system, and the Chinese submitted an estimate of expense as follows :—

| Work | Length | Material | Cost per Lin.ft. | Total |
|---|---|---|---|---|
| Canal retaining wall .. | 6,000 ft. | Concrete | $ 70.00 | $420,000.00 |
| Outlets, four .. | .. | Cement | 800.00 | 3,200.00 |
| River dam .. | .. 300 ,, | Concrete | 150.00 | 45,000.00 |
| Lock for canal | .. 30 ,, | Stone | 150.00 | 4,500.00 |
| Cleaning pits, four | .. | Concrete | | 18,000.00 |
| Rock excavation | .. 4,000 ,, | | 10.00 | 40,000.00 |
| Canal bed .. | .. 6,000 ,, | Concrete | 8.00 | 48,000.00 |
| Equipment, engineering | | | | 50,000.00 |
| Organization expenses (six months) | | | | 10,000.00 |
| | | | | $628,700.00 |

This expenditure only covers the work to be done in restoring the old canal at point E-F, the estimate for time needed being rather too short in the opinion of writer, as the nature of the rock may lead to landslides and unexpected obstacles, while transportation of necessary materials to the site takes time and money also.

To this the Chinese engineer appends the following extensions and improvements:—

| Work | Length | Material | Cost per Lin. ft. | Total |
|---|---|---|---|---|
| Improving canals | 360,000-ft. | Earthwork | 11 cts. | $ 39,600 |
| New canals ... | 180,000 ,, | ,, | 57 ,, | 102,600 |
| Double span stone bridges, thirty | | | $1,200 | 36,000 |
| Canal locks, six... | | | 3,000 | 18,000 |
| | | Total | | $196,200 |

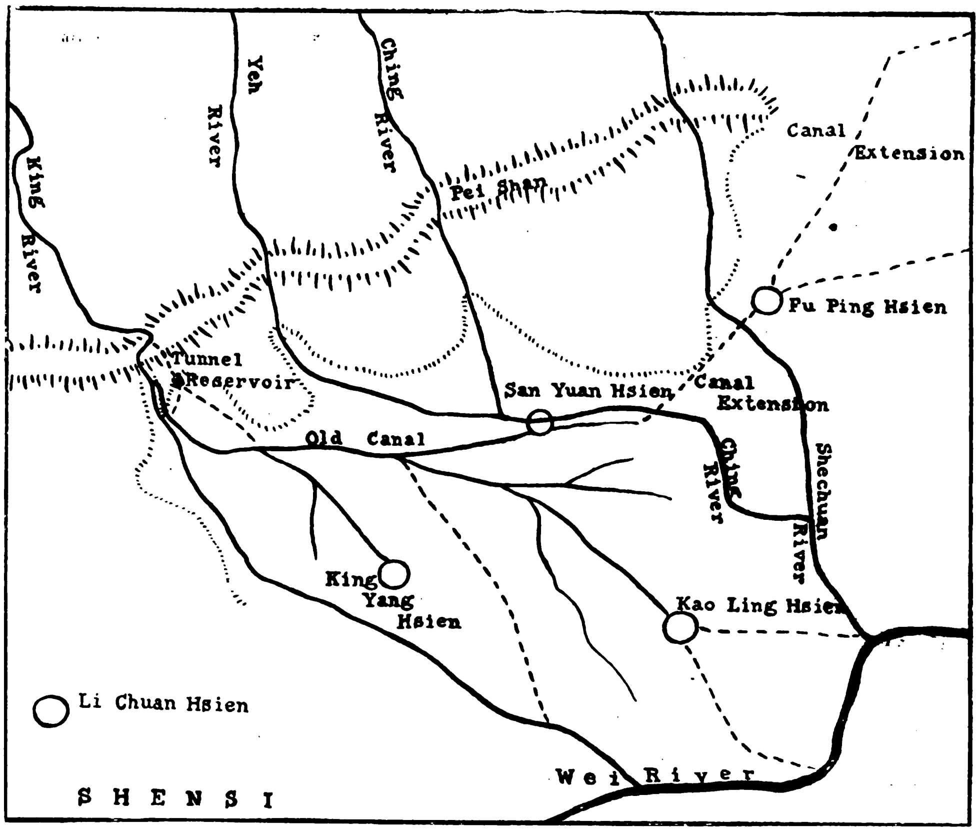
making a total of over $820,000 in all, without any allowance for the purchase of the necessary land from the owners, or the organization expenses for the time required, which cannot be much less than one year.

In any case the project is not one than appeals to the conservancy engineer, for it provides no remedy for the troubles which ruined the canals before, and which would doubtless do so again in a few years, so that the expenditure would be practically wasted.

The second scheme was also reported on by a Chinese engineer, but is much more exhaustive in its nature, and indicates the possibility of constructing an irrigation works which shall be of a lasting character, though at a somewhat greater first cost.

The proposal put forward can best be understood by reference to the accompanying maps, which indicate roughly the terrain and the locality of the present works.

In the first place it is intended to cut a culvert tunnel through the hills at A-D, in order to divert the course of the river from the working site at B.

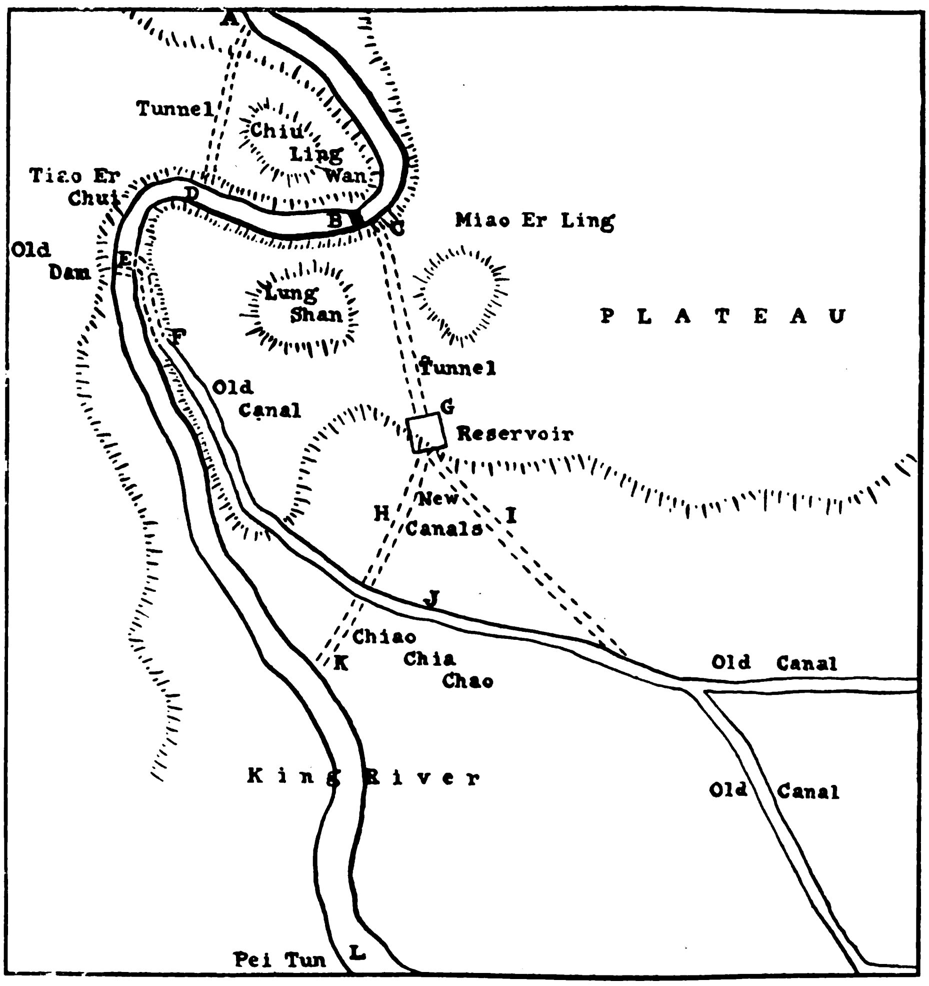



The King River Irrigation Scheme.

At C-G an irrigation tunnel will be built, leading to a reservoir at G, and thence branch canals will lead the water by H and I into the King River and the old canal system as required.

A low dam at B will divert the flow of the King River into the irrigation tunnel when completed, by the simple expedient of closing the culvert tunnel at A, and it is proposed to follow up the construction of the low dam by another high dam below it when funds will permit.

The culvert tunnel is all rock work and has a length of 400 metres, with a cross sectional area of 12 sq. metres and a discharge of 60 cum/sec, while the irrigation tunnel has a total length of 2,560 metres, 1,500 metres of which is in rock and the remainder in loess.




King River Irrigation Scheme.

The tunnel will be lined with cement, and two shafts will be provided, together with the necessary vertical sluice gates at the entrance and outlet.

The low dam will have a height of 13 metres and a length of 160 metres at the widest, being constructed n stone and cement on a rock foundation.

The high dam to be subsequently built below the low dam will be of cyclopean concrete on a rock base (white oolitic limestone) and will have a height of 75 metres and a length of 400 metres, giving a reservoir capacity of more than eighty million cubic metres.

The estimated water supply from the King River amounts to 788,400,000 cubic metres, and with an estimated efficiency of 60 per cent., there is a total of 473,000,000 cubic metres that can actually be used for irrigation.

The outside reservoir will be 60 metres in width and 275 metres in length, closed by a stone dam with a penstock opening at the lower end, the depth being 42 metres.

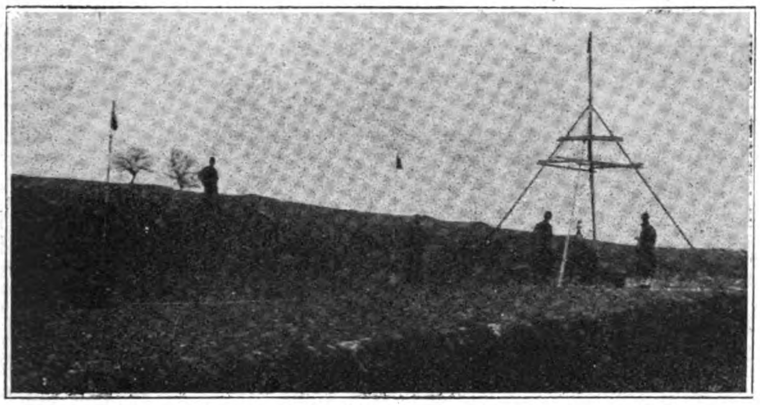
The outlets will permit either of a direct supply to the new main canal, or an overflow into the King River again, the capacity of the main canal being estimated at a minimum of 25 cubic metres per second.

The route taken will be that of the old Cheng-Kuo canal to a certain extent, but extensions of the present disused system will carry the water across the Shechuan River to Fu Ping Hsien, irrigating the area beyond there until it eventually reaches the Lo River above Lung-yong, where it will discharge.

The existing canal system suffers greatly from loss by seepage, the measured leakage being about 30 per cent. of the total volume, so that it is necessary to carry out extensive repair work on the canal bed before efficiency can be guaranteed.

As before mentioned, the area that could be covered by the existing system if it were put in good shape would be a little over one hundred thousand acres, but the scheme as outlined above would greatly increase this when completed, the figures being estimated as follows:

| | |
|---|---|
| King Yang and Li Chuan Hsiens .. .. | 103,000 acres |
| San Yuan and Fu Ping Hsiens .. .. | 131,000 ,, |
| Lin Tung, Wei Nan, and Pu Cheng Hsiens (lying to the east of the Shechuan River and being new construction work) .. | 390,000 ,, |
| Total .. .. | 624,000 acres |



The survey party carrying out base line measurements close to the main triangulation station above the King River.

It will be seen that this comprises nearly the total area covered by the canal scheme constructed by Cheng-Kuo; at a cost which is yet unknown, but which could be spread over a number of years and repaid out of the receipts on taxation on the improved land.

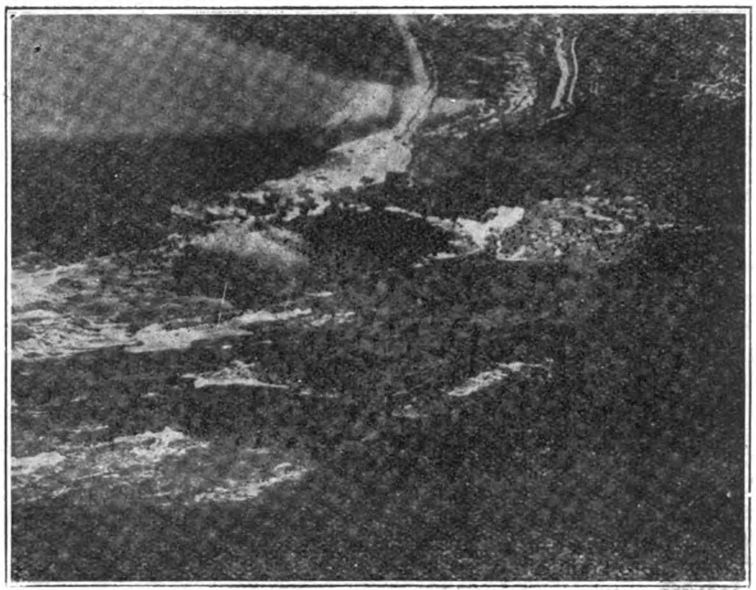
The following figures have been submitted as the initial expenses for the preliminary work:—

| Work | Area | Cost | Total Cost |
|---|---|---|---|
| Rock excavation, irrigation tunnel .. .. .. | 24,750 c.m. | $ 1.70 per c.m. | $ 42,075 |
| Loess excavation, do. .. | 17,490 c.m. | 0.55 per c.m. | 9,620 |
| Timbering .. .. .. | | | 5,170 |
| Shafts, one in rock .. | 56 m. | | |
| one in earth .. | 100 m. | | 3,000 |
| Cost of lining .. .. | | 25.60 per c.m. | 179,200 |
| 9,000 labour days for hauling materials .. .. | | | 4,500 |
| Compressed air and ventilation costs .. .. | | | 100,000 |
| Plant, including pumps, cranes, drills, etc. .. | | | 100,000 |
| Light rails, forty tons at $120 to the ton .. | | | 4,800 |
| Cost of car .. .. .. | | | 4,000 |
| Superintendence charges .. | | | 55,000 |
| | | Total | $507,365 |

This figure would seem to be fairly accurate if one may judge by similar work which the writer has examined elsewhere, though it must be admitted that the work in the other case was carried out in civilized countries where supplies were easily obtainable as required, and transportation presented no great difficulties.

Continuing the estimate we find that:—

| Work | Area | Cost | Total Cost |
|---|---|---|---|
| Culvert tunnel at A-D. | 400 metres | $ 200 per m. | $ 80,000 |
| Low dam .. .. | 7,000 cu. m. | 20.30 per c.m. | 142,100 |
| Excavation of new canal | 184,500 c.m. | 0.30 per c.m. | 55,350 |
| Masonry facing, canal.. | 1,300 c.m. | 21.50 per c.m. | 27,950 |
| Enlarging old system .. | 120 k.m. | 500 per k.m. | 60,000 |
| Prolonging old system | 60 k m. | 1,250 per k.m. | 75,000 |
| Purchase of ground sites | 250 acres | 120 per acre | 30,000 |
| Superintendence charges | | | 10,000 |
| Three Sluice Gates .. | | 5,000 each | 15,000 |
| Bridge reconstructions | | | 2,000 |
| | | Total .. | $497,400 |



A view of the cliffs on the bank of the King River at "C" immediately above the site of the proposed dam and at the point where the irrigation tunnel will commence.

To this may be added at least one million dollars for the construction of the high dam when required, if one takes similar construction costs as a fair estimating basis, so that the scheme will need slightly over $2,000,000 Mex. in all.

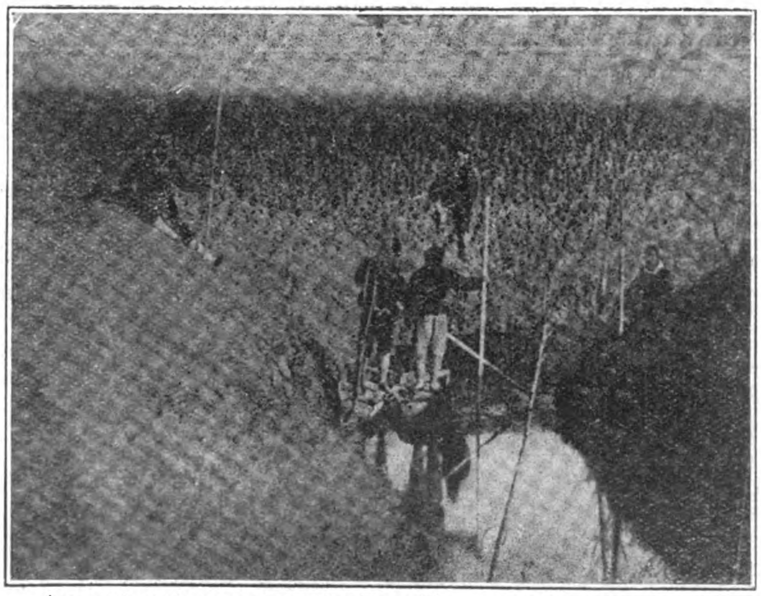
This is the whole project as presented to the public by the governor of Shensi, who is very desirous of seeing the work commenced as soon as possible; and he has applied to the executive committee of the China international famine relief commission for assistance in carrying it out.

The principle recently adopted by the commission has been to provide funds for famine prevention schemes on a loan basis, and it is probable that they may consider the feasibility of this scheme under these conditions, providing that satisfactory guarantees can be provided by the provincial authorities.

The surety of the Chinese chambers of commerce is the best security obtainable, and it is the experience of the writer that they are generally willing to support such schemes for the public welfare, providing that they are assured that the funds will be handled by foreign committees, thus avoiding any danger of the military confiscating it for their own purposes.

It would only be necessary to expend about one million dollars for the commencement of the work, leaving the construction of the high dam for a later date, when it is seen how work is progressing and whether the authorities are giving full support to the scheme.

As to repayment, this could be spread over three to five years, and would be largely obtained by taxation on the land benefited, for the increased yield in crops would easily enable the proprietors to carry the extra charges after the first two years receipts.



An engineering party on the Lung Tung and Cheng-Kuo Canals, part of the King River Irrigation Scheme, Shensi. The coolie holding the pole for a profile survey is using small boats known as "Dragon's Shoes."

# Mining in the F.M.S.

## From an Account of the Geology and Mining Industries of South Selangor and Negri Sembilan

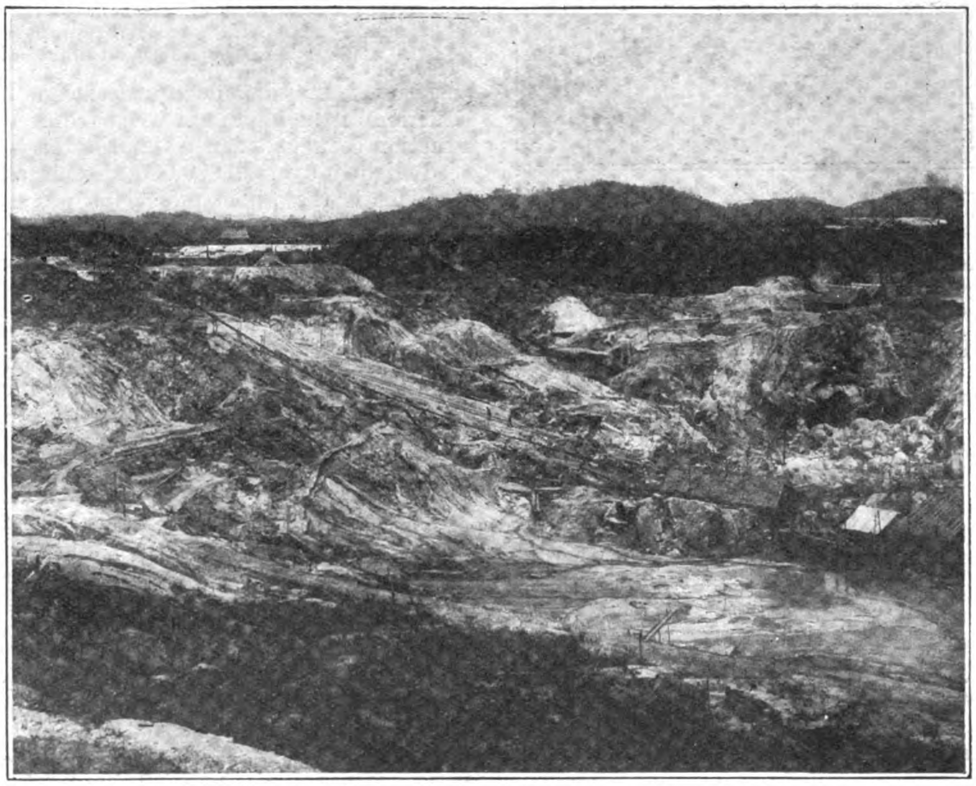
*By E. S. Willbourn, Asst. Geologist, F.M.S.*

Kuala Lumpur Plain.—In the neighborhood of Kepong the granite hills near the contact with limestone have been hydraulicised to a considerable extent; and, in the same district, the alluvium is being worked by open-cast methods down to the bed-rock of dolomitised limestone. Several exposures in French Kepong Mine and in Chinese-owned mines in the neighborhood show the general line of the granite limestone contact, and prospecting is being carried on in the search for further rich alluvial deposits. Yap Po's mine is situated on the contact, and it seems that a fissure has been formed in the limestone, where it came into contact with the granite, which now contains tin-bearing sands and clays. The *karang* here contains a comparatively small proportion of clay. The old French Kepong Mine was on the contact too, and it contained a rich *lead* of tin. This was probably an alluvial deposit laid down in a fissure formed by solution at the granite, limestone contact. The mine which is at present being worked by the French Kepong Company has bed-rock of limestone (Plate IV. Fig. 2) and the granite contact is several hundred yards away.

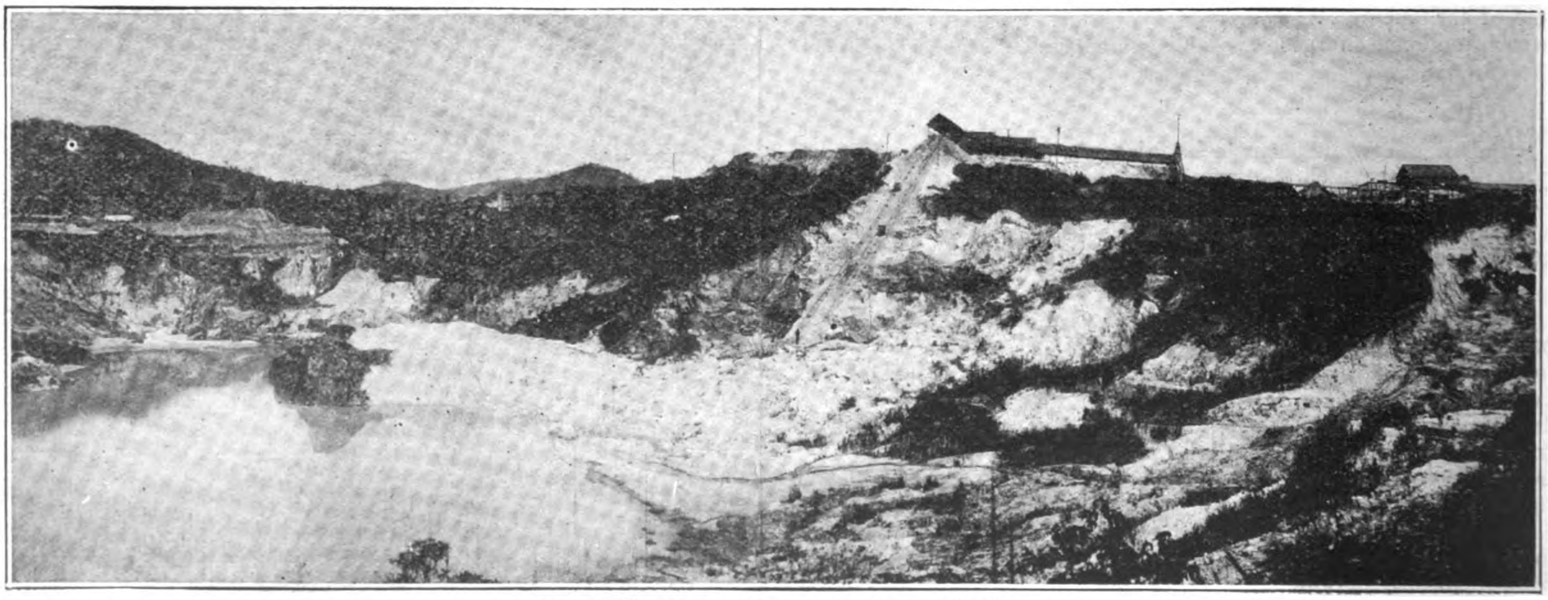
The granite hills near the 8th mile Rawang road are being ground-sluiced, but not much work is now going on there, and there is also an old *lampan* at the second mile from Kuala Lumpur, on the Batu road, which has evidently not been worked for some years. The face shows weathered fine-grained granite, which is a small intrusion into the country rock of shales and sandstones, and which may be continued eastwards into the limestone.

There are several open-cast mines in the alluvium near Setapak, most of the country between here and the granite to the east and to the Ampang road being formerly mined for tin, and at the present time there are *lampan* workings in the weathered schists just to the east of the rifle-range.

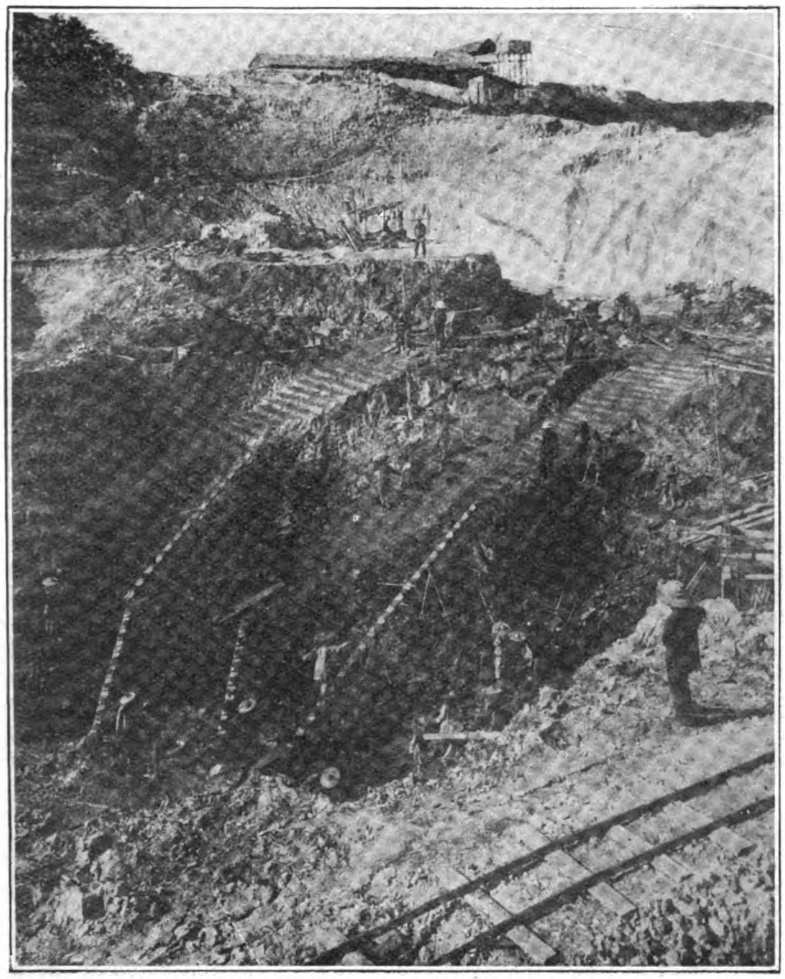
There are some very large open-cast mines in the neighborhood of Ampang, all with dolomite and dolomitic limestone as bed-rock; the proximity of the main range granite is indicated by the occurrence of intrusions of pegmatite and also of fine-grained aplites. In the mine to the southeast of Ampang, nearest the granite hills, such intrusions are connected with the presence of scheelite, of which it is said that three hundred pikuls were won from the neighborhood of a pegmatite-vein. Some lumps of quartz were noticed lying on the floor of this mine with crystals of cassiterite several inches across, so it is clear that the tin here must be derived from veins in the neighboring granite and schist near the contact, for these large lumps cannot have traveled far.



The Sungei Besi Tin Mine, at Sungei Besi, Selangor, F.M.S.



Kepong Tin Mine at Kapong, Selangor. F.M.S.



Chinese Women at Work in the Kepong Tin Mines

LODE MINE SOUTHEAST OF AMPANG.—The granite in this mine is non-porphyritic and is veined with kaolin-stringers, and, in addition, it is penetrated by two sets of vertical quartz-veins, one with strike N., 30°W. by S. 30°E., and the other with a strike N., 50°E. by S., 50°W. The widest vein noticed had a breadth of eighteen inches and was deeply stained with iron. The quartz-veins are tin-bearing, and, in addition, tin was won from irregular patches of pegmatite in the granite. The mine had been abandoned when it was visited in 1920. In March 1917, pegmatite was being worked at the lowest spot in the centre of the mine-floor. It was impossible to be sure about the mode of its occurrence, but it appeared to have no relation to the above-mentioned quartz-veins. The lode-stuff from the mine is very rich in arsenopyrite, and contains a little topaz.

The granite slopes south-west of Ampang, within two miles of Pudu, and the low-lying granite country east of the railway at Salak South, were being sluiced four or five years ago, and in 1917 some lodes were being worked by shafting on them.

There are several open-cast mines north-west of Salak South, the largest, Thong Hing's and Thong Fok's mines, being in alluvial beds, with limestone and dolomite as bed-rock, both being near granite, and having granite exposures on their floors and walls. The west side of the former mine is within a few yards of hills ground made up of a formation of shales and sandstones, which are penetrated by thin kaolin-stringers and thicker veins of quartz.

The greater part of the low granite country which lies to north and west of Salak Hill has at one time been worked for tin.

SUNGEI BESI VALLEY.—In this valley, the low-lying country forms a long narrow strip of country running from north to south, flanked on the west side by hilly land formed of shales and quartzites, and on the east by granite hills. There is no doubt about the origin of the tin—many of the granite hills near the stanniferous alluvial deposits have also been stripped of their softer weathered portions by Chinese miners. Of the open-cast mines, the one known as Chai Seng's mine, east of the Salak Hill, has already been mentioned, as containing crystals of an altered mineral (probably amphibole) in the dolomite bed-rock, they were evidently introduced into it by the intrusion of the neighboring granite. The crystals have not been noticed in the Thong Onn Kongsi Mine dan in the Sungei Besi Mine in the dolomite limestone near the granite contact, perhaps because the actual contact cannot be seen, and the zone containing minerals formed by contact metamorphism in limestone rarely exceeds a few inches in thickness. In Thong Sang's mine near Serdang, which is also an open-cast, granite is seen in contact with dark-blue shales, which are like shales seen near the granite contact east of Ampang. The rocks near the contact are soft enough to be worked with a *changkal*, and contain a considerable amount of tin ore, which, of course, differs both in appearance and origin from the tin of the alluvial beds which are worked in the same excavation. Here is noticed, that there are thin quartz-veins running at right angles to the granite-shale contact in the granite, which do not penetrate into the sedimentary rock. In the Thong Sang Mine there is the difference that, in the altered shales near the contact, numerous quartz-veins lie in the foliation-planes, parallel to the contact, and this suggests that a shearing-movement has taken place in the shales along the contact-plane, and that the quartz-veins, which formerly penetrated them at right angles to the contact, have in this way been dragged sideways, and appear to have been intruded parallel to it.

As already mentioned, a muscovite rock containing a little quartz is common in this district, and thin stanniferous quartz-veins, which penetrate it in a small hill near Cheras, are being worked by Chinese miners. At the 16th mile from Kuala Lumpur just south of Kajang, there is a *lampan* in the decomposed fine, grained granite which is penetrated by thin stanniferous veins of quartz. In 1916 shafts were being sunk by Chinese into some of these veins and there was little other work going on.

The only other mine of any size in this part of South Selangor is a *lampan*, working in weathered granite and the overlying soil, on the Negri Sembilan boundary, near Broga.

SUNGEI WAY.—The granite in this district has introduced tin-bearing veins of quartz into the sedimentary rocks, as, for example, in the quartzites and shales near Pantai, and near the 8th mile Kuchai road.

At Pantai about fifteen years ago these veins were followed into the country rock, and a battery was erected to crush the stone. In 1907, Mr. Warnford Lock wrote "Much if not most of the original deposit still remains in the hills, and several attempts have been made by Europeans to operate on it. So far, but little real benefit has resulted. On the other hand, the mode of procedure has been very ill-judged and costly, and the scale of operations has been trifling, so that past failures are no real criterion of what the future can do. Work on an extensive basis will have to embrace some scheme for disposal of tailings, as there is next to no dumping space, and no convenient river to act as a tail-race."

The sedimentary rocks near the 8th mile, Kuchai road are similar to those at Pantai, and, in the past, the hills to the south of the road were lampanned. The alluvial deposits derived by

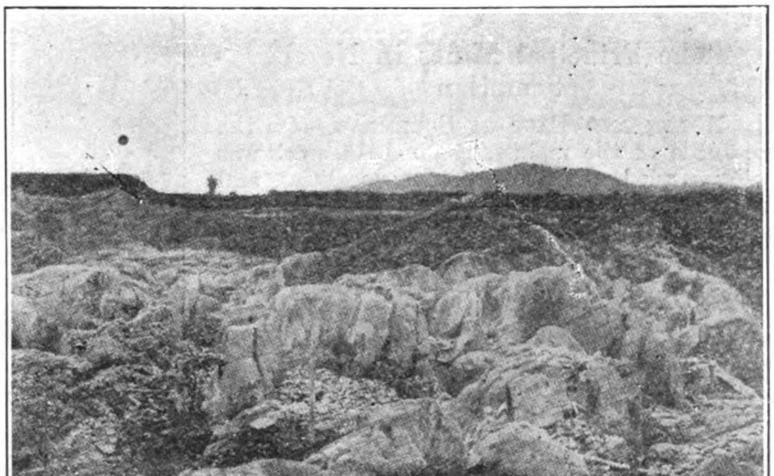
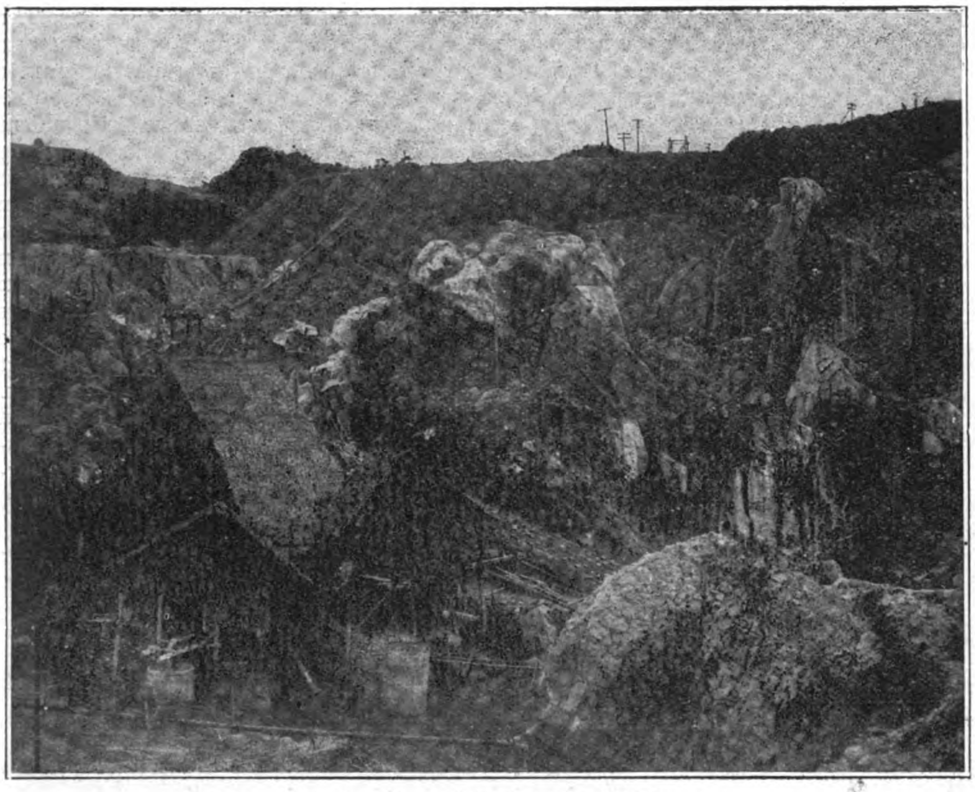


Fig. 2. Limestone showing steady dip away from granite. Granite forms hilly ground 200 yards to the right (not shown on the photograph). French Kepong Mine



Another View of the Sungei Besi Mine

erosion of these hills are being worked open-cast in a *lumbong* on the north side of the road, and veins in the decomposed quartzite which forms the bed-rock also provide some tin.

The mine in S. Way Estate was in 1920, being closed down, in order to bring it under European management, and to use more up-to-date methods. An exposure of weathered non-porphyritic granite veined with tin-bearing quartz-veins gives the source of, at any rate, part of the tin-ore, which is disseminated throughout a considerable thickness of coarse-grained wash, consisting of quartz grains embedded in a kaolin-like clay. The beds of *karang* dip at an angle of 30° away from the granite. Clay bands which are interbedded with the *karang* show slight faults and dislocations, which suggest that limestone forms the bed-rock, though, at the time of writing, this has not been definitely proved. A considerable amount of tin-ore was obtained by working the granite intrusion mentioned above. The ore in this mine contains a lot of pyrites, and galena is not uncommon. Some scheelite is said to have been obtained by washing the alluvium excavated when digging a sump-hole.

## The Principal Mines in Negri Sembilan

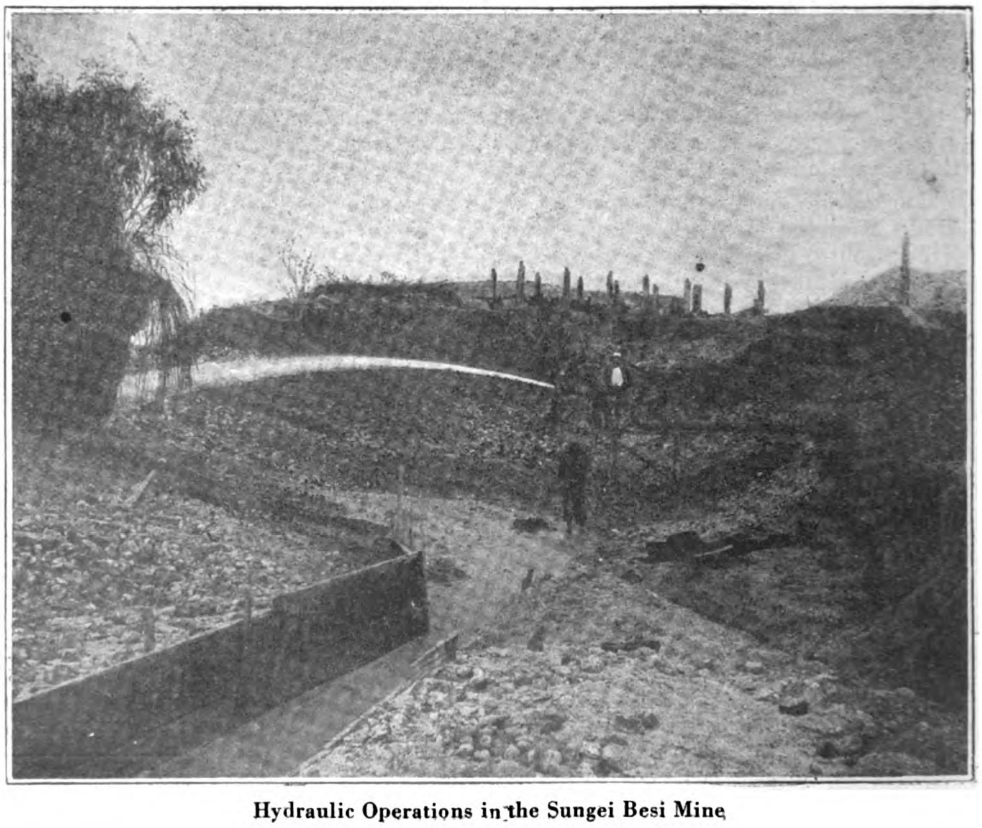
North and East of Seremban.—On the west side of the main range, in 1915, work was being carried on in only a few localities, and not on a very large scale. There are old alluvial workings near Pajam and Mantin, in the former case near the granite boundary, but little or no work was being done. On the Setul Pass, a few miles from Seremban, a few coolies were at work on the thin deposits of alluvium, and the tinstone here was evidently derived from the pegmratite-veins which are so plentiful in this neighborhood. Operations were on similar scale near the Labu road and railway, in the neighborhood of Seremban. On the road from Lenggeng to Broga too, the alluvium derived from the granite hills has yielded quantity of tin, but only a few coolies were working there, and no extensive rich deposits have been found.

Prospecting has been going on in several of these localities with a view to dredging.

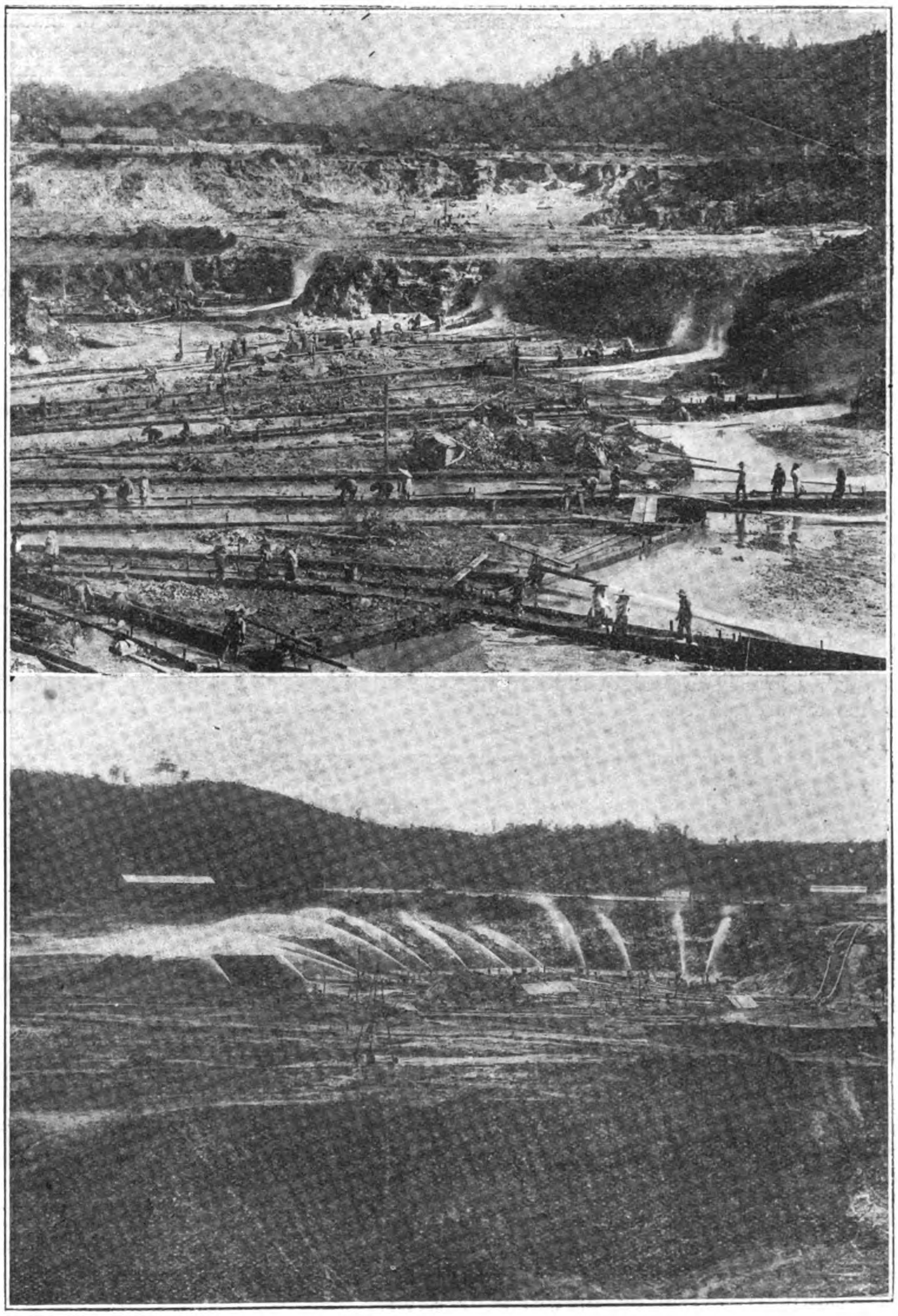
Seremban.—Several open-cast mines were being worked within a mile or two of the town in 1916. There was a Chinese-owned mine between the Setul and the Kuala Pilah roads, within a short distance of the granite-schist contact, in which peaty beds were exposed on the sides of the excavation, underlain and overlain by sandy beds. In an open-cast mine situated near the second mile railway-crossing on the road to Port Dickson, the bedrock was schist, overlain by a grey pebbly sand containing tinstone, the granite junction being one mile away to the north-west. The total thickness of the overburden in this mine was small, so it was possible to work at a profit even if the tin-bearing deposit was thin and of a low value. There were other open-cast mines near Rahang, a village on the outskirts of Seremban on the road to Tampin, and here too the bed-rock is schist, but the granite is only a few hundred yards away.

Seremban Tin Mine.—All the mines hitherto described are alluvial workings, but that situated on the Kuala Pilah road, four miles from Seremban, differs in that hydraulising methods are used to extract the cassiterite from the soil and the partially decomposed granite and schist near the contact. A considerable distance along the granite-schist contact lies in land worked by this company, but the occurrence of tin-ore in workable quantities is very erratic, and when the mine was last visited, in 1914, operations were confined to following a thin quartz-vein with a monitor, the height of the working face down to the harder less decomposed rock being about six feet. The granite is veined with kaolin and quartz-tourmaline veins, and large veins of white quartz several yards wide occur at many places in the mine near the contact, but these large intrusions have always failed to contain tin-stone in workable quantities.

South of Seremban.—Mining has been carried on for some years in the alluvium of the Linggi Valley near Mambau at a distance of three or four miles from the granite outcrop, in an occasional open-cast mine, and this is the only district south of Seremban where any mining is carried on near the main range. There is a mine, however, near the 16th mile Port Dickson road, where



Hydraulic Operations in the Sungei Besi Mine



Hydraulic Mining in the French Tekka Mines

work is going on in the alluvial beds, both by shafting and in an open-cast, the tin having been derived from a small granite intrusion near here. The weathered part of the granite mass was being *lampanned* in 1914 though the work was then being carried out on a rather smaller scale than before. In 1914 about thirty or forty pikuls a month were obtained in the Parit Gila syndicate's mine.

Titi.—This mine, on the east of the main range, is the principal tin-producer of the state, and it is interesting to note that it also yields a considerable quantity of wolfram. In recent times, practically all the ore was produced by tunnelling into a hill through which passes the granite-schist contact, and following up various lodes through the partially decomposed granite. Work was often considerably hindered owing to hard core-boulders of granite being encountered.

Much tin was won from a vein of quartz which was called the Glami Lode, and in the beginning of 1917 the same lode was again encountered. In this mine most of the lodes have not been worked far into the schist as their tin-content then seems to become rapidly less, indeed in one exposure it was noticed that the quartz-veins ended abruptly at the contact, and were not continued from the granite into the schist. Some of the lodes have been worked down to a depth of over one hundred and fifty feet, and the lode-stuff contains a considerable quantity of arsenical pyrites. Ohe specimen was noticed to contain small transparent green crystals of a mineral which was probably *scorodite* (arsenate of iron).

There are two main sets of quartz-veins penetrating the granite of this hill, one set, including the main Titi Lode and several others, having direction of a strike N., 70°W. by S., 70°E., and another, which for practical purposes do not contain tin or wolfram, with a strike direction at right angles, namely N., 20°E. by S., 20°W. The latter set are later than those containing the tin. The shales and quartzites have been much altered at and near their contact with the granite, the shales being converted to tourmaline and mica-schists and the quartzites to mica-schists and to a hard dark-coloured homogeneous quartzose rock.

Operations were about to be considerably extended in 1917.

In the Jelundong Valley, only a few miles from Titi, a Chinese-owned mine, where decomposed granite near the contact is being worked by monitors, gives a yield of about one hundred pikuls a month. There are many *lampans* in the Jelundong, Tinggi, Kenoh and Kongkoi Valleys, working shallow alluvium and soil derived from the denudation of schists and granite near the contact, but, for the most part, they are in narrow valleys, not suited for the accumulation of extensive deposits, and, in the hilly country, operations are rendered more difficult by the presence of large boulders of granite and schist.

## Old Gold Workings of Negri Sembilan

There are no gold mines at present worked in Negri Sembilan, but a description of the positions of the disused workings, and the little that is known about their history may be interesting.

Chindras.—The mine is reached by walking two miles along the railway in a north-easterly direction from the station at Ayer Kuning south, and by then following a cart road through the jungle for about two miles over flat country formed of Raub shales. This is the formation at the mine, and the shales are traversed by a number of quartz-veins with a strike of north and south, one or two of which have been followed by tunnels into the hillside, and which were evidently the source of gold. They have been intruded along the bedding-planes of the shales, which dip to the west at an angle usually bigger than 45°.

In one drive the quartz-veins can be followed from the shales into a red-green weathered quartzose rock, which, under the microscope, appears to be a fine-grained granitic rock with larger rounded crystals of quartz and micaceous pseudomorphs after felspar. The rock contains no felspar, all of which has been replaced by mica. It is evidently a greisenised granite porphyry, coarser grained, though otherwise similar to, the dykerock exposed on the *lalang*-covered hills, north of Ayer Kuning station, which run in a direction from S., 60°W. to N., 60°E. towards Bukit Chindras and are only a mile or two away from Chindras. The rock is interesting because it is very like an altered granite-porphyry known as beresite, which is described by several writers as being penetrated by gold-bearing quartz-veins in the Ural Mountains. The Penghulu at Ayer Kuning says that, some years ago, his father got some gold from the Ayer Kuning Hills by washing the soil there, and, if this is true, it would appear to be certain that the gold was introduced at the time of intrusion of the dyke-rock. There is no evidence as to its age, and whether the rock should be

classified with the Pahang Volcanic series, or as an offshoot from the Mesozoic granite, is a matter of doubt.*

Mr. Scrivenor says, in his preliminary report on the gold mines of the F.M.S. in May 1904, " The quartz has a little country mixed with it. I am told that very favorable assays of this stone were made at Chindras, and that some ran 1 oz. to the ton. Nevertheless an unerected 15—head battery can be seen on the mine at the present day." He alludes to a pale-green rock, which was not seen *in situ*, composed of muscovite, quartz grains, iron-ores, and small prisms of rutile, and says that it is similar to that at Punjom, described in the same report. This is evidently the greisenised granite-porphyry.

Batu Bersawah.—It can be reached by going five or six miles down the Muar River from Kuala Jelei, or by following a jungle path which leaves the Kuala Jelei—Tampin road about 1½ miles from Kuala Jelei.

If the latter route be followed, in which case a guide is necessary, an interesting intrusion exposed in the banks of a tributary of the Muar River (S. Raia) can be examined, interesting because of the possibility that the rock may be connected with the occurrence of gold in the district. The country rock is light-blue Raub shales and the intrusion is of the minette type, being a dark-colored rock consisting of biotite, orthoclase, hornblende, abundant apatite, and a certain amount of quartz. The Raub shales and limestones exposed in the country surrounding the Batu Bersawah Mine show signs of folding, for the strike varies between N., 50°W. by S., 50°E. and N., 10°W. by S., 10°E. Some of the pebbles in the Muar River bear a resemblance to volcanic ash of the Pahang Volcanic series, but all are too much weathered for accurate determination.

At the mine itself, little can be made out, for the whole of the hill is covered with very long *lalang*, and the shaft is half filled up with fallen earth, undergrowth, and the ruins of machinery, but the rocks described and seen *in situ* by Mr. Scrivenor in 1904 can be recognized in the spoil-heaps near the shaft. Mr. Scrivenor's description of the mine in the report above referred to is as follows :—

" The lode at Batu Bersawah is worked by a shaft connecting four levels. The first of these is entered from the side of a hill, and has no definite designation. The second level is No. 1. No. 3 is 240-ft. from the top of the shaft. The lode outcrops on the surface with an approximate course of 350°. Nowhere is it of any considerable thickness where I saw it. It is composed of quartz, sulphides of iron and zinc, with a small admixture of country. The walls are distinct. The underlie is to the east."

" The country at Batu Bersawah runs with the lode. It is composed of a medium-grained rock, which effervesces with acid, with partings of shale. When at the mine I was deceived by the gray colour of the former and its behavious with acid and took it to be a peculiar type of limestone. The microscope, however, shows that it is an altered diabase, consisting of idiomorphic crystals of a plagioclase felspar, chlorite, and magnetite with a large amount of crushed material derived from the felspar, and abundant calcite veins. In the slides examined there are no crystals that can be called porphyritic."

" I am indebted to Mr. Benjamin Odgers, the manager, for the following notes :—In No. 1 north the ore taken out ran 7 dwt. to the ton ; but there was no stone above the level for stopping to the south. A mixture of stone taken from No. 2 for 504-ft. and stone from No. 3 ran 14 dwt. In No. 3 there is a good body of quartz which has for the last year yielded an average of 13 dwt."

" The above figures looking promising for the mine ; but, although I do not wish to appear an alarmist, it is necessary to add that the amount of ore crushed has been small and that until the mine has been further developed it will not be possible to arrive at a true estimate of its value. It is sincerely to be hoped that the percentages quoted will be maintained or exceeded."

Work at the mine was stopped shortly after Mr. Scrivenor's visit.

Pasoh.—The flat ground in the jungle, between the railway and this mine, is pitted with numerous gold-workings. At the mine itself little can now be seen ; the unerected machinery still remains, and occasional large boulders of granite with porphyritic felspars are lying about on the hill-side. The following account is extracted from Mr. Scrivenor's report :—

" The mine at Pasoh is situated on the side of a steep hill close to the Pahang border. Preparations for serious work were made, as can be seen by the amount of machinery stored on the mine, but unerected."

" The geology of Pasoh is very interesting in connection with gold mining. In the first place, the lode behind the shaft, giving prospects of 5-6 dwt., is an igneous rock, a granophyre with no trace of a ferro-magnesian mineral. The other rocks composing this part of the hill are—granite with large porphyritic crystals of felspar ; gneiss with tourmaline that has been affected by the shearing ; and hornblende schist that is probably drived from a diabase. The granophyre is for the most part intensely sheared—in fact, were it not for small eyes that have escaped it would be impossible to determine its nature.† At one of the shafts near the battery site more hornblende schist and gneiss occur. When exposed *in situ* the trend of the shear planes in these rocks is northerly ; and at least two lines of weakness, analogous to that at Raub, are represented."

" It would appear from the relations of the granite, gneiss, and hornblende schist in the field and the examination of slides that the hornblende schist has been derived from a basic intrusive rock cutting, and therefore of later date than, the granite. That this is not impossible is borne out by a very clear exposure in the headland at Kuantan, Pahang, where four small dykes of diabase are seen traversing granite. Since then, in Pahang, " a greenstone " has been found to be altered by the granite owing to contact metamorphism, there must either be two distinct ages of granite or two distinct sets of "greenstones ;" and that the latter is the correct interpretation is, I think, shown by the fact that the Kuantan headland granite, although situated in a district where shale and sandstone have been enormously disturbed, is itself in no way affected."

*The rocks, their relations to one another, and to similar rocks in other parts of the world, formed the subject of a paper in the *Geological Magazine*, pp. 44-6, October, 1916.

† " Divisional places in this granaphyre show beautiful dendritic crystals of manganese dioxide, which have given rise to the statement that 'fossil ferns' occur at Pasoh."

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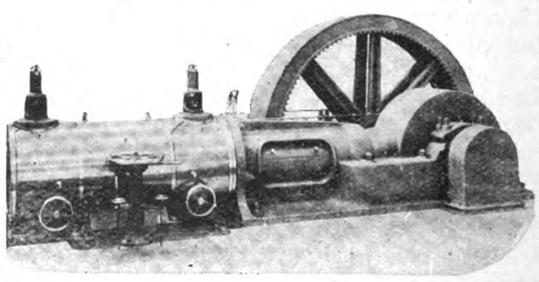
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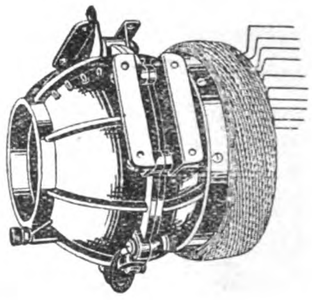

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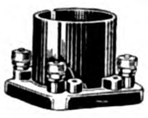

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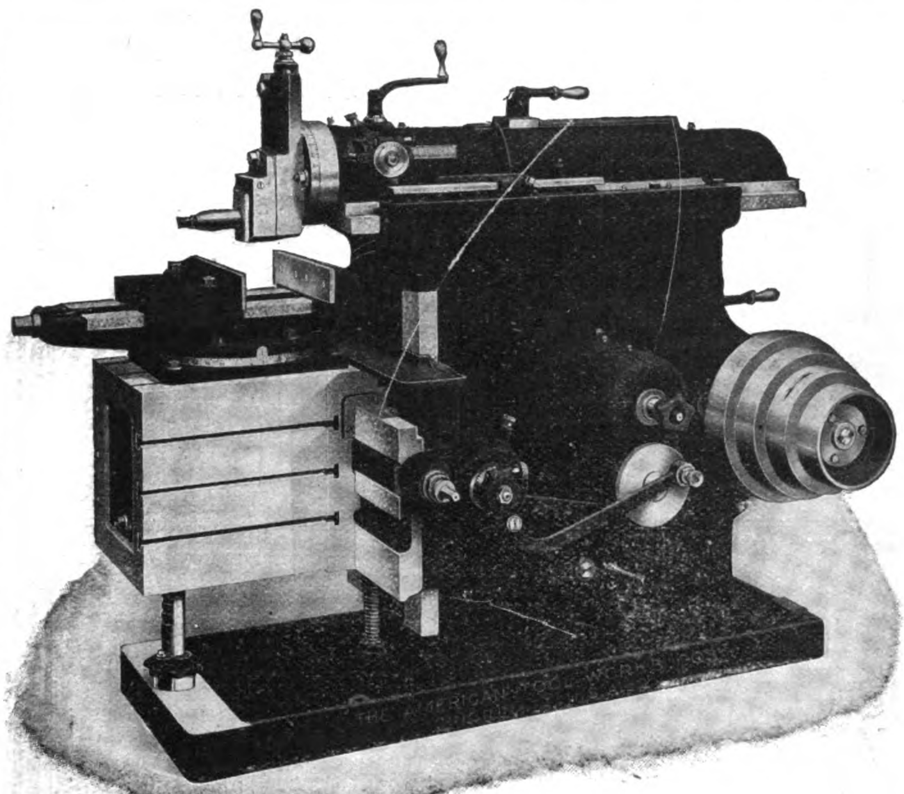

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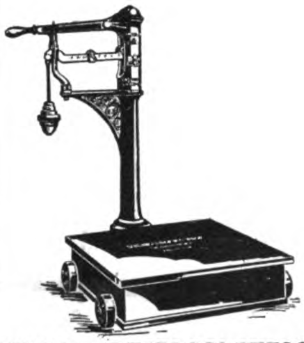

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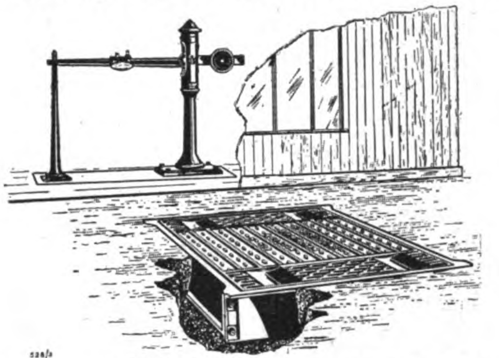

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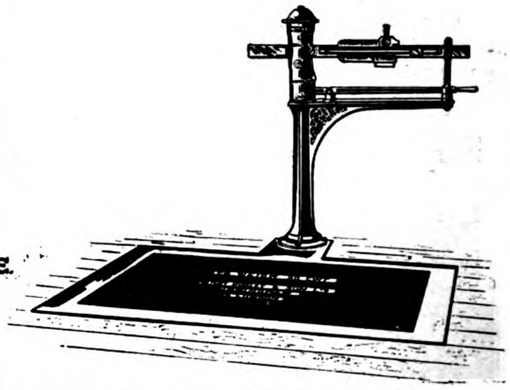

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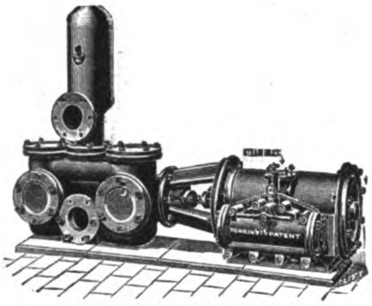

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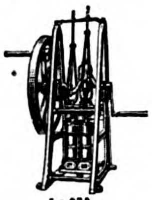
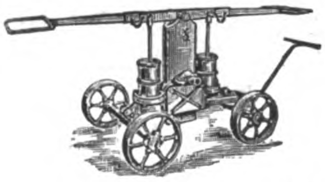
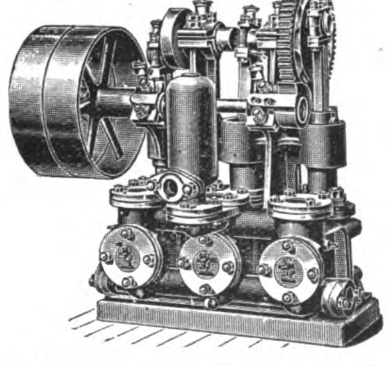


FIG.228.

FIG.160.





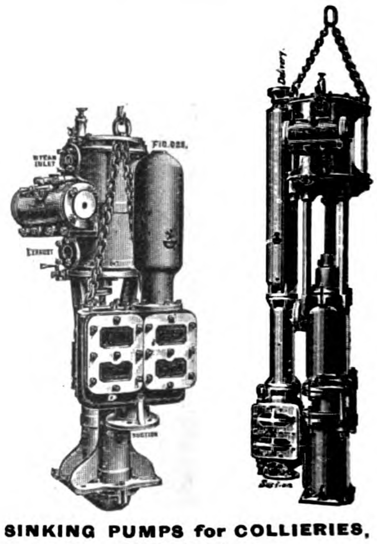


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FIG.191.

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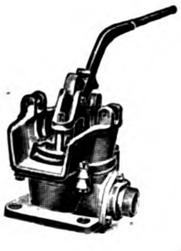

FIG.185.

Agents for China

J. WHITTALL & CO., LTD.

16 Victoria Terrace Tientsin

Stocks Kept in Tientsin

26, Hsi Tang Tze Hutung, Peking

# DORMAN, LONG & Co., Ltd.

*Steel Manufacturers,*

*Bridge Builders & Constructional Engineers,*

**MIDDLESBROUGH, ENGLAND.**

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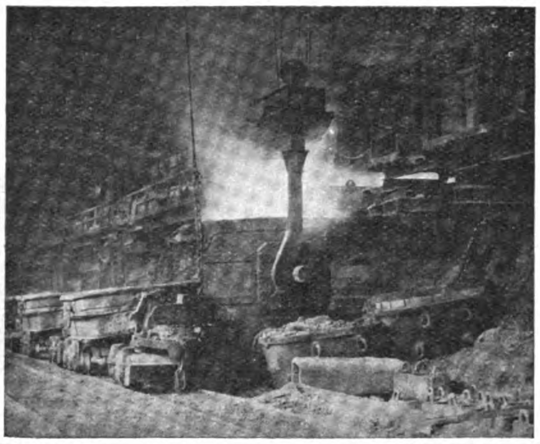

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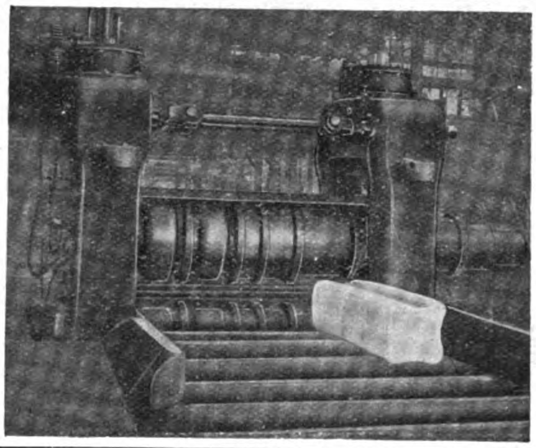
**MIDDLESBROUGH.**

Open-Hearth STEEL JOISTS, ANGLES and OTHER SECTIONS, RAILS.

Open-Hearth STEEL BARS in long lengths suitable for

**FERRO-CONCRETE WORK, BILLETS AND BLOOMS.**



**Redcar Iron and Steel Works, Redcar.**

**Steel Works and Rolling Mill Dept.**

Plate Mills capable of Rolling all Plates for **Shipbuilding and Engineering** purposes, from $\frac{3}{16}''$ to $1\frac{1}{2}''$ thick, fulfilling the requirements of British Standard Tests, Board of Trade, Admiralty, Lloyds, etc.

**Universal Plates** with Rolled Edges 12″ to 42″ wide up to 90-ft. long.

**Clarence Steel Works and Rolling Mills,**

**PORT CLARENCE.**

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Electrically Melted Steels of all Carbons.

NICKEL ALLOY STEEL.

Flange and Bulb Head Rails, Billets, Slabs, etc.

**Ayrton Rolling Mills,**

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Galvanized Corrugated and Plain Sheets,

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The Mills can supply the **longest single length** of Rods or Wire without weld or joint of anyone in the Trade.

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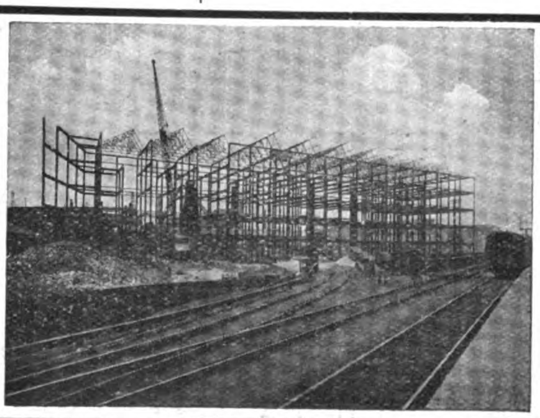
for all purposes.

Speciality:

**STEEL FRAME BUILDINGS**

for home and abroad.



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43 KIANGSE ROAD, SHANGHAI.

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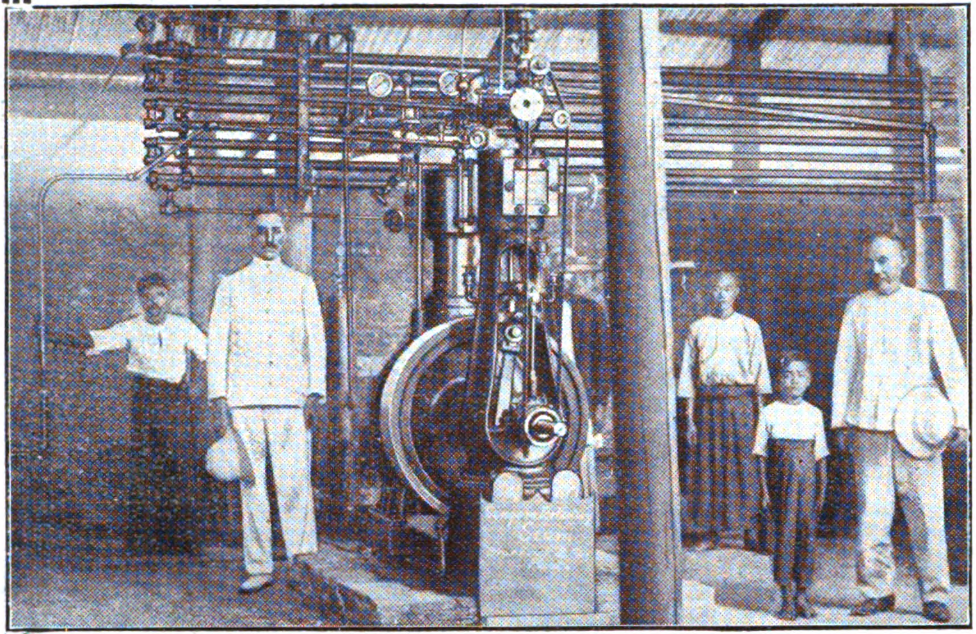


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has won world-wide popularity and success.

There is hardly a country in which you will not find some notable example of the Brunswick Equipment, purchased years ago and still operating efficiently.

To the left is shown the first

## Brunswick Plant in Siam

This plant was furnished the Singora Ice Factory in 1911. It is still functioning successfully and its satisfactory service has influenced the ordering of many other machines. Long, continuous, economical service is the best proof of heavy and rugged construction.

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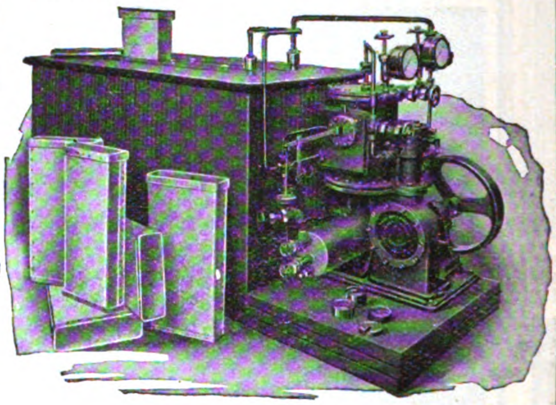


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IT IS POSSIBLE TO MAKE YOUR OWN POWER AT A COST WHICH CAN COMPETE

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TELEPHONE FOR AN APPOINTMENT TO CENTRAL 283.

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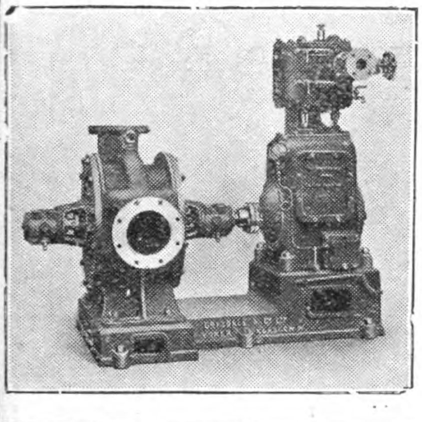

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JOHN M. HENDERSON & Co.
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**Palmetto** is entirely heat resisting and carries such quantities of lubricant as to be practically frictionless. Braided (round and square) for rods. Twist for small valves.

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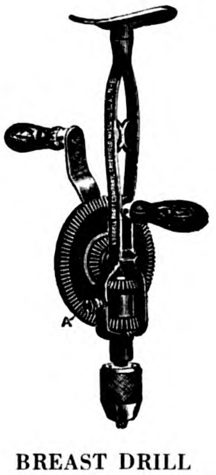

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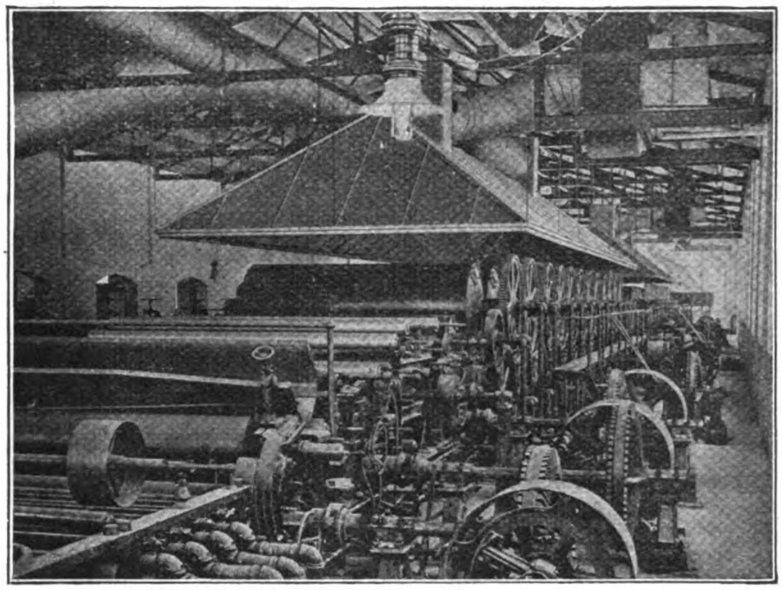

Paper Machine Room Ventilation, Belgo-Canadian Pulp Co., Shawinigan Falls, P. Q.

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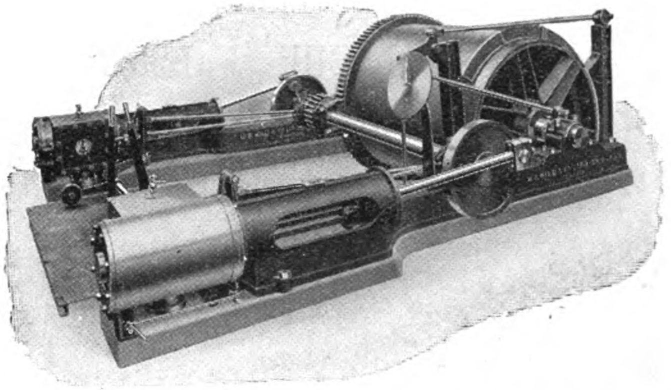

The careful design and proportioning, to meet the various conditions likely to arise, together with strength and sound workmanship, are features which place us in the highest rank for this class of Engine.

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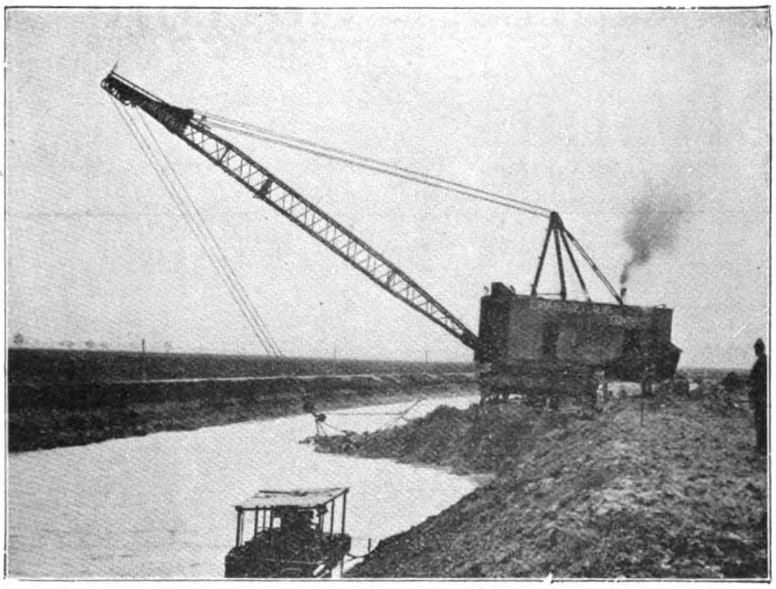

**Notice how this dragline excavator widens the existing canal and builds the bank slope.**

If you are interested in irrigation or drainage work, it will pay you to investigate Bucyrus dragline excavators.

40 years of experience in building excavating machinery are incorporated in our steam and electric shovels, dragline excavators, hydraulic and placer dredges.

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Supplied with steel frames that do not break, nut guards that keep the adjusting nut from being turned accidently in close quarters, and inserted jaws in end of handle that can be removed when worn, saving the handle.

There are other superior points that every user of Trimo Pipe Wrenches knows—all for economy to the user.

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As a 1 or 3 Wheel Cutter

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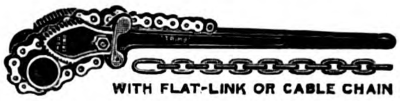

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SILK AND COTTON YARNS, NOILS, etc.

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## NSC. Formerly N. Schlumberger & Co.

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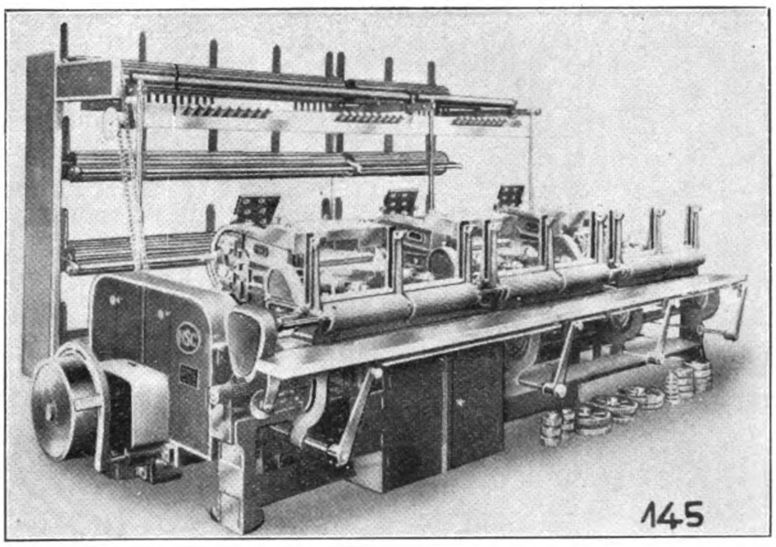
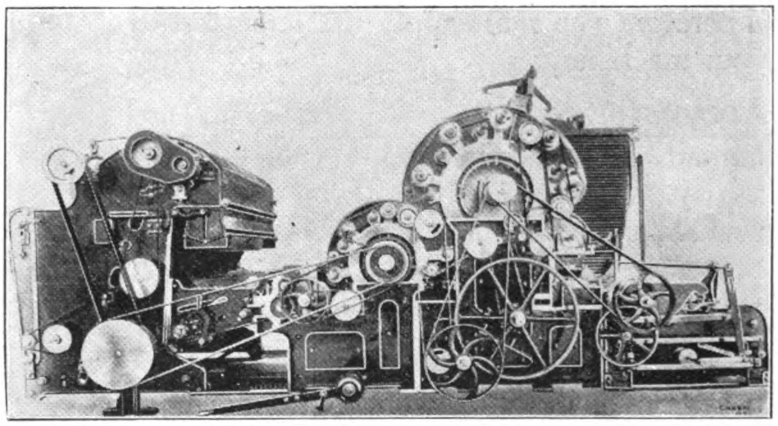



**Worsted Machinery**

Worsted Cards, Sliverlap Machines, Combing Machines, Back Washing and Drying Machines, Patented Gillbox-Intersecting Drawing Frames, Rubber Drawing Frames, Ring Frames, Self-Acting Mules, Twisting Machines, Accessories.

## Atelier HOUGET Verviers

### Belgium



**Wool Machinery**

Opening-Scouring-Washing-Drying-Wringing Machines for granny wool, Unfelting Machines, Breakers, Shake-Willeys, Oiling Breakers, Ravelling Machines, Ordinary-, Half- and Full-Automatic Card Sets for wool, cotton waste and silk noils, Ring Frames, Self-Acting Mules of ordinary and semi-fixed types, Twisting Frames, Woollen Looms and Preparatory Machines.

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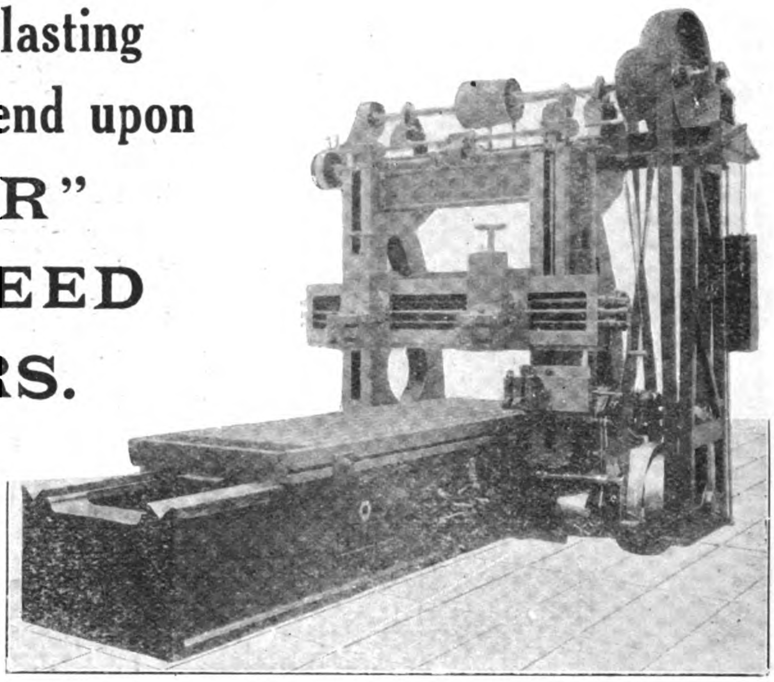

*View of 10-ft. by 4-ft. by 4-ft. Improved High Speed Planer.*

**Because they attain three objectives :—**

1. **Maximum Yearly Production.**—You test the success of your business annually? Therefore you must apply the same test to your machinery.
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THE NAME AVERY UPON ANY SCALE OR WEIGHING APPLIANCE IS ACCEPTED AS A GUARANTEE OF ITS EFFICIENCY AND UTILITY THE WORLD OVER.

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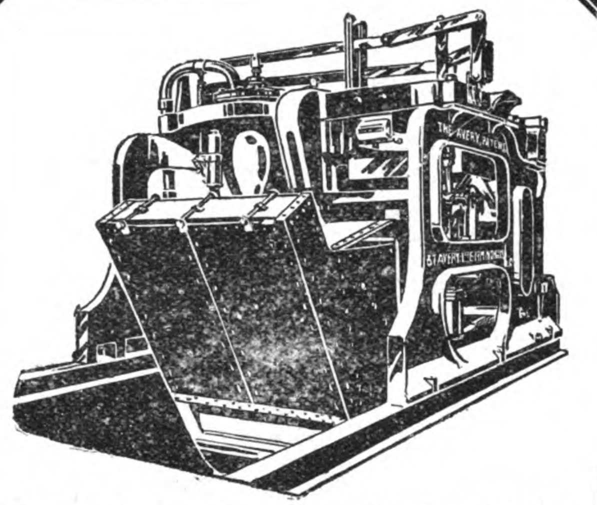

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For Water, Syrups, Juices, Oils, Fuel Oil, Chemical Liquids

AVERY

Agents for China,
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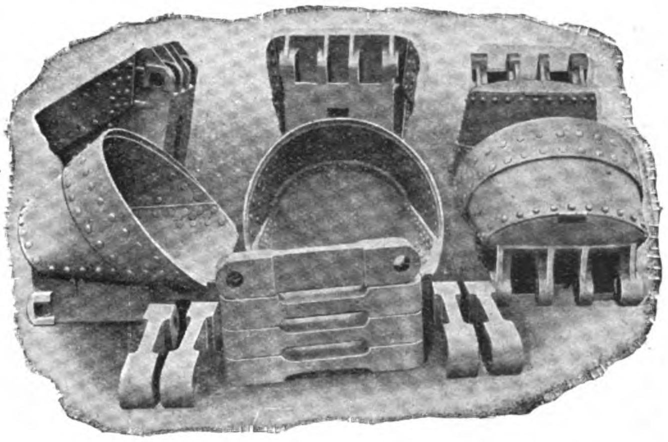
Shanghai.





## "Imperial" Manganese Steel

"Imperial" Manganese Steel, whether used for the lips of dredger buckets, the bucket chain links, pins or bushes, means fewer stoppages due to breakage or rapid wear. As an example, the following extract from a letter may be quoted: "Up to the time I left West Africa the three bucket dredgers (gold dredging)

**did not break a pin.**

One dredge has been at work nearly two years, and the other two six months. I think the wear of the pins constitutes a record." What would a record like that mean to you in money saved?

# The Makers of "Imperial" Manganese Steel

are

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# Edgar Allen & Co. Ltd
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AND GAS IS WHAT YOU ARE BUYING

**Export Drum with Wood over Cask**

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**"S" BRAND HIGH-GRADE CARBIDE OF CALCIUM**

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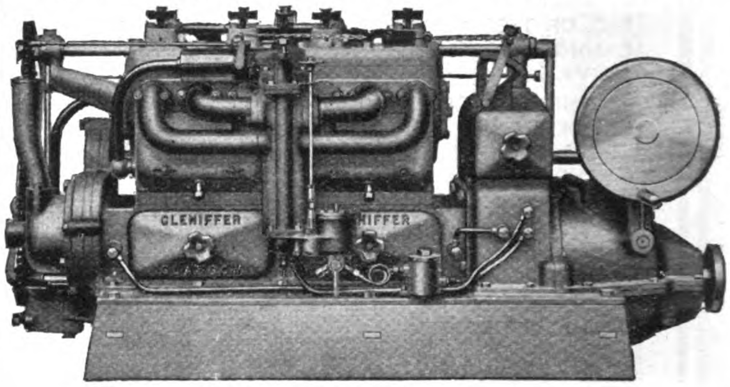
Western Union, Bentley's and A.B.C. 5th Edition Codes.

# GLENIFFER

**KEROSENE & PETROL MARINE MOTORS**




**FOR ALL TYPES OF BOATS**

**RANGE OF MODELS—10 TO 90 H.P.**

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*Siam*—Douglas and Grant, Ltd., Ban Mai, Bangkok.
*French Indo-China*—Douglas and Grant, Ltd., P. O. Box 127, Quai de Belgique, Saigon.
*Dutch East Indies & Timor*—British and Dutch Engineering Co., Ltd., at Soerabaia, and at Batavia.

**GLENIFFER MOTORS, LTD.**

**ANNIESLAND, GLASGOW, SCOTLAND.**

**TELEGRAMS: "GLENGINE, GLASGOW."**

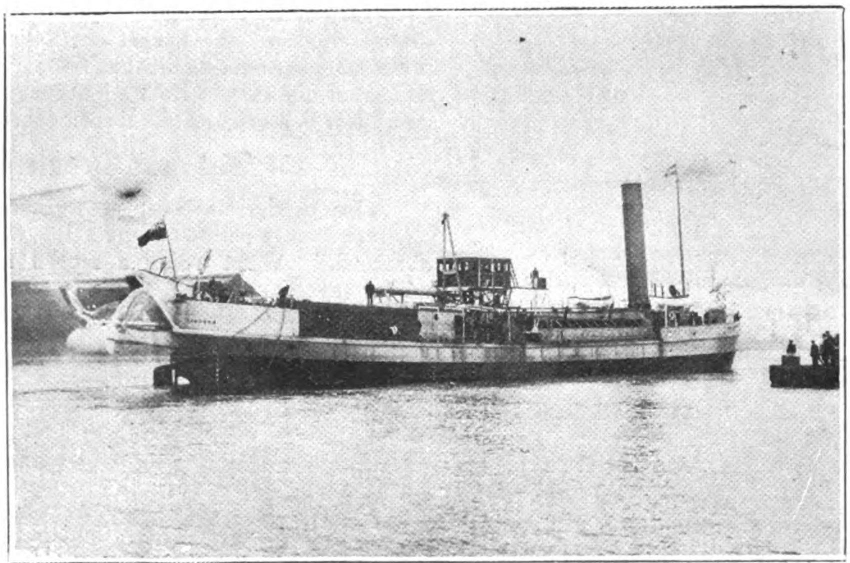
# Wm. Simons & Co., Ltd., Renfrew

CONSTRUCTORS OF

## Marine Dredging Plant

of most Modern and Improved Types and of the Greatest Capacities.

**Constructors of Barge Loading, "Simons" Reclamation, Canal and Suction Cutter Hopper Dredgers. Hopper and Barge Loading Bucket Dredgers. Alluvial Dredgers. Trailing Suction Dredgers.**



Drag Suction Hopper Dreger *Cormorant* Constructed for the Rangoon Port Commissioner

**Propelling and Dumb Hopper Barges.**

**Replace Parts supplied or fitted to existing Dredgers.**

**Inventors and First Constructors of "Hopper" and "Sternwell" Dredgers and Elevating Deck Ferry Steamers.**

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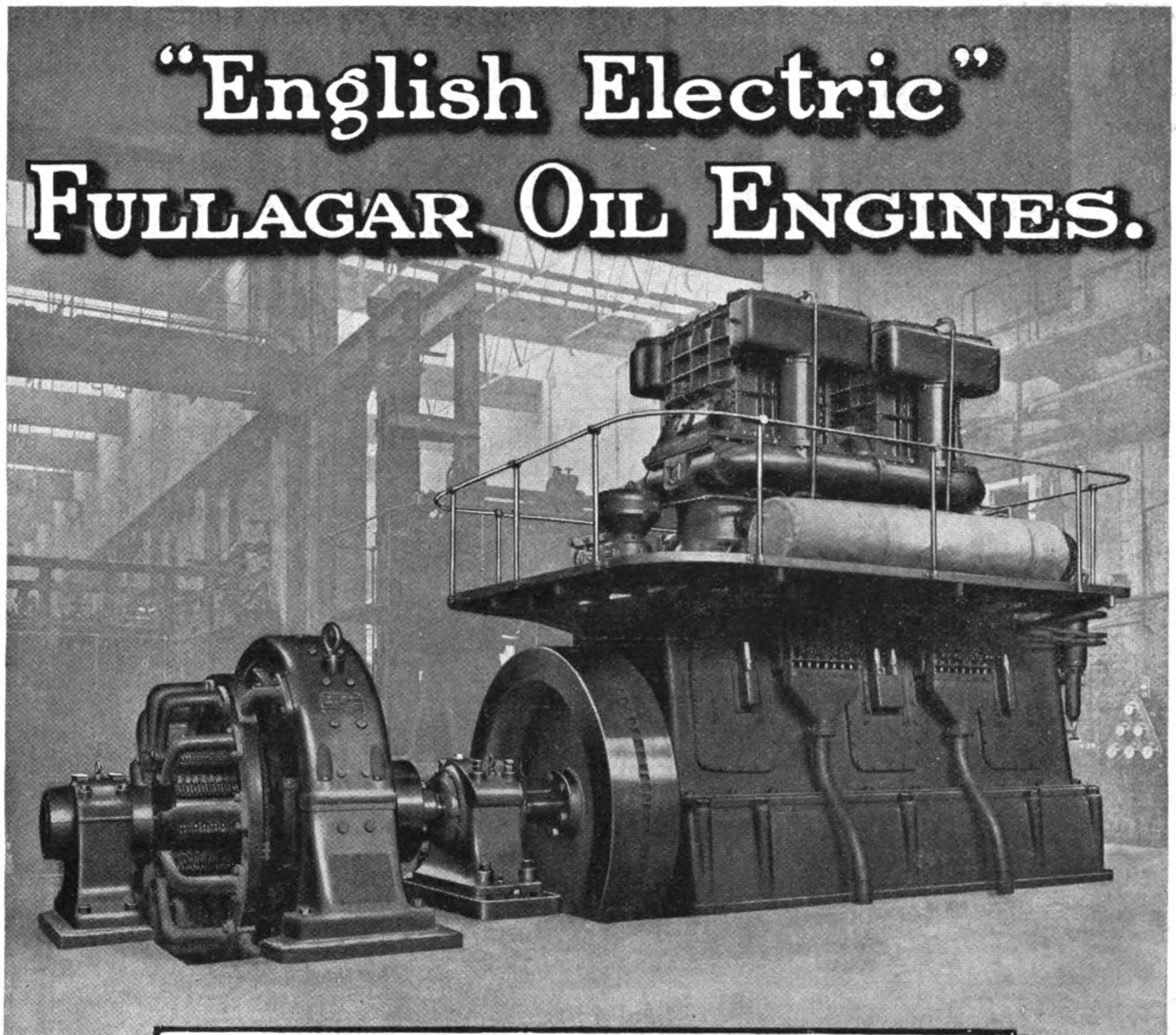


The Fullagar Engine is in effect a two-stroke double-acting engine without cylinder covers, and, as a result, it is smaller and lighter for a given power than any two or four-stroke Diesel Engine with fuel economy equal to the latter.

**SPECIAL FEATURES.**

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*Write for copy of publication No. 414.*

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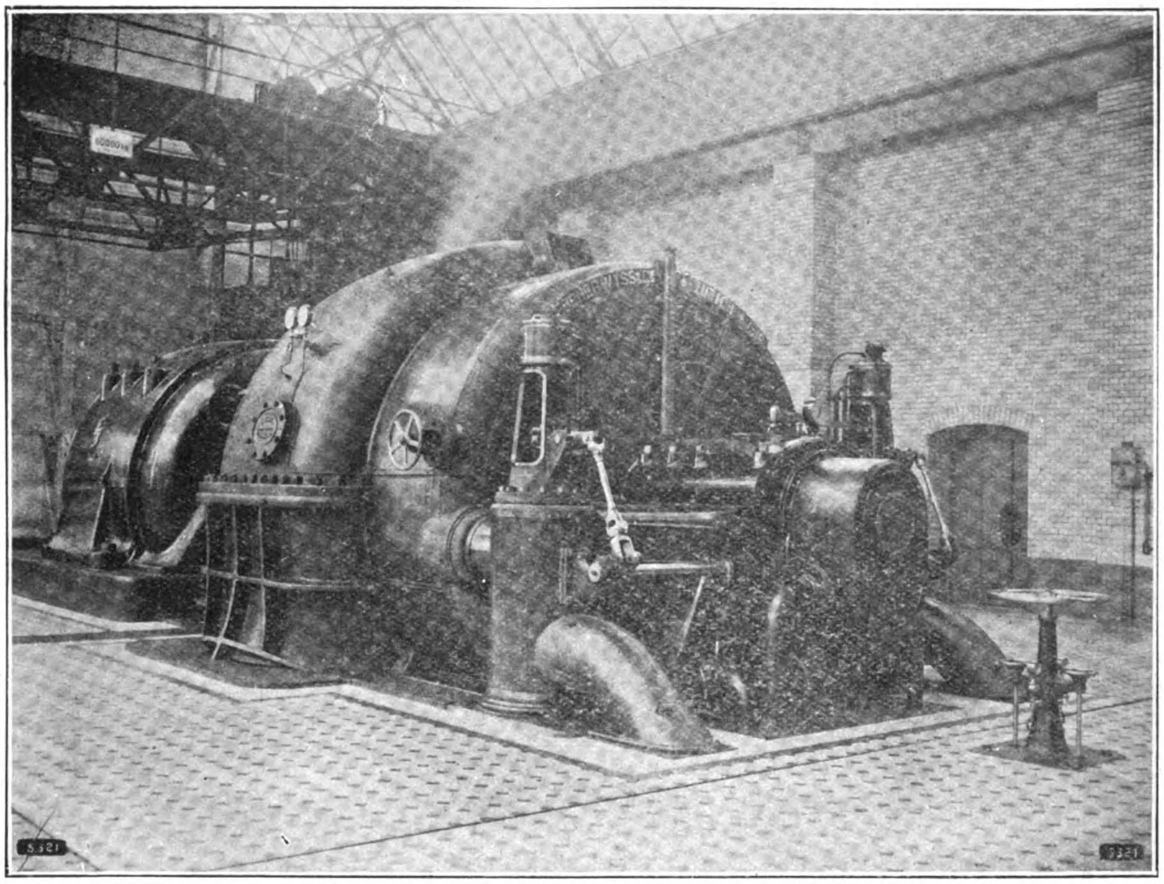
## ZURICH, SWITZERLAND



30,000 K.W. Escher Wyss "Zoelly" Steam Turbogenerator

STEAM AND WATER TURBINES, STEAM BOILERS SYSTEM "GARBE" TURBO PUMPS AND COMPRESSORS, ICE AND PAPER MACHINERY

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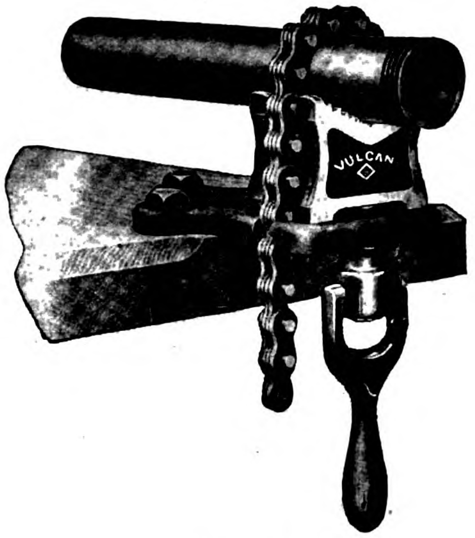


3 SIZES
For 1/8 to 8 inch Pipe

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There is as much difference in tools as in men.

Good work requires both good workmen and good tools. It may be difficult to select good men but the outstanding difference in certain tools makes it easy to choose the good.

Williams' "Vulcan" Drop-Forged Chain Pipe Vise is so noticeably different from the cast tool of conventional yoke design, that its superiority is evident almost at a glance—sturdy, unbreakable construction with positive, rigid grip, yet ready release, and practically instantaneous adjustment.

Why choose an inferior vise when the difference in efficiency and service offered by Williams' "Vulcan" is so great?

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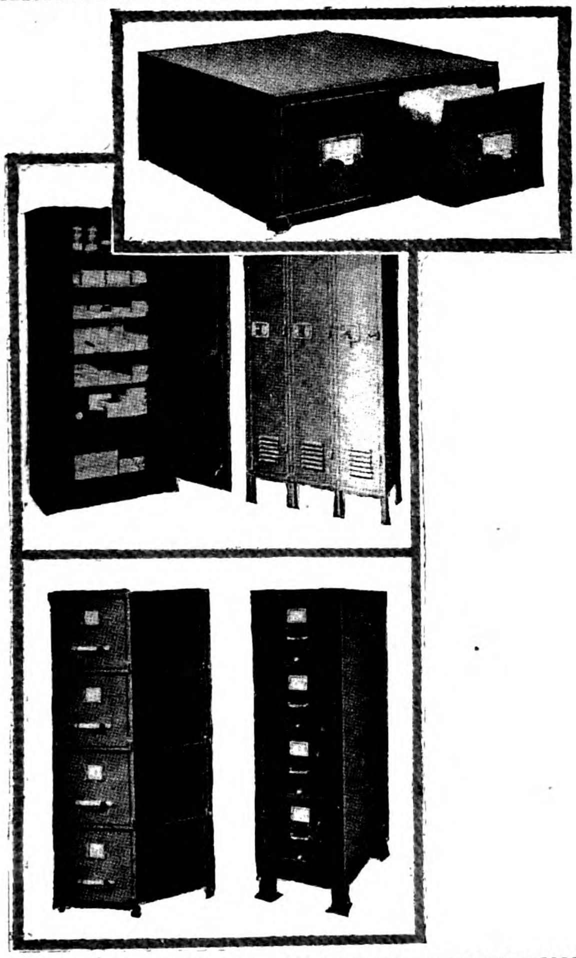

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Whether it be to build permanently or to install permanent fixtures and utility accessories, Berloy Sheet Metal Products possess numerous exclusive advantages which make them practically indispensable for such purposes.

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ANNUAL PRODUCTION:

| | | |
|---|---|---|
| Electrolytic Copper Ingots | 20,000 | Tons |
| Pig Iron | 100,000 | ,, |
| Steel | 50,000 | ,, |
| Coal | 3,500,000 | ,, |

COLLIERIES:

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STEAMSHIP DEPARTMENT—KOBE

| | | |
|---|---|---|
| Fleet Owned | 25,000 | Tons Gross |
| Chartered Steamers | 12,000 | ,, ,, |

Regular and Irregular Routes between home ports and Chinese and South Sea Islands Ports, etc.

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**The Finest Steaming and Bunker Coals of the Far East are mined from the famed Miike, Tagawa, Yamano Sunakawa and Kawakami Collieries operated by the**

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Annual Coal Output is equal to one-quarter of Total Japanese Mines.

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Are produced from the Company's, KAMIOKA, Lead, Silver and Zinc Mine; SANO, Copper and Zinc Mine; KUSHIKINO, Gold Mine; KONGO, Tungsten Mine; IWAONOBORI, Sulphur and Metal Mine; Zinc Plants, Coke, Dyestuffs and By-products Establishments in Miike.

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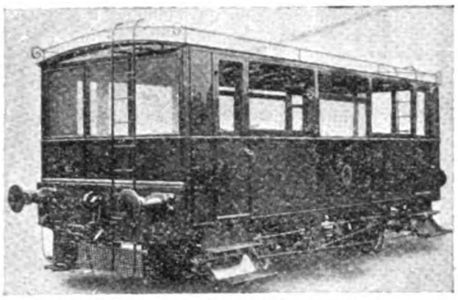

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ALL THE WORLD OVER
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Designing Engineers and Manufacturers

## THE SUPERHEATER COMPANY

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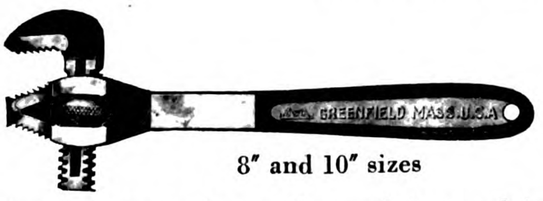
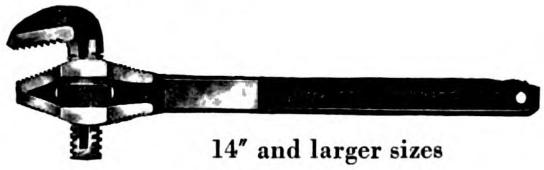
# *Little Giant*—The New Pipe Wrench

"THE WRENCH WITH THE ORANGE HANDLE"




8" and 10" sizes



14" and larger sizes

A new design which gives increased strength, increased simplicity, increased usefulness, *less* weight, and fewer parts.
The "*Little Giant*" Pipe Wrench has become popular at once because of the end opening jaws. It can be thrust straight on a pipe like a pair of pliers, and will be found useful in places which are beyond the reach of an ordinary pipe wrench.

The arrangement of the jaw, which can be engaged at will with 2 or 4 sets of teeth on the handle can be seen in the picture. These extra sets of teeth mean long life. The "*Little Giant*" Wrench is drop-forged and heat-treated throughout.
Merchants will be particularly interested in the light weight (less than an ordinary pipe wrench) and the few parts. The "*Little Giant*" has only 3 parts, which means a smaller investment in replacements. Any of our representatives will be glad to quote prices.

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASS., U.S.A.

***Canadian Plant**: Greenfield Tap & Die Corporation of Canada, Limited, Galt, Ontario.*

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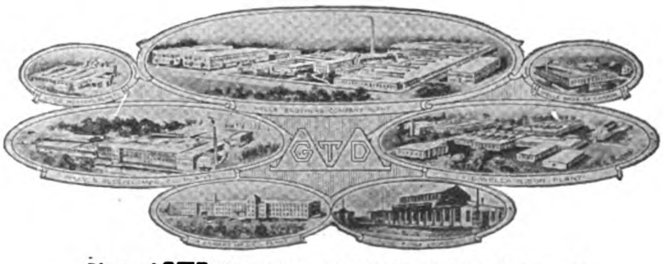

*Plants of GTD Corporation, World's Largest Manufacturers of Screw-threading Tools*

# The Green Island Cement Co., Ltd.

SHEWAN, TOMES & CO.,

GENERAL MANAGERS, HONGKONG

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Insist on your Architect specifying the use of the best brand of Portland cement in construction. If the house or factory is to be blocks or tiles, they should be of concrete, if stucco, only the best cement should be employed; if reinforced concrete is used, only a standard cement will stand the test; if your building is to be fireproof, waterproof, safe against earthquake or typhoon, improving with age, and lowering the cost of insurance, you must employ concrete, and the best concrete construction is only secured through the use of

## Green Island Cement

Green Island Cement is supplied in Bags = 250-lbs. net, Casks = 375-lbs. net, Iron Drums = 375-lbs. net.

Also, Glazed Stoneware, House Drains, Sewer Pipes and Fittings, Paving Bricks, Tiles, Fire Bricks and Fire Clay.

The Green Island Brand has become the standard Portland Cement of Asia, owing to its purity, uniformity and tests.

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Rope supplied to the British Navy on the China Station and to all Mail and regular Steamship Lines.

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It possesses great compressive, shearing, tensile, and dielectric strength. Though tough, hard and dense, it is of light weight and can be machined and worked easily. These superior properties attract manufacturers who desire to improve their product and cut production costs.

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Boiler Tubes for Land and Marine Work.
Lighting and Transmission Poles.
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Drive, Casing, Oil Line and Upset Rotary Drill Piping.
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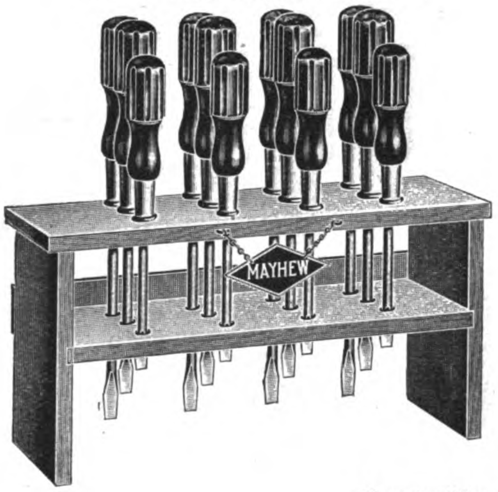
The Borneo Co., Ltd.

*No Agency Representation in China, Japan, & Dutch East Indies*

MAYHEW

# TOOLS THAT ENDURE

*On the market for 63 years*




MAYHEW NO. 509—12
SCREW DRIVER
ASSORTMENT

A VERY good selling assortment, consisting of twelve Mayhew Screwdrivers mounted on an attractive wooden Display Stand. These screwdrivers have forged spring steel blades with black finished hardwood handles and are furnished in the assortment in the following blade lengths:—

Four 4 Inch    Four 5 Inch    Four 6 Inch

List Price for Assortment with Display Stand (packed in a Heavy Fibre Carton—Easy for You To Ship) $4.00.

No. 509: List Prices per Dozen for the same Screw Drivers Separately.

| | | | | | |
|---|---|---|---|---|---|
| 2 Inch | $3.00 | 5 Inch | $3.70 | 8 Inch | $5.00 |
| 3 ,, | 3.15 | 6 ,, | 3.90 | 10 ,, | 5.80 |
| 4 ,, | 3.30 | 7 ,, | 4.25 | 12 ,, | 6.75 |

*List Prices Are Subject To Liberal Trade Discounts*

## MAYHEW HIGH SPEED *TUNGSTEN* HACK SAWS

MAYHEW saws are manufactured of the finest material by the most improved process, and by men who are experts in this field. Improved methods of hardening, and tempering, by which each blade receives individual treatment under exactly the same conditions, assures absolute uniformity. Flexible blades made under this method are unequalled for hand use.

We Suggest The Selection of Hand Blades As Follows:

| | |
|---|---|
| For Soft Steel, Solids and Rails.. .. | 14 Teeth per Inch |
| * For Hard Steel, Medium Pipe and General Use .. .. .. | 18 ,, ,, |
| For Drill Rod, Brass, Light Pipe, etc. .. | 24 ,, ,, |
| For Thin Tubing, Thin Sheet Metal, Small Conduit, etc. .. .. | 32 ,, ,, |

* Furnished on orders where Teeth Not Specified

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**MAYHEW HACK SAWS FOR HAND FRAMES**

*Specify Hard or Flexible*

| Length | Width | Thickness | Teeth per Inch | List Price Gross |
|---|---|---|---|---|
| 8 | ½ | .025 or 23 ga | 16,18,24,32 | $8.00 |
| 9 | ½ | .025 or 23 ga | 16,18,24,32 | 9.00 |
| 10 | ½ | .025 or 23 ga | 14,18,24,32 | 10.00 |
| 11 | ½ | .025 or 23 ga | 14,16,18,24,32 | 11.00 |
| 12 | ½ | .025 or 23 ga | 14,18,24,32 | 12.00 |

**Also Manufacturers of Awls, Bit Extensions, Bits, Chisels, Counter Sinks, Drills, Gimlets, Hack Saws, Ice Picks, Pliers, Punches, Reamers, Screw Drivers, etc.**

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*Eley cartridges are entirely British made*
*Perfect manufacture and loading guaranteed*

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New Glasgow, Canada
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Peking, China
Port Elizabeth, South Africa
Portland, Oregon
Rio de Janeiro, Brazil
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San Juan, Porto Rico
Santiago, Chile
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Seattle, Washington
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We give prompt attention to inquiries for all class of our Steel Products, including the following :—

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ALLOY STEEL SHEETS
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ANGLES
ARMATURE SHEETS
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BLOOMS
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SHAPES—Standard Structural
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SKELP
SLABS
SPIKES—Railway Track Spikes
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TANK PLATES
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TIN PLATE—" Coke," " Charcoal " and " Terne "
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WEATHERPROOF INSULATED WIRES AND CABLES
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**The Combined Actual Annual Ingot Production of our Manufacturing Companies for the year 1920 was in excess of 19,000,000 tons.**

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No. 2 Canton Road, Shanghai

*President:*
**Baron K. Okura**

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Factory Equipments, and all kinds of Machines
Automobiles, Guns and Explosives
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Mineral Products, Chinese and Japanese Produce, Silk
Cotton, Wool, and their Manufactures
Fertilizers, Chemicals, Vegetable Oils and Wax, Dye Stuffs
Food Stuffs, Hides and Fur, Skins, Pen-hsi-fu Smokeless Coal and Pig Iron, etc.

BUILDING AND CIVIL ENGINEERING CONTRACTORS,
INSURANCE AGENTS

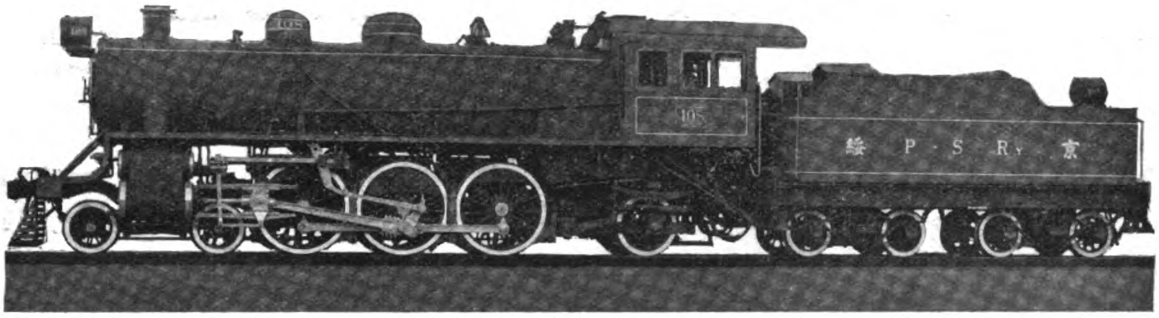
## Yih Chong Wharf (Okura)

POOTUNG, SHANGHAI

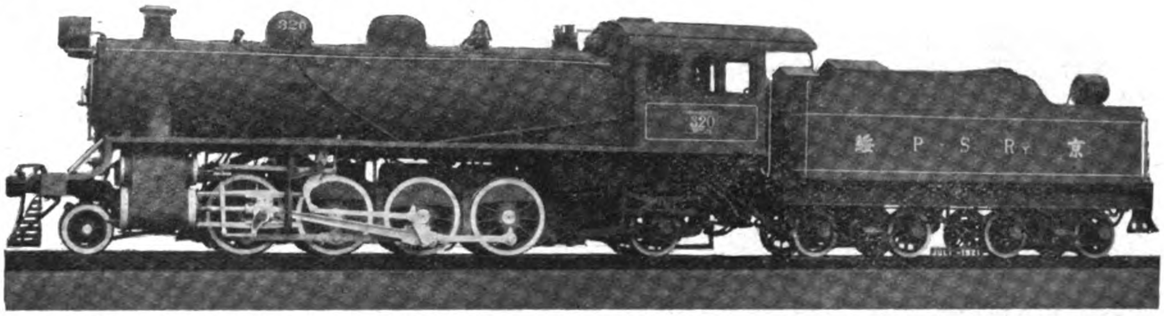
# "AMERICAN" LOCOMOTIVES

## ON THE

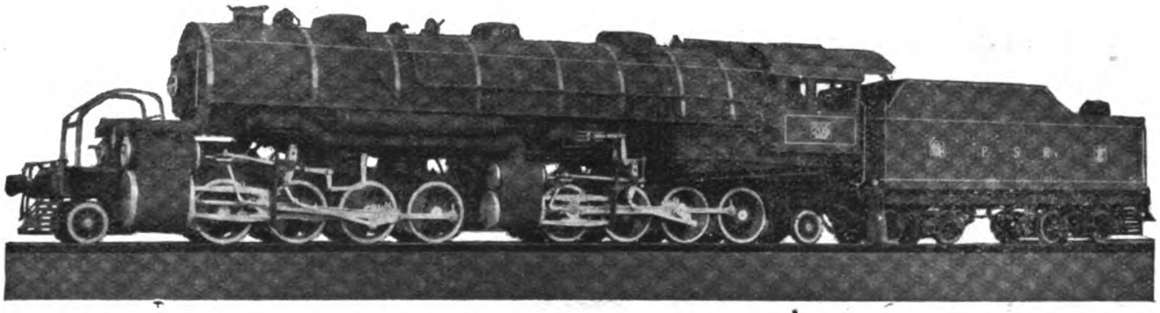
## PEKING-SUIYUAN RAILWAY



Total Weight of Engine, 184,500 pounds; Weight on Driving Wheels, 109,500 pounds; Diameter of Driving Wheels, 62 inches; Boiler Pressure, 180 pounds; Cylinders, 20 by 26 inches; Maximum Tractive Power, 25,650 pounds.



Total Weight of Engine, 188,500 pounds; Weight on Driving Wheels, 137,000 pounds; Diameter of Driving Wheels, 50 inches; Boiler Pressure, 180 pounds; Cylinders, 20 by 28 inches; Maximum Tractive Power, 34,300 pounds.



Total Weight of Engine, 446,000 pounds; Weight on Driving Wheels, 388,500 pounds; Diameter of Driving Wheels, 50 inches; Boiler Pressure, 220 pounds; Cylinders, 24 & 38 by 28 inches; Maximum Tractive Power, Compound, 92,500 pounds; Maximum Tractive Power, Simple, 110,000 pounds.

Safety, excellent quality of materials, correct design, good appearance, and perfect workmanship are the features back of "American" locomotives.

These features, coupled with the fact that we have built over 65,000 locomotives should have the earnest consideration of those contemplating the purchase of locomotives.

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Mitsui: Tokio, Japan

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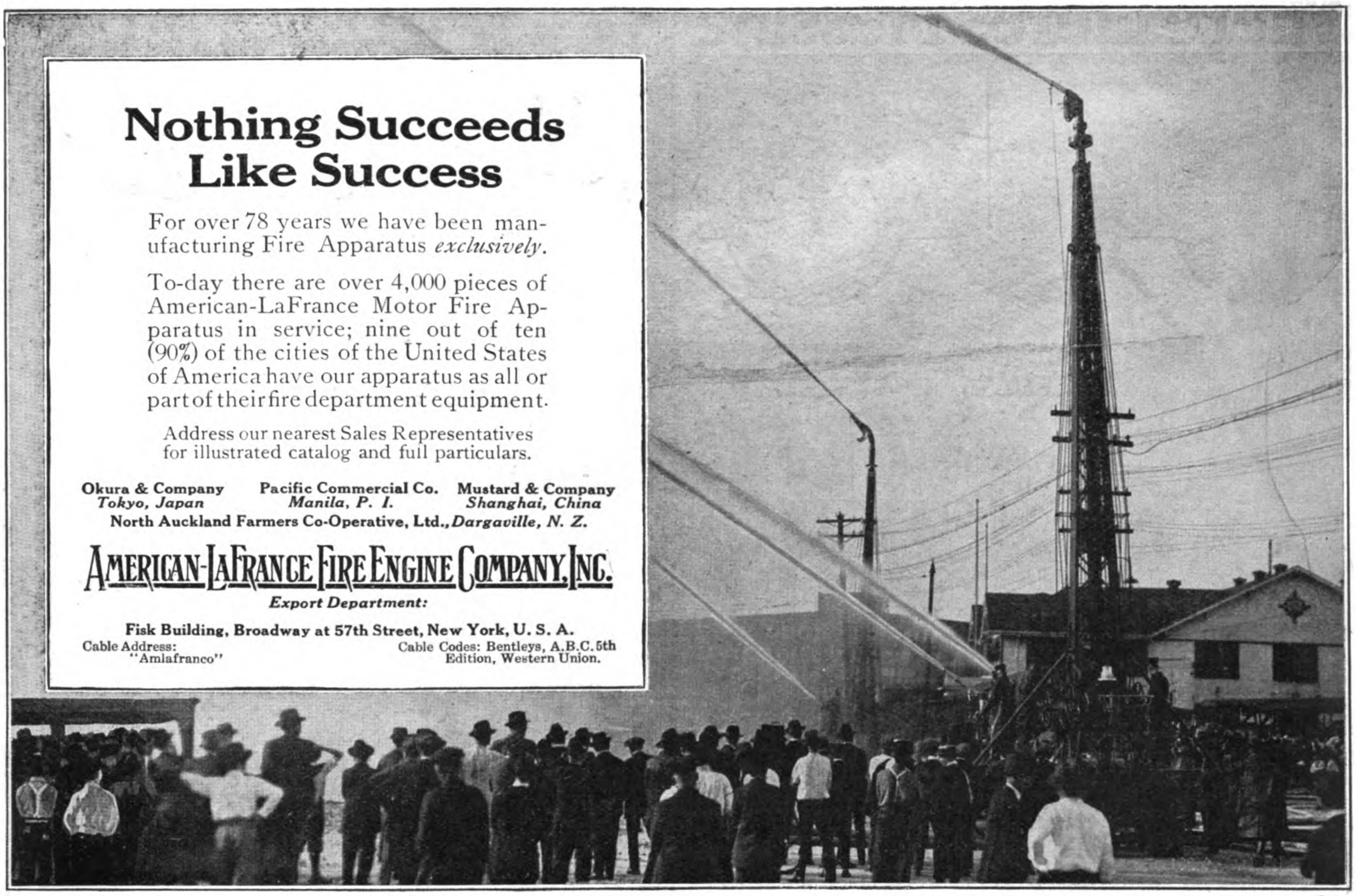

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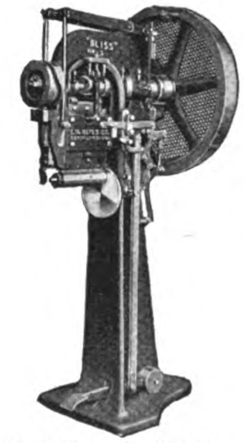
**MACHINERY for Manufacturing Tin Cans—Tin Ware—Metal Packages Cutlery—Hardware—Aluminum Ware and Enamel Ware—Electrical Equipment. Also Horseshoe—Minting and Drop Forging Machinery**

1857 BLISS 1923



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CHINA: Allied Machinery Co. of America, Shanghai, Tientsin, Dairen, Manchuria

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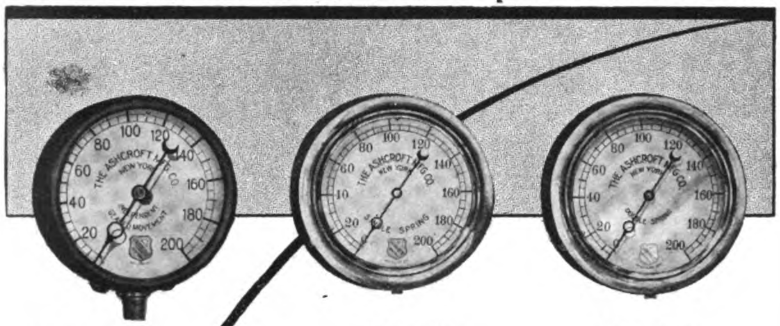
F. No. 242

# Where there's Pressure



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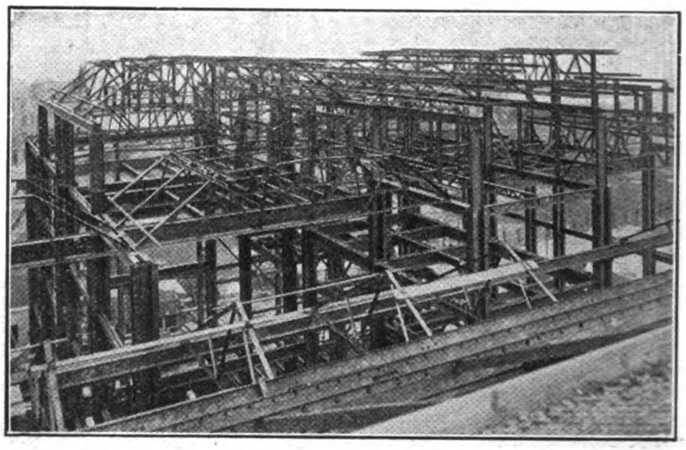

View of Large Corporation Power Station in Course of Construction by Redpath, Brown & Co., Ltd.

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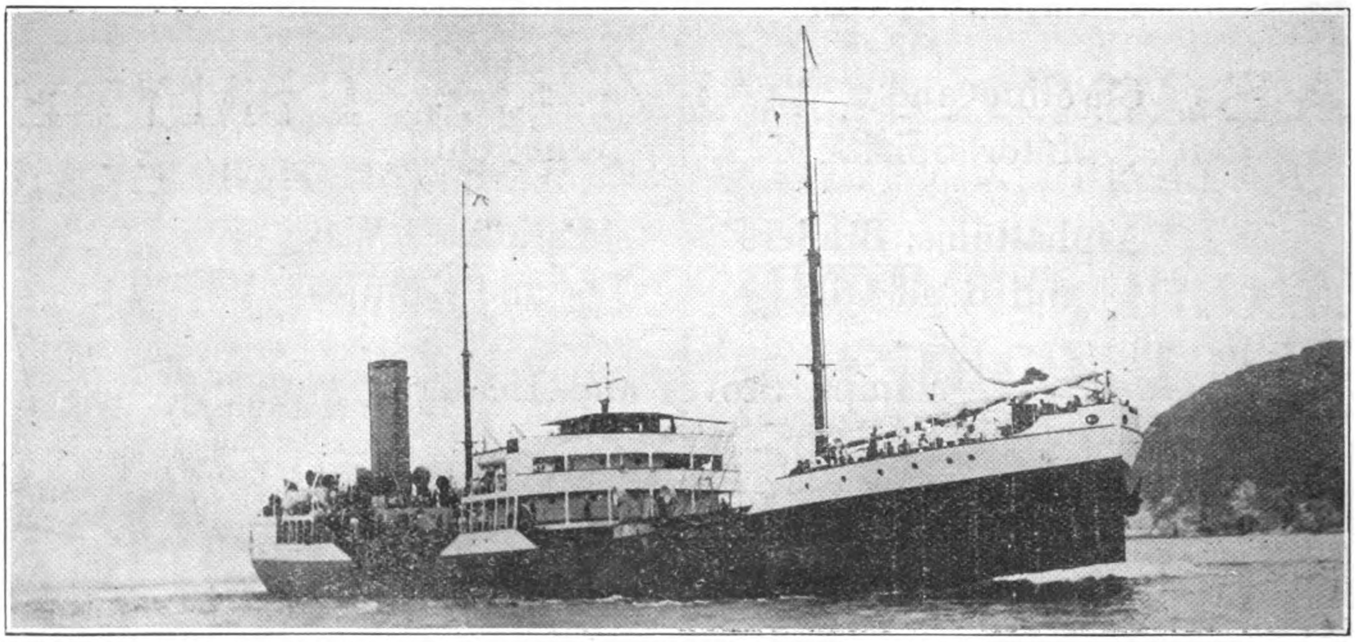

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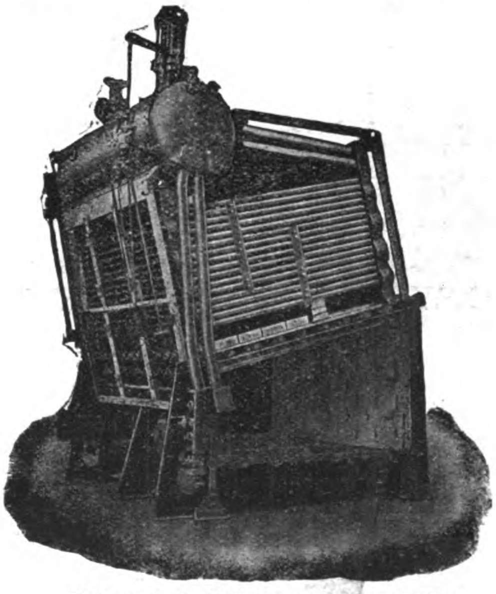

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**Established 1862** **(LATE S. C. FARNHAM, BOYD & CO., LTD.)**

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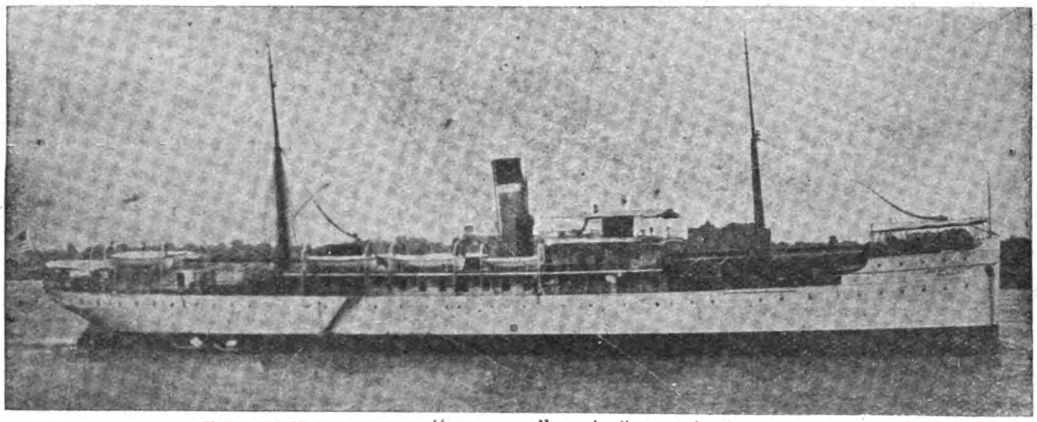

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|---|---|---|---|
| | | Breadth of Entrance | Depth of water on Sill |
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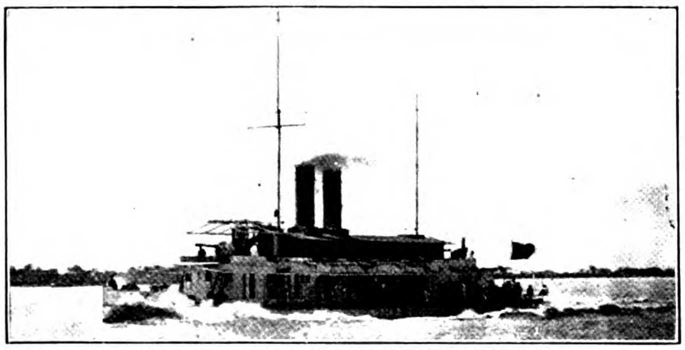
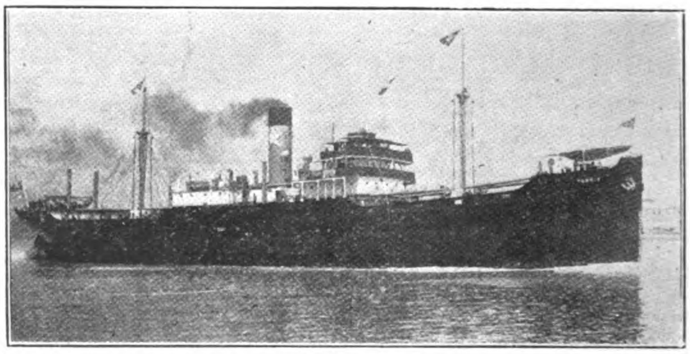
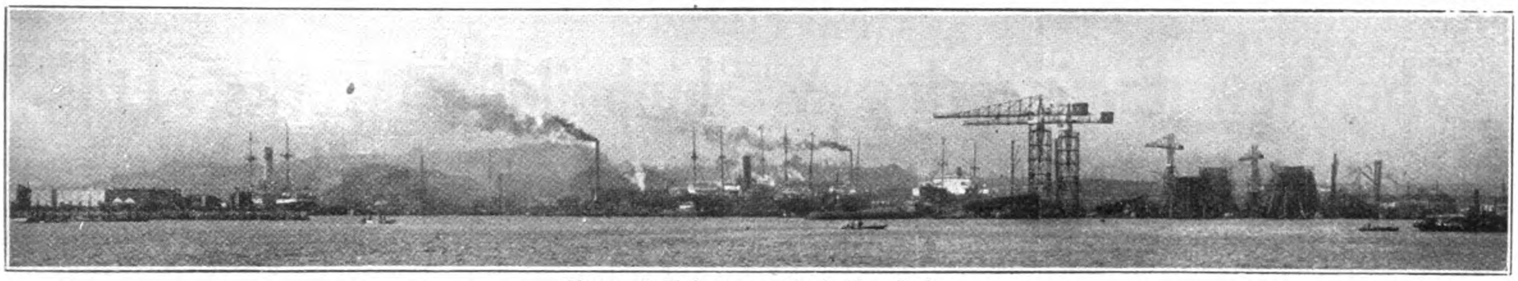
| International Dock ... | 528 ,, | 77 ,, | 23 ,, |
| Old Dock ... ... | 399 ,, | 53 ,, | 16 ,, |
| Tunkadoo Dock ... | 350 ,, | 67 ,, | 16 ,, |



H.I.M.S. "ERMANNO CARLOTTO"
Designed and Constructed for the Royal Italian Navy
Length 160 feet. Twin Screw Engines.
Draft 2 feet 10 inches with full equipment and 30 tons of coal on board. Mean continuous speed 14 knots per hour.



s.s. "YANNIS" ex "WAR TIARA"
Sister Ship s.s. "PANAGIS" ex "WAR DIADEM"
Sister Ship s.s. "MELLON" ex "WAR REGALIA"
Built for the British Government.



View of Yokohama Dock Co., Ltd.

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**Dock Owners, Shipbuilders, Repairers, Engineers, Machinists, Boiler Makers and Warehousemen.**
**Operating Dockyard, Shipbuildingyard and Storage Warehouses at Yokohama, Japan.**

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*Builders for*
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and other Principal Shipowners

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Code Used:
A. 1. A.B.C. 4th and 5th, Bentley's

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| No. 2 ... ... | 380′ × 50′ × 26′ |
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Devoted to the Advancement of the Automotive Industry in the Countries of Eastern Asia.

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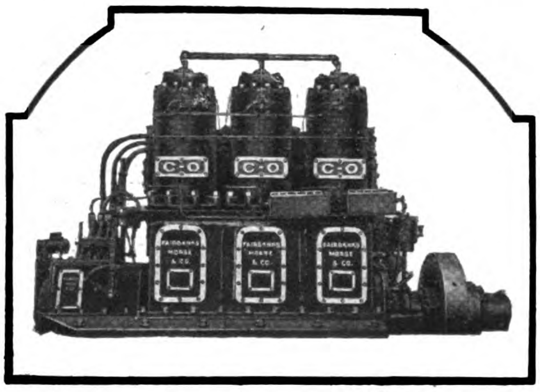

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*"C-O" MARINE OIL ENGINES*

Fairbanks-Morse "C-O" Marine Oil Engines in a range of sizes from 30 H.P. to 300 H.P. provide reliable, economical power for coastal vessels, fishing boats, tug-boats and ocean-going auxiliary ships.

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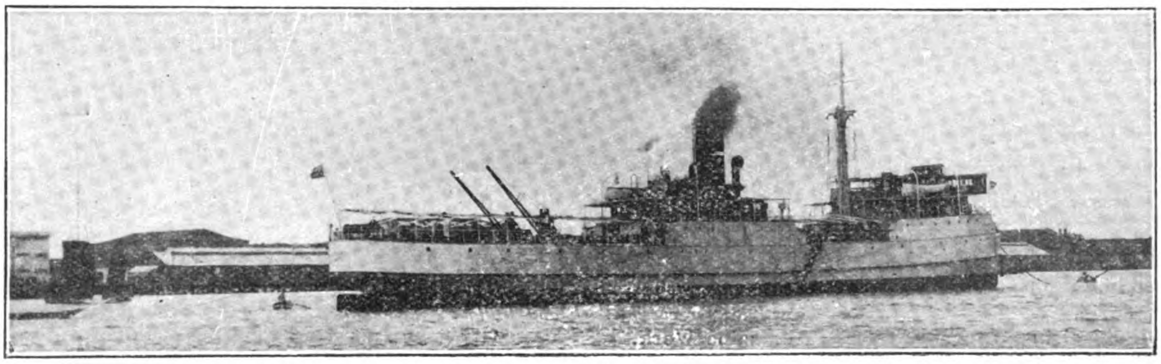

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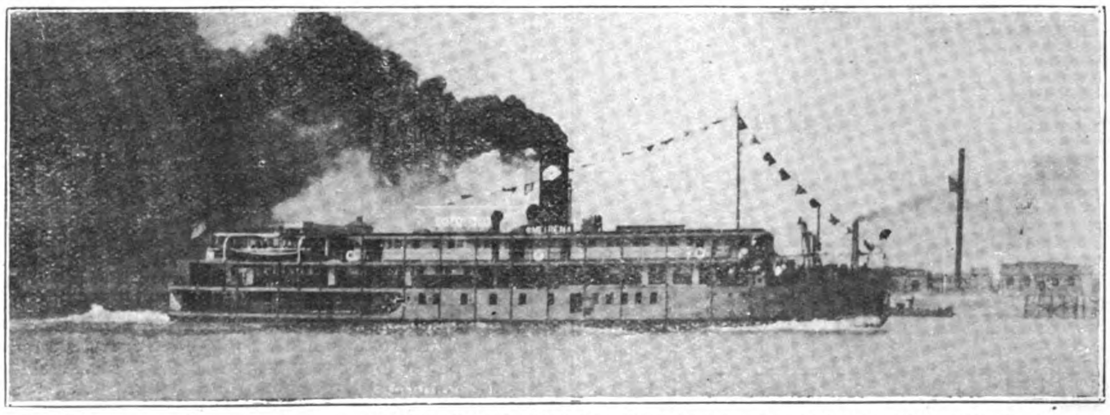

200-feet Upper Yangtsze Steamer Built and Engined at the New Engineering & Shipbuilding Works, Ltd.

Repairs and Overhauls Effected Promptly, Efficiently and Expeditiously
Under Foreign Supervision at Moderate Charges.

SPECIAL STAFF FOR ATTENDING TO REPAIRS AT MILLS AND FILATURES.

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Bentley's
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Western Union Codes Used

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ESTABLISHED 1870

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FIRST-CLASS HIGH-SPEED OCEAN STEAMERS OF THE LARGEST SIZE AND POWER

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PRINCE'S BUILDING

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*Manufacturers of Tiles of all descriptions.*

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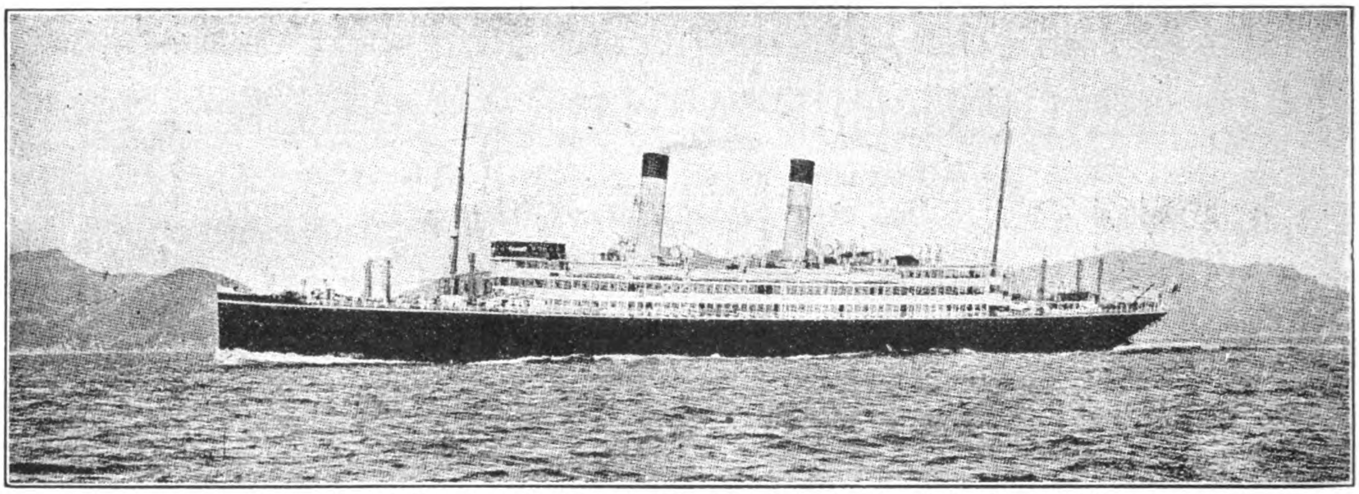

The *Tenyo Maru*, built and engined by the Mitsubishi Zosen Kaisha, Ltd., Nagasaki Works

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|---|---|---|---|---|---|---|---|---|
| Extreme Length | 523 | Ft. | Extreme Length | 371 | Ft. | Extreme Length | 728.9 | Ft. |
| Length on Blocks | 513 | ,, | Length on Blocks | 350 | ,, | Length on Blocks | 714 | ,, |
| Width of Entrance on Top | 89 | ,, | Width of Entrance on Top | 66 | ,, | Width of Entrance on Top | 99½ | ,, |
| ,, ,, ,, ,, Bottom | 77 | ,, | ,, ,, ,, ,, Bottom | 53 | ,, | ,, ,, ,, ,, Bottom | 88½ | ,, |
| Water on Blocks at Spring Tide | 26½ | ,, | Water on Blocks at Spring Tide | 24 | ,, | Water on Blocks at Spring Tide | 34½ | ,, |

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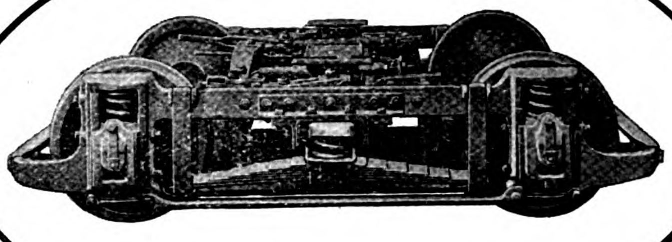

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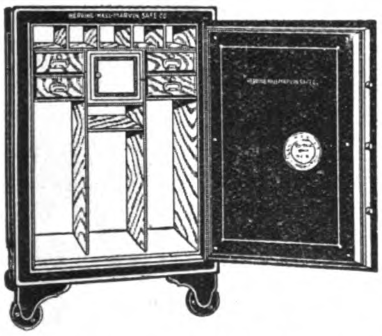

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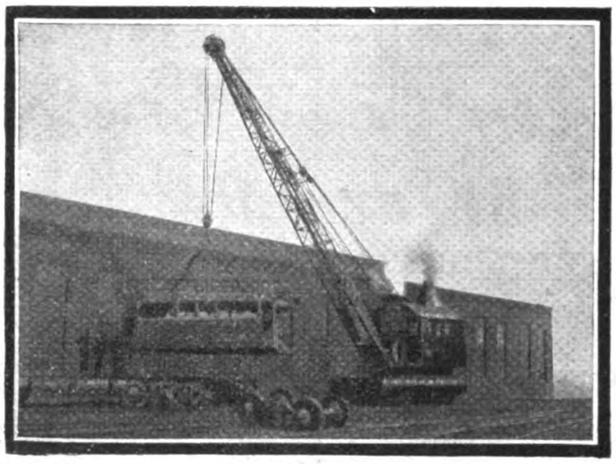

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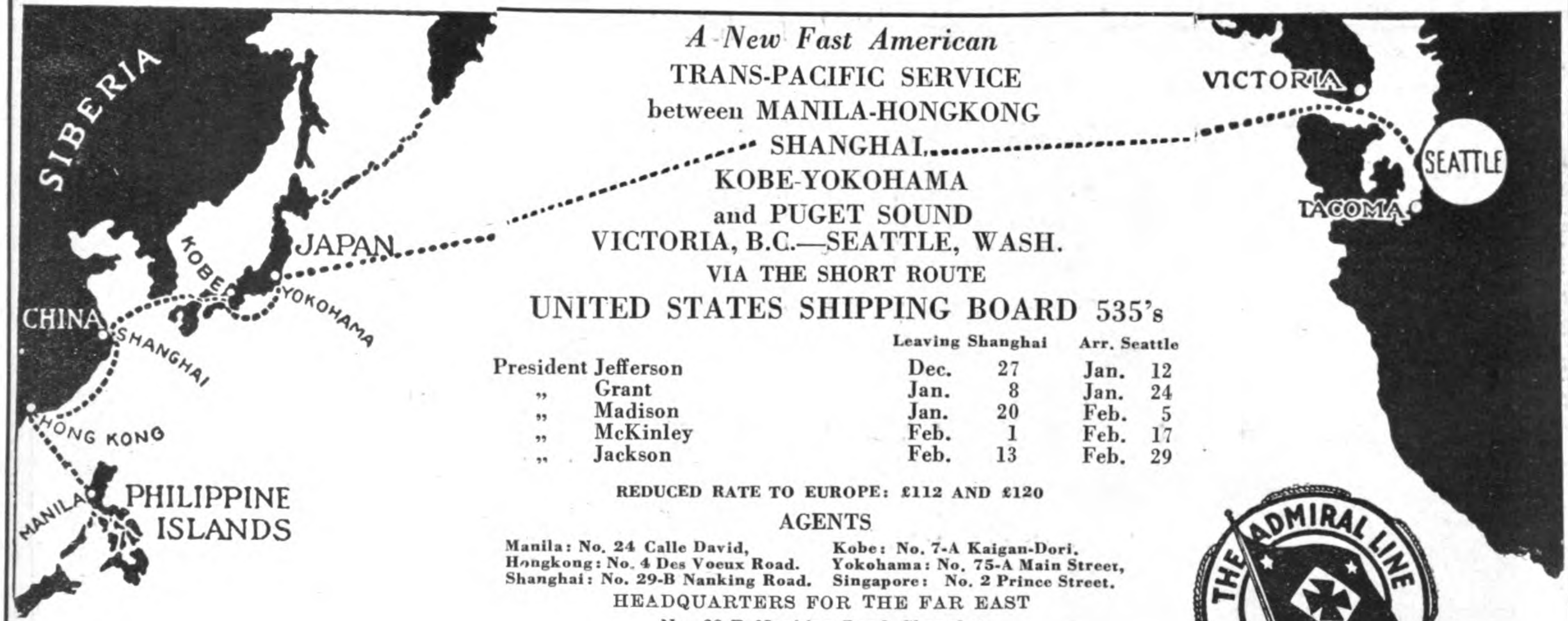


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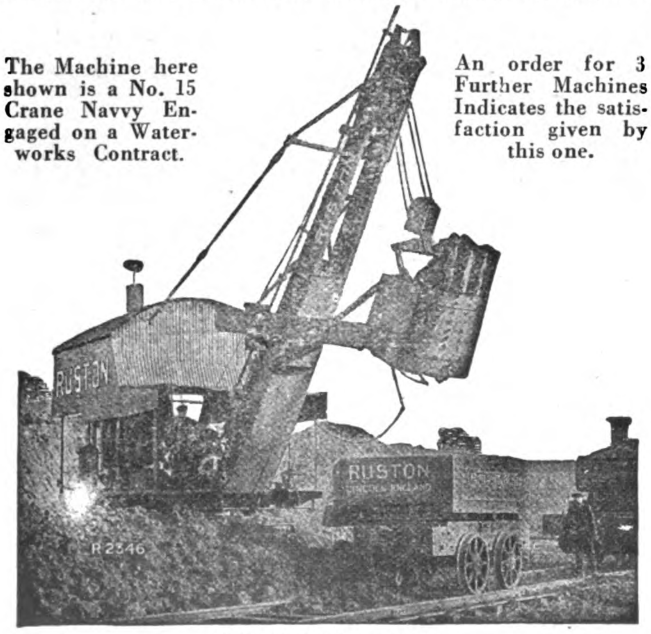


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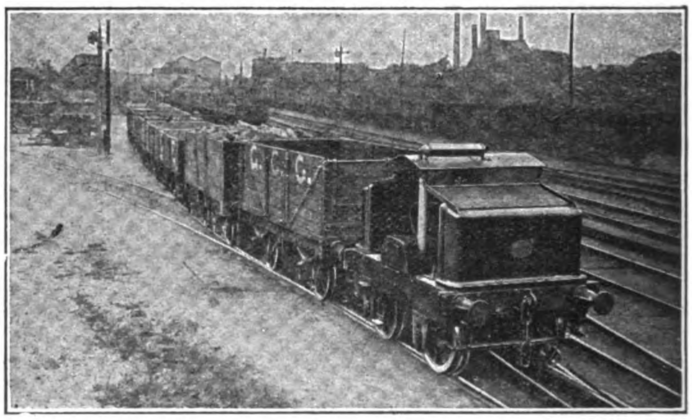

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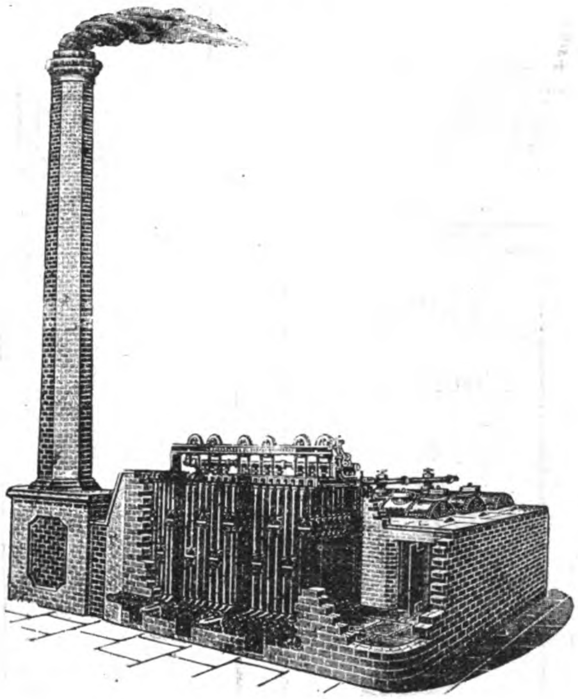

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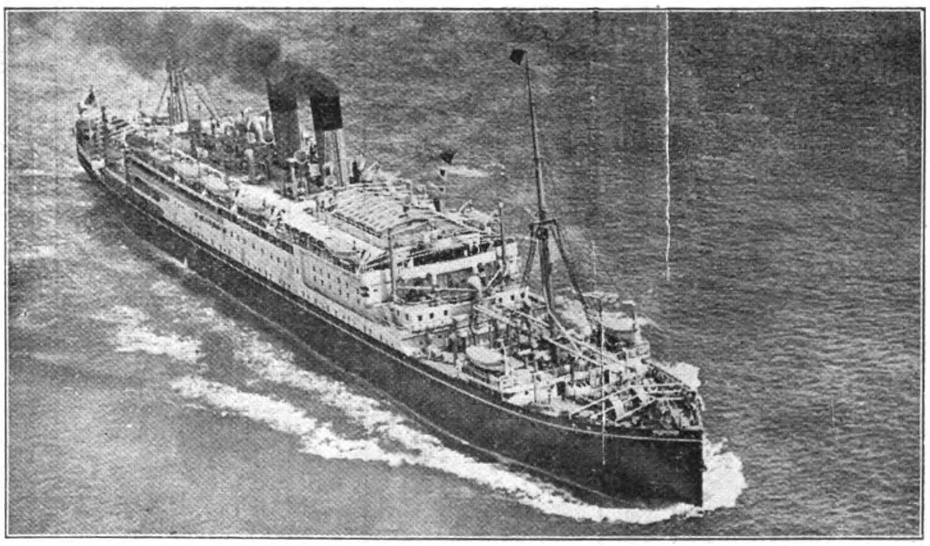

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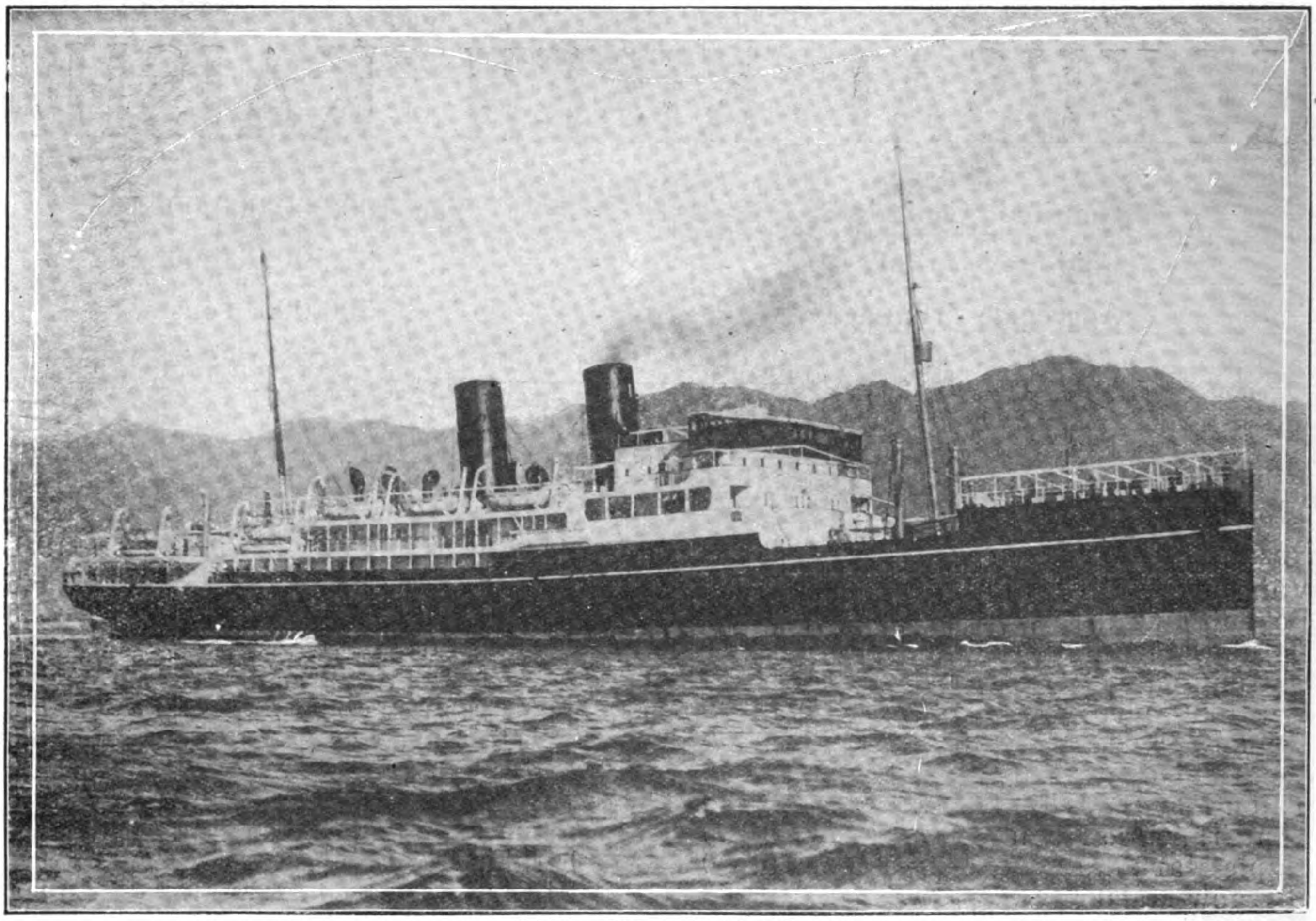

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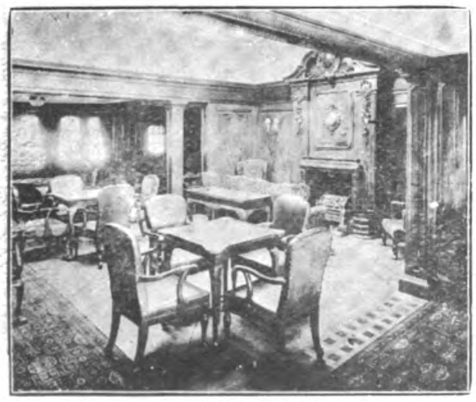

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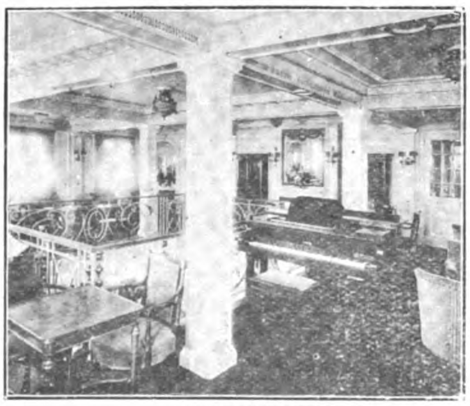

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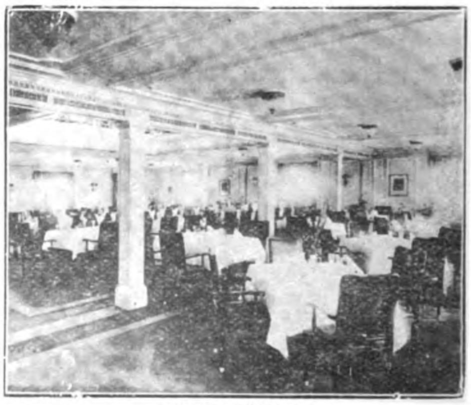

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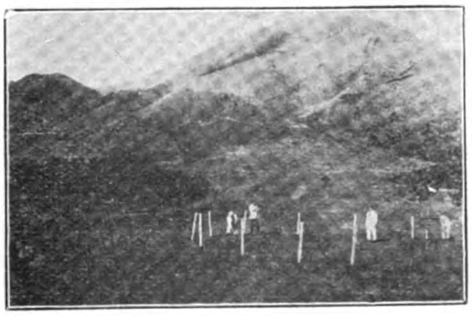

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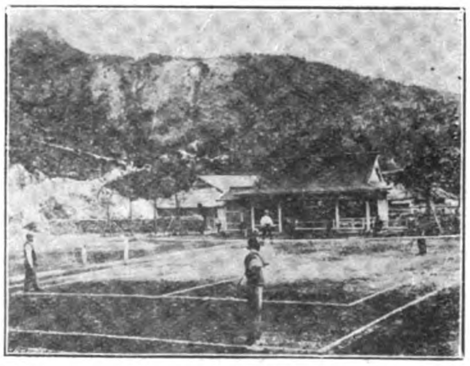

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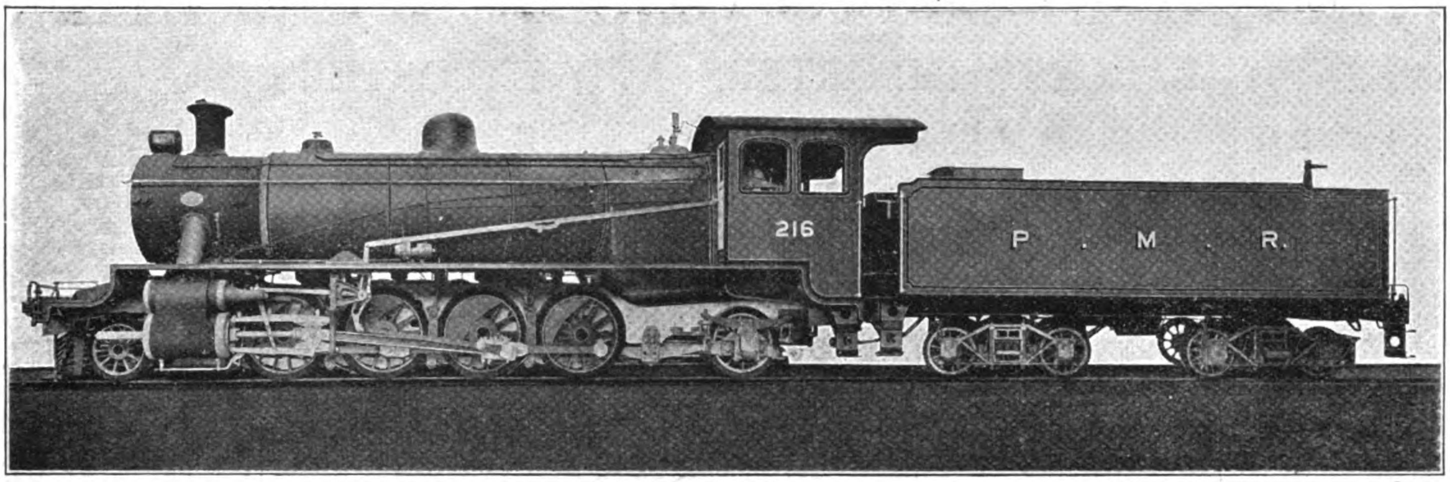
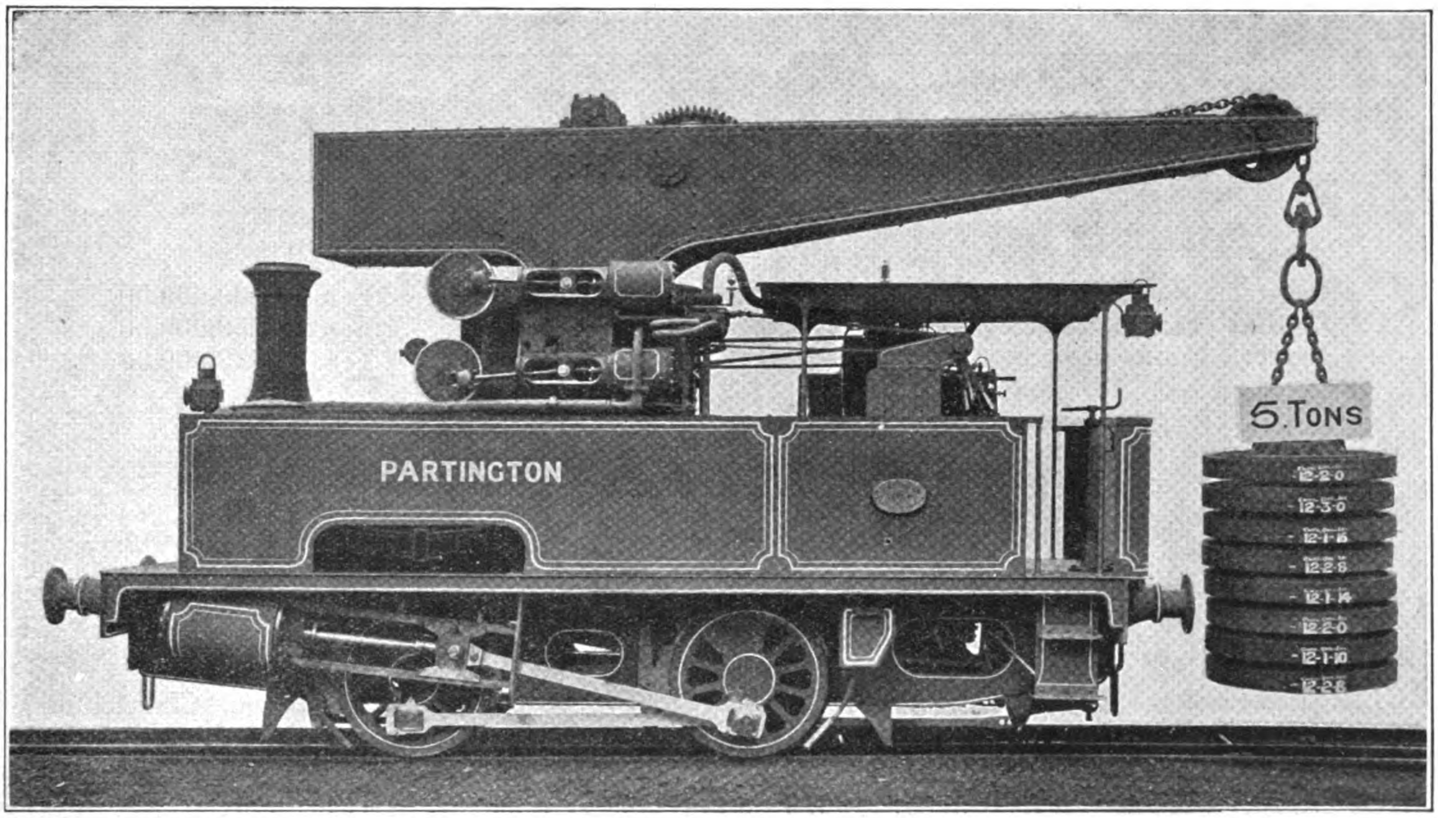
46 WAI CHIAO PU CHIEH
PEKING




ANDREW BARCLAY SONS & CO., LTD.
THE AVONSIDE ENGINE CO., LTD.
W. G. BAGNALL LTD.
BEYER PEACOCK & CO., LTD.
HAWTHORN LESLIE & CO., LTD.
HUDSWELL CLARKE & CO., LTD.
THE HUNSLET ENGINE CO., LTD.
KITSON & CO., LTD.
NASMYTH WILSON & CO., LTD.
THE NORTH BRITISH LOCOMOTIVE CO., LTD.
ROBERT STEPHENSON & CO., LTD.
THE VULCAN FOUNDRY, LTD.
THE YORKSHIRE ENGINE CO., LTD.




AS BUILT AT ONE OF THE A.B.L.M.C. WORKS

# NIPPON MENKWA
## KABUSHIKI KAISHA

# (THE JAPAN COTTON TRADING CO., LTD.)

LARGEST IMPORTERS AND EXPORTERS
IN THE FAR EAST

## COTTON
COTTON YARN
COTTON PIECE GOODS
RAW SILK
WOOL
GENERAL COMMISSION MERCHANTS

*Established 1892*

HEAD OFFICE: No. 10 2-Chome, Nakanoshima, OSAKA, JAPAN
SHANGHAI OFFICE: 8 Hankow Road
TIENTSIN OFFICE: 42 Rue de France, French Concession

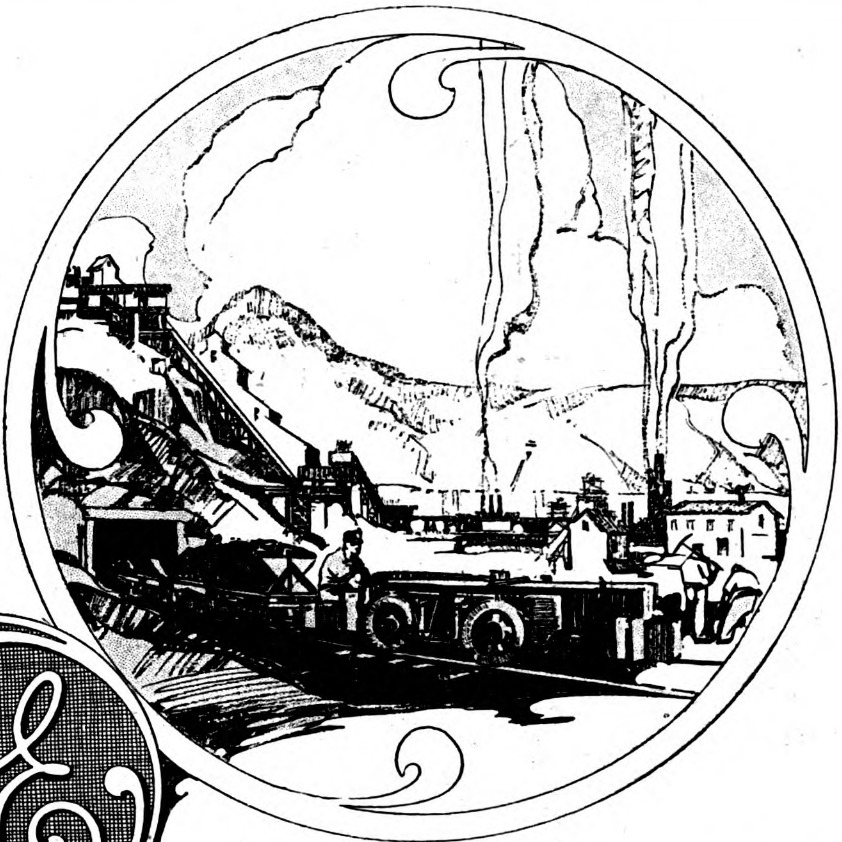
| | |
|---|---|
| Capital Subscribed | Yen 50,000,000.00 |
| Capital paid-up | Yen 20,250,000.00 |
| Reserve Funds | Yen 26,825,000.00 |

MATAZO KITA, Esq., *President*
ATUSHI YAMADA, Esq., *Vice-President*

*Directors* :

K. SUYEYOSHI, Esq.
H. OHOKA, Esq.
G. IMAMURA, Esq.
T. SHIKATA, Esq.
T. YASUI, Esq.
R. NAKAMURA, Esq.
K. KUSUMOTO, Esq.

BRANCHES: Semba (Local), Dairen, Shanghai, Hankow and Bombay
AGENCIES: Kobe, Yokohama, Tokyo, Seito, Tientsin, Newchwang, Tiehling, Changchung, Harbin, Hongkong, Calcutta, Karachi, Rangoon, Alexandria, Liverpool, New York and Buenos Aires
SOLE BUYING AGENCY IN U.S.A.: Japan Cotton Trading Company of Texas, Fort Worth, Texas
SOLE BUYING AGENCY IN COREA: Corea Cotton Trading Company, Limited
FACTORIES: Cotton Press at Hankow, Cotton Gins and Presses in India




# Electricity in Mining

MANY difficult problems of the mining industry have found their solution in electric power.

By increasing the scope of production, reducing hand labor, increasing output and making operation safer, cleaner and more efficient, electricity has become an essential in the industry.

Electric mine locomotives and electric equipment for ventilators, hoists, conveyors, crushers, drills and electrolytic baths are among General Electric Company applications that are contributing to the progress of the industry, and the welfare of its workers.

G-E engineering is at your service through our nearest office or representative.

**International General Electric Company, Inc.**

120 Broadway
NEW YORK
U. S. A.

SCHENECTADY
NEW YORK
U. S. A.

***Address all correspondence to nearest representative***

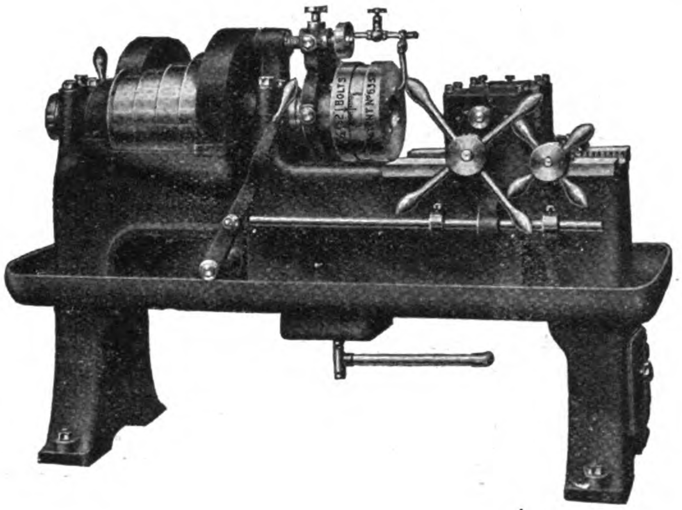
**Japan:** International General Electric Company, Inc., Yokohama; Shibaura Engineering Works, Tokyo; Tokyo Electric Company, Ltd., Kawasaki.
**Philippines:** Pacific Commercial Company, Manila.
**Dutch East Indies:** International General Electric Co., Inc., Soerabaia, Java.
**China:** Andersen, Meyer & Company, Ltd., International General Electric Co., Inc., Shanghai.

*General office for the Far East, excluding Japan and China:* International General Electric Company, Inc., Shanghai.

11-90

There is a vast difference!
The "difference" in the "CAPSTAN" as compared to other brands is at once apparent to the smoker.
They are "different" in flavour and in quality. It is a "difference" that pleases.
The "Universal" CIGARETTE
"CAPSTAN"
This advertisement is issued by the British-American Tobacco Co. (China), Ltd.

# Heap's Patent Screwing Machines



are made in all sizes, and suitable for dealing with all classes of work.

The illustration opposite shows our 2in. Patent Automatic Bolt Screwing Machine which is one of a complete line of Single and Multiple Head Machines specially designed for use wherever large quantities of Bolts have to be dealt with in the most expeditious and economical manner.

We will gladly advise you as to the most suitable machine for your particular class of work.

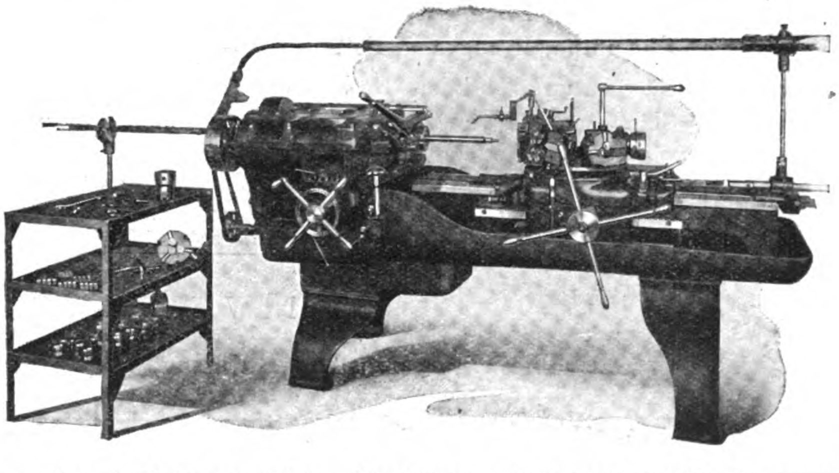
Catalogue free on request.

# JOSHUA HEAP & CO., LTD.,

**ASHTON-UNDER-LYNE, ENGLAND.**

# For the Small Shop or the Large One

The Hartness Flat Turret Lathe *fits the small shop*—even the shop so small that it has only just broken the habit of making a piece at a time. The Hartness Flat Turret Lathe *made a lasting reputation* for itself in the days of the small shop, on work which was *put through in small lots*. Its universal tool equipment was specially designed for this condition. The machine has since been *tremendously improved;* the improvements have increased its effectiveness *for small lot manufacturing.*



At the same time, the Hartness Turret Lathe is the *standard machine for large-lot manufacturing in big establishments*. The strength, stiffness, power and accuracy of the machine have given it a place held by no other. On bar or chuck work within its range *its output per machine or per dollar of investment is unmatched.*

***Catalogue and descriptive literature sent post free on request.***

# Jones & Lamson Machine Company

**9-10 Water Lane, London, England**
Cable Address: "Turretorum" London

**Springfield Vermont, U.S.A.**
Cable Address: "Turret" Springfield, Vt.

# THE BANK OF CHOSEN

Capital Subscribed - - - Yen 80,000,000
Capital Paid-up - - - Yen 50,000,000

Governor : S. Minobe, Esq.
Deputy-Governor : T. Kanoh, Esq.

Directors :
S. Suzuki, Esq. S. Kakei, Esq.
Y. Katayama, Esq.

## Head Office: SEOUL (Korea)

FOREIGN DEPARTMENT : TOKYO

(All communications relating to correspondence arrangements and the Bank's general foreign business to be addressed to the Foreign Department)

## Branch Offices:

Japan Proper—Tokyo, Osaka, Kobe, Shimonoseki
Korea—Chemulpo, Pyengyang, Fusan, Wonsan, Taiku, Chinnampo, Kunsan, Mokpo, Hoilyong, Chungjin
Manchuria—Antung, Mukden, New Town (Mukden), Dairen, Yingkow (Newchwang), Changchun, Harbin, Tiehling, Liaoyang, Ryojun, Kaiyuan, Chengchiatun, Szupingchieh, Fuchiatien, Kirin, Lungchingtsun
China Proper—Shanghai, Tientsin, Tsingtao, Tsinan
Siberia—Vladivostock, Alexandrofsky Port

NEW YORK AGENCY :

The City Investing Building, 165 Broadway, New York City

LONDON REPRESENTATIVE :

Palmerston House, 34 Old Broad Street, London, E. C. 2

## Correspondents:

San Francisco, Seattle, New York, London, Paris and in other commercial centers throughout the world

# International Banking Corporation

**CAPITAL AND SURPLUS - - - U.S. $10,000,000.00**

**OWNED BY THE NATIONAL CITY BANK OF NEW YORK**

---

HEAD OFFICE: 60 WALL STREET, NEW YORK

LONDON OFFICE: 36 BISHOPSGATE, E.C.

## Branches:

BARCELONA
BATAVIA
BOMBAY
CALCUTTA
CANTON
CEBU
COLON
DAIREN
HANKOW
HARBIN
HONGKONG
KOBE
MADRID
MANILA
PANAMA
PEKING
RANGOON
SAN FRANCISCO
SANTO DOMINGO
SHANGHAI
SINGAPORE
SOERABAYA
TIENTSIN
TOKIO
YOKOHAMA

Commercial and Travellers' Letters of Credit, Bills of Exchange and Cable Transfers bought and sold. Current Accounts and Savings Bank Accounts opened and Fixed Deposits in local and foreign currencies taken at rates that may be ascertained on application to the Bank.

We are also able to offer our Customers the services of the Branches of the National City Bank of New York in the principal countries of South America and in the West Indies.

N. S. MARSHALL, *Manager.*

1A KIUKIANG ROAD.

# BANQUE DE L'INDO-CHINE.

| | |
|---|---|
| **Capital** ... ... ... ... ... ... ... ... ... ... | **Frs. 72,000,000** |
| **Reserves** ... ... ... ... ... ... .. ... ... | **„ 70,000,000** |

HEAD OFFICE: 96 BOULEVARD HAUSSMANN, PARIS.

**Succursales et Agencies:**

| | | | | |
|---|---|---|---|---|
| Bangkok | Haiphong | Mongtze | Pnom-Penh | Singapore |
| Battambang | Hankéou | Nouméa | Pondichery | Tientsin |
| Canton | Hanoi | Papeete | Saigon | Tourane |
| Djibouti | Hongkong | Peking | Shanghai | |

**Bankers:**

IN FRANCE: Comptoir National d'Escompte de Paris, Credit Lyonnais; Banque de Paris et des Pays-Bas; Crédit Industriel et Commercial Société Générale.

IN LONDON: The National Provincial and Union Bank of England, Ltd.; Comptoir National d'Escompte de Paris; Crédit Lyonnais.

The Shanghai Agency undertakes all banking operations and exchange business; grants credits on goods and approved securities and receives deposits on current and fixed deposits according to arrangement.

L. ARDAIN, *Manager.*

# JUGO GINKO, LIMITED

**(THE FIFTEENTH BANK)**

**TOKYO, JAPAN**

**Telegrams: "Jugo Tokio"**

**Capital Subscribed Y. 100,000,000 Capital Paid-up Y. 49,750,000 Reserve Funds Y. 23,900,000**

***President*: The Hon. Iwao Matsukata *Vice-President*: Masayasu Naruse, Esq.**

***Managing Directors*: Yutsuha Sato, Esq. and Kanesato Aiko, Esq.**

***Head Office Manager*: Sei Usagawa, Esq.**

***Head Office*: No. 6, 7chome, Kobiki-cho, Kyobashiku, Tokyo.**

BRANCHES:

SHIMBASHI, MARUNOUCHI, GOFUKUBASHI, TOHORISANCHOME, KAKIGARACHO, NINGYOCHO, RYOGOKU, FUKAGAWA, KANDA (TOKYO). OSAKA, SENBA, TAMATSUKURI, NISHI, KUJO, MINAMI, NAMBA, TENNOJI, KITA, TENGACHAYA (OSAKA), KOBE, SAKAEMACHI, FUKIAI, HYOGO (KOBE). KYOTO, NAGOYA, SAKAI, WAKAYAMA, NISHINOMIYA, OKAYAMA, HIROSHIMA, SHIMONOSEKI, FUKUOKA, KUMAMOTO, KAGOSHIMA, SENDAI.

LONDON BANKS AND AGENTS:

LAZARD BROTHERS & CO., LTD. LONDON COUNTY WESTMINSTER AND PARR'S BANK, LTD.
UNION DISCOUNT CO. OF LONDON, LTD.

THE

# MITSUBISHI BANK,

LIMITED

CAPITAL SUBSCRIBED - Yen 50,000,000
CAPITAL PAID-UP - - - Yen 30,000,000

CHAIRMAN:

Mr. Manzo Kushida

MANAGING DIRECTORS:

Mr. Kiyoshi Sejimo Mr. Takeo Kato
Mr. Toru Otobe

HEAD OFFICE:

No. 3 Yayesucho Nichome, Kojimachi-ku,
Tokyo, Japan.

BRANCH OFFICES:

Fukagawa (Tokyo), Tokio Kaijo Building (Tokyo), Marunouchi Building (Tokyo), Nihombashi (Tokyo), Osaka, Nakanoshima (Osaka), Semba (Osaka), Kobe, Sannomiya (Kobe), Kyoto, Nagoya, Otaru

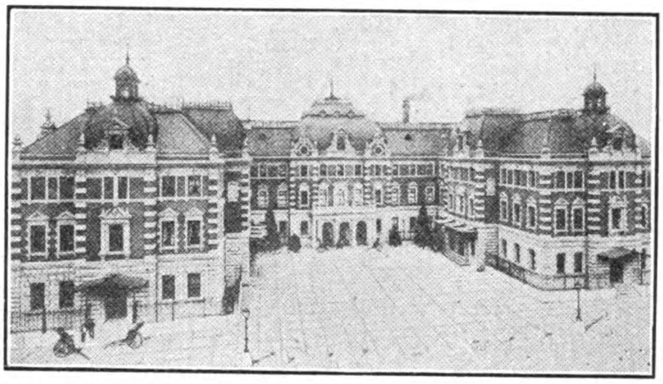
Shanghai, London and New York.

General Banking and Exchange Business

Agents for the Hongkong and Shanghai Banking Corporation

# THE MITSUI BANK, LTD.

The Oldest Bank in Japan, Founded in 1673



Capital Subscribed... ..........Y. 100,000,000.00
Capital Paid-Up..................Y. 60,000,000.00
Reserve Fund (Feb. 1923) ...Y. 36,600,000.00

*HEAD OFFICE:*

No. 1 Suruga-cho, Nihonbashi-ku,
TOKYO

*Branches:*

NIHONBASHI (Tokio), MARUNOUCHI (Tokio), OTARU, YOKOHAMA, NAGOYA, KYOTO, OSAKA, OSAKADOJIMA, OSAKANISHI, OSAKAKAWAGUCHI KOBE, HIROSHIMA, SHIMONOSEKI, MOJI, WAKAMATSU (Kyushu), FUKUOKA, NAGASAKI, SHANGHAI, NEW YORK.

*Foreign Agents:*

London: Barclays Bank, Ltd.
London Joint City & Midland Bank, Ltd.
Paris: Banque de l'Union Parisienne.
Comptoir National d'Escompte de Paris.
Hamburg: Commerz und Privat Bank.
Bombay: National Bank of India, Ltd.
Lloyds Bank, Ltd., Cox's Branch.

# Industrial Bank of Japan, Limited

(NIPPON KOGYO GINKO)

Incorporated by Special Charter in 1902 to Encourage Foreign Investments

CAPITAL SUBSCRIBED - - - - - Yen 50,000,000

HEAD OFFICE:

7 EIRAKU-CHO, NICHOME, MARUNOUCHI, TOKYO. CABLES "KOGIN," TOKYO

BRANCHES:

TOKYO: NIHONBASHI
OSAKA: KORAIBASHI
KOBE: NAKAMACHI

YEIJIRO ONO, Esq., President
JINI MATSUMOTO, Esq., Vice-President
K. IYANAGA, Esq., Director
T. IWASA, Esq., Director
KOZO MATSUMOTO, Esq.

AUDITORS:

NAGATANE SOMA, Esq.
KINTARO HATTORI, Esq.
TAICHI OHBA, Esq.

All descriptions of general banking, exchange, both foreign and domestic, and trust and corporation financial business transacted.

Correspondents in the principal cities at home, and in London, Paris, New York, and San Francisco.

BUSINESS TRANSACTED:

1.—Loans on the security of public bonds of debentures and shares, estates (Zaidan), specified land and buildings.
2.—Subscription and underwriting public bonds or debentures.
3.—Deposits and safe custody of valuables.
4.—Trust company business.
5.—Discounting of bills.
6.—Foreign exchange business.
7.—Other banking business sanctioned by the Minister of State for Finance in accordance with Law of Ordinance.

# Hongkong and Shanghai Banking Corporation

| | | |
|---|---|---|
| *Capital:* | Authorised Capital ... ... ... ... ... | $50,000,000 |
| | Issued and fully paid up ... ... .. ... | $20,000,000 |
| *Reserve Funds:* | Sterling ... ... ... .. ... ... | £4,500,000 |
| | Silver... ... ... ... ... ... ... | $24,500,000 |
| | Reserve Liability of Proprietors ... ... ... | $20,000,000 |

**Court of Directors:**

Hon. Mr. A. O. LANG, Chairman

D. G. M. BERNARD, Esq., Deputy Chairman

A. H. COMPTON, Esq.

G. T. M. EDKINS, Esq.

Hon. Mr. P. H. HOLYOAK

W. L. PATTENDEN, Esq.

J. A. PLUMMER, Esq.

N. L. WATSON, Esq.

H. P. WHITE, Esq.

**Head Office:**

**HONGKONG**

**Chief Manager:**

**HONGKONG . . . Hon. Mr. A. G. STEPHEN**

**London Bankers:**

**THE WESTMINSTER BANK, LIMITED**

Shanghai Branch: 12 The Bund

Sub-Agency: 9 Broadway

**Branches and Agencies:**

AMOY, BANGKOK, BATAVIA, BOMBAY, CALCUTTA, CANTON, CHEFOO, COLOMBO, DAIREN, FOOCHOW, HAIPHONG, HAMBURG, HANKOW, HARBIN, ILOILO, IPOH, JOHORE, KOBE, KUALA LUMPUR, LONDON, LYONS, MALACCA, MANILA, NAGASAKI, NEW YORK, PEKING, PENANG, RANGOON, SAIGON, S. FRANCISCO, SHANGHAI, SINGAPORE, SOURABAYA, SUNGEI PATANI, TIENTSIN, TSINGTAO, VLADIVOSTOCK, YOKOHAMA

Interest allowed on Current Accounts and on Fixed Deposits according to arrangement.

*Local Bills Discounted. Credits granted on approved Securities and every description of Banking and Exchange business transacted. Drafts granted on London and the chief commercial places in Europe, India, Australia, Africa, China, Japan and America.*

**G. H. STITT,** *Manager.*



# THE ONE HUNDREDTH BANK, LTD.

## (DAI HYAKU GINKO)

**HEAD OFFICE, AWOMONO-CHO, TOKYO**

**TOKYO BRANCHES: No. 1 Torihatagocho, Nihonbashi: No. 10, Ginza Nichome, Kyobashi**
**YOKOHAMA BRANCH: Nos. 53-55 Honcho Shichome**
**OSAKA BRANCH: 28 Bingo-machi, Nichome**
**KYOTO BRANCH: Shijo Higashinotoin**
**SHINMACHI BRANCH: Shinmachi Dori Sanchome**

***President:*** **K. IKEDA, Esq.**

***Managing Director:*** **S. CHOH, Esq.**

| | |
|---|---|
| SUBSCRIBED CAPITAL - - - - - | Yen 25,000,000 |
| CAPITAL PAID-UP - - - - - - | Yen 17,500,000 |
| RESERVE FUND - - - - - - | Yen 8,094,340 |
| DEPOSITS - - - - - - - - - | Yen 110,740,264 |

**Transacts General Banking and Foreign Exchange Business. Conducts Trust Company Business**

# THE SUMITOMO GOSHI-KAISHA

OSAKA, JAPAN

OWNERS OF BESSHI COPPER MINE, COAL MINES, SILVER AND GOLD MINES, ETC.

MANUFACTURERS OF

Tubes, Plates, Sheets and Bars of Copper, Brass, Bronze and other Alloys, Solid and Drawn Steel Tubes, Nails, Etc.—Superphosphate and Composite, Manure, Sulphuric and Nitric Acid, etc.

## GENERAL WAREHOUSE BUSINESS AND FORESTRY ENTERPRISES

### WORKS AND DEPARTMENTS

| | |
|---|---|
| Warehouses | Osaka, Kobe & Tokyo |
| Mining Offices | Besshi, Wakamatsu, Sapporo & Ohgayu |
| WORKS: | |
| Copper Works | Osaka |
| Fertilizer Works | Niihama |
| Sales Departments | Osaka, Kobe, Tokyo, Kure, Yokosuka, Hakata, Shanghai, Hankow and Tientsin |

## THE SUMITOMO STEEL WORKS, LTD.

OSAKA, JAPAN

MANUFACTURERS OF

Steel Ingots, Steel Forgings, Steel and Iron Castings of Every Description for Railways, Shipbuilding Yards, Mines, Hydraulic Electric and Other Engineering Works, etc., etc.

## THE SUMITOMO ELECTRIC WIRE & CABLE WORKS, LIMITED

OSAKA, JAPAN

MANUFACTURERS OF

Copper, Brass, Bronze and Nickel Wires and Strips, Trolley Wires, Insulated Wires and Cables of Every Description for Telephone, Telegraph, Lighting, Power Transmission, etc., etc.

# THE SUMITOMO BANK, LIMITED

OSAKA

Cable Address: "SUMITBANK" Established, March, 1912

(Successors to The SUMITOMO BANK)

**Subscribed Capital ... Yen 70,000,000 Paid-up Capital ... Yen 50,000,000 Reserve Funds ... Yen 26,100,000**

### DIRECTORS:

| | | | |
|---|---|---|---|
| Baron K. SUMITOMO | President | K. NAKADA | Director |
| K. YUKAWA | Managing Director | K. HORI | ,, |
| S. YOSHIDA | ,, ,, | T. KANOH | ,, |
| N. YATSUSHIRO | ,, ,, | S. IMAMURA | ,, |

**Head Office: KITAHAMA, OSAKA, JAPAN**

**City Offices:** Business Department in Head Office, Semba, Bingomachi, Kawaguchi, Nakanoshima, Dotombori, Temma, Nipponbashi, Uemachi, etc.

**Home Branches:** Tokyo (Tokyo, Toriaburacho, Shimbashi, Fukagawa, Asakusa, Marunouchi, etc.), Yokohama, Nagoya, Kyoto (Kyoto and Nishijin), Kobe (Kobe and Hyogo), Onomichi, Niihama, Kure, Hiroshima, Yanai, Shimonoseki, Moji, Kokura, Wakamatsu, Hakata and Kurume.

**Foreign Branches:** London, New York, San Francisco, Bombay, Shanghai and Hankow.

**Affiliated Banks:** The Sumitomo Bank of Hawaii, Ltd., Honolulu. The Sumitomo Bank of Seattle, Seattle.

**Bankers:** Lloyds Bank, Ltd., London. National City Bank of New York, New York. Lloyds and National Provincial Foreign Bank, Ltd., Paris.

**Correspondents:** In all important places at home and abroad.

The Bank buys, sells and receives for collection Drafts and Telegraphic Transfers; issues Commercial and Travellers' Letter of Credit available in all important parts of the World, and acts as trustee for Mortgage Bond, besides doing General Banking Business.

**1869—Local Institution.**

**1923—An International Force.**

BORN a little over fifty years ago with total resources of $729,163, this Bank has to-day—through sound business principles, enterprise and service—a history of phenomenal growth to its credit, and resources of over 470 Million Dollars.

With 572 branches in Canada and Newfoundland and over 100 in Cuba, the West Indies, Central and South America, in addition to London, Paris, New York and Barcelona, complete banking facilities are placed at your disposal.

# THE ROYAL BANK OF CANADA.

*"Ask us about Canada."*

**A. J. MORSE & SON, Inc.**

221 High St., Boston, Mass., U.S.A.

Established 1837

**DIVING APPARATUS**

*Special Apparatus built to order*

FRANK L. STRONG, *Agent—24 Calle Echague, Manila, P.I.*



PUBLISHED ANNUALLY

# THE LONDON DIRECTORY

**with Provincial and Foreign Sections and Trade Headings in Five Languages**

enables traders to communicate direct with

**MANUFACTURERS AND DEALERS**

in London and in the Provincial Towns and Industrial Centres of the United Kingdom and Ireland, the Continent of Europe, America, etc. The book contains over 250,000 names, addresses and other details classified under more than 2,000 trade headings, including

**EXPORT MERCHANTS**

with detailed particulars of the Goods shipped and the Colonial and Foreign Markets supplied;

**STEAMSHIP LINES**

arranged under the Ports to which they sail, and indicating the approximate Sailings.

One-inch BUSINESS CARDS of Firms desiring to extend their connections, or Trade Cards of

**DEALERS SEEKING AGENCIES**

can be printed at a cost of **£1 10s. 0d.** for each trade heading under which they are inserted. Larger advertisements from £2 to £16.

The directory is invaluable to everyone interested in overseas commerce, and a copy will be sent by parcel post for **£2,** nett cash with order.

**THE LONDON DIRECTORY CO., LTD.**

25 Abchurch Lane, London, E.C. 4, England

BUSINESS ESTABLISHED IN 1814.



# THE BANK OF TAIWAN, LTD.

*Established* 1899

**TAIPEH, FORMOSA, TAIWAN**

**Tokio Branch: No. 1 Eirakucho, 2 Chome, Kojimachi**

**Telegraphic Address: TAIWANGINK**

**Telephones: 1060,1066,446,449 Marunouchi**

| | |
|---|---|
| Capital Subscribed .. .. .. | Y. 60,000,000 |
| Capital Paid-up .. .. .. | Y. 52,500,000 |
| Reserve Funds .. .. .. | Y. 11,780,000 |

*President* :

Kojuro Nakagawa, Esq.

*Directors* :

Gunji Kawasaki, Esq.
Kumematsu Morinaga, Esq.
Masumi Esaki, Esq.
Tadasu Hisamune, Esq.
Denkichi Takita, Esq.

*Branches* :

| | |
|---|---|
| Japan : | Tokyo, Kobe, Moji, Osaka, Yokohama. |
| Taiwan : | Keelung, Tainan, Takow, and 11 others. |
| China : | Amoy, Canton, Foochow, Hankow, Kiukiang, Shanghai, Swatow. |
| London : | 25 Old Broad Street. |
| New York : | 165 Broadway, Benenson Investing Bldg. |
| Others : | Bangkok, Batavia, Bombay, Hongkong, Semarang, Singapore, Soerabaia. |

*AGENTS and CORRESPONDENTS*

In the Principal cities and towns throughout the World. Interest allowed on fixed Deposits and Current Accounts on terms which may be ascertained on application. Most favorable terms are granted to Petty Current Accounts. Every description of Exchange and General Banking business transacted.

Special facilities are available for exchange business on China, Strait Settlements, East Indies, Australia, Great Britain, America, Canada and South Africa, etc.

K. NAKAGAWA, *President.*

# THE DAI-ICHI GINKO, LTD.

**(FORMERLY THE FIRST NATIONAL BANK)**

**ESTABLISHED 1873**

| | |
|---|---|
| **Subscribed Capital** | **Yen 50,000,000.00** |
| **Paid-Up Capital** | **Yen 43,175,000.00** |
| **Reserve Fund** | **Yen 37,500,000.00** |

Y. SASAKI, *President*

K. ISHII, *Managing Director.* Y. NOGUCHI, *Managing Director.* S. SUGITA, *Managing Director.*

**HEAD OFFICE:**

No. 1 KABUTO-CHO, NIHONBASHI-KU, TOKYO.

T. AKASHI, *Manager*

**CITY BRANCHES:**

ISECHO, SHIN-OSAKACHO, FUKAGAWA, MARUNOUCHI, KYOBASHI.

**HOME BRANCHES:**

YOKOHAMA, NAGOYA, TAMAYACHO (NAGOYA), YOKKAICHI, KYOTO, NISHIJIN (KYOTO), GOJO (KYOTO), FUSHIMI, OSAKA, NISHIKU (OSAKA), MINAMIKU (OSAKA), HONMACHI (OSAKA), KOBE, HYOGO, KYOMACHI (KOBE), HIROSHIMA, SHIMONOSEKI, CHOFU, MOJI, KOKURA, FUKUOKA, KURUME, KUMAMOTO, HAKODATE, OTARU, SAPPORO, MURORAN.

**BRANCHES IN COREA:**

SEOUL, FUSAN.

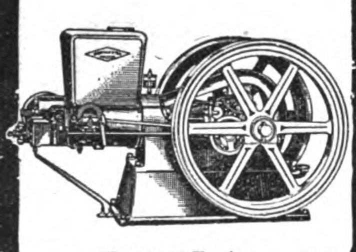
**LONDON & NEW YORK BANKERS:**

London: Westminster Bank, Ltd.; The London Joint City & Midland Bank, Ltd.; The Yokohama Specie Bank, Ltd.

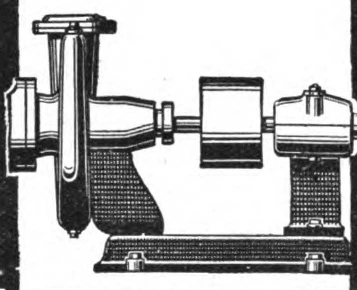
New York: The National City Bank of New York.; The National Bank of Commerce in New York.; The Yokohama Specie Bank, Ltd.

**CORRESPONDENTS:**

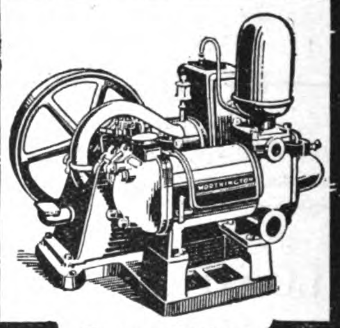
The Bank, in addition to its own Branches, has numerous Agencies or Correspondents in the principal Cities and Towns at Home and Abroad.

Kerosene Engine.



Centrifugal Pump.



Kerosene Engine-Driven Pump.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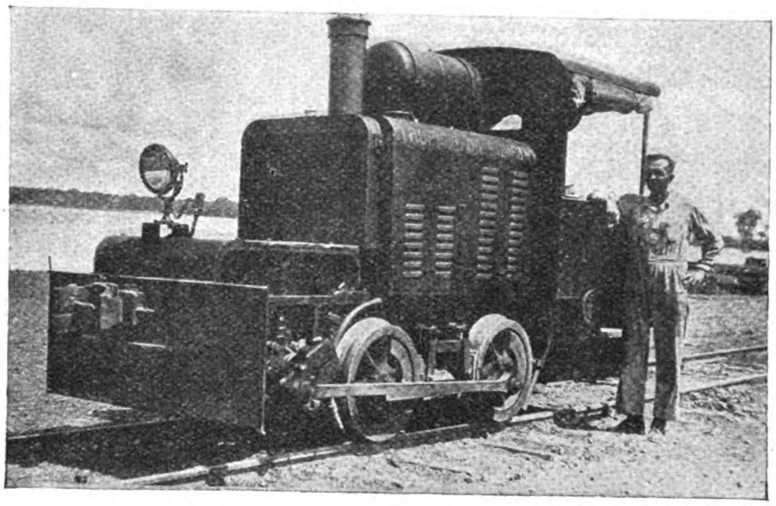

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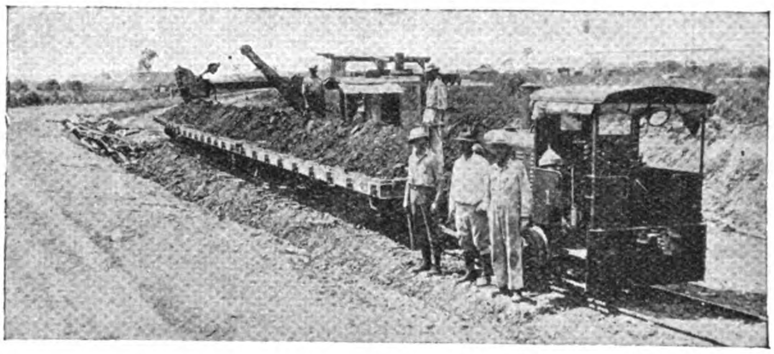

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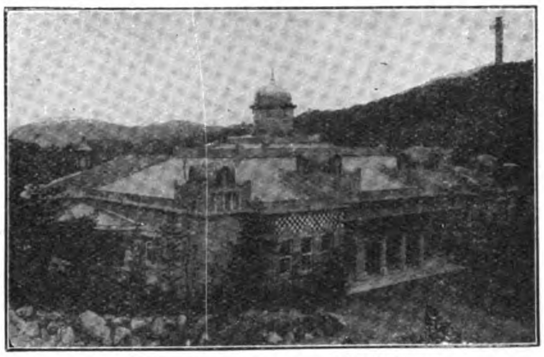

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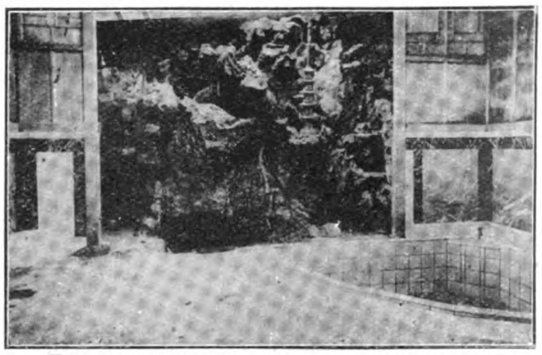

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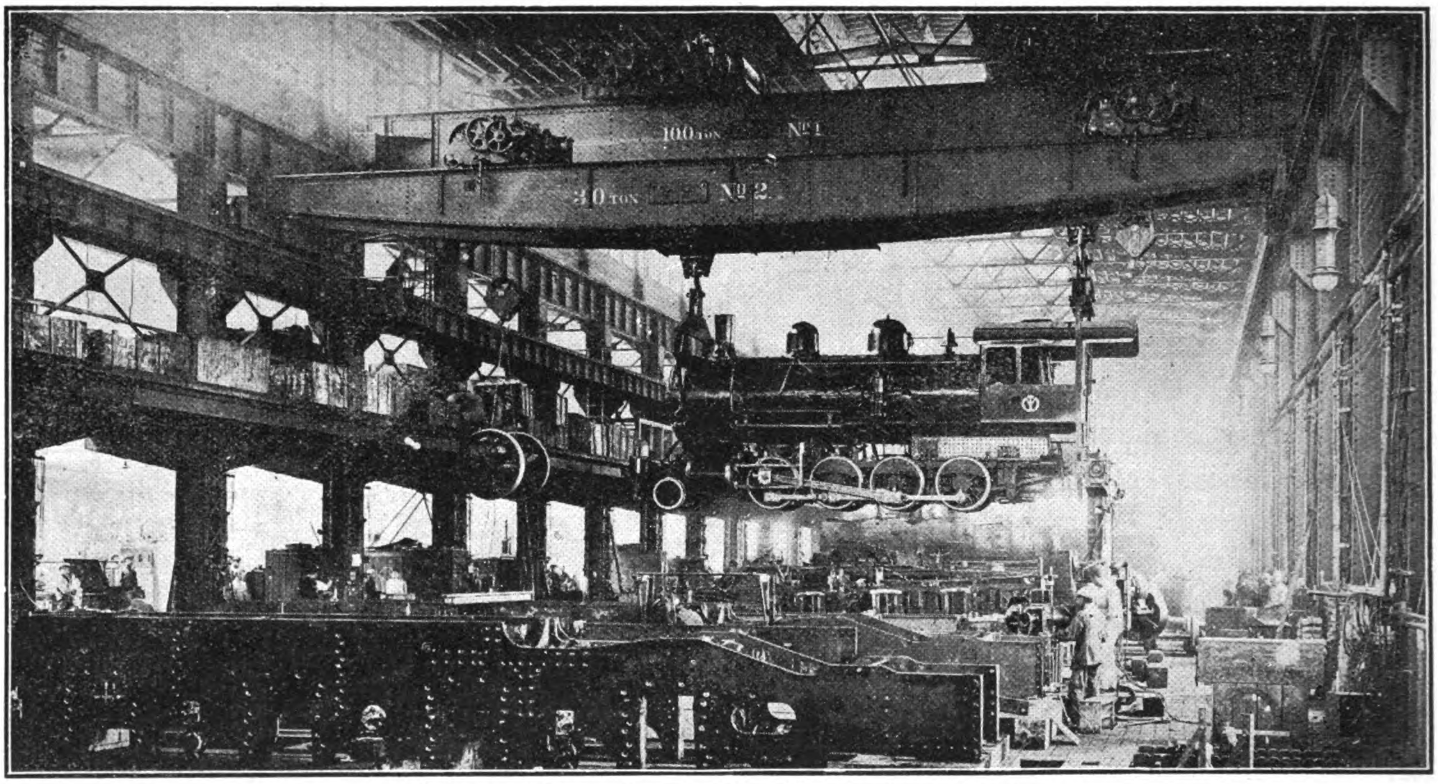

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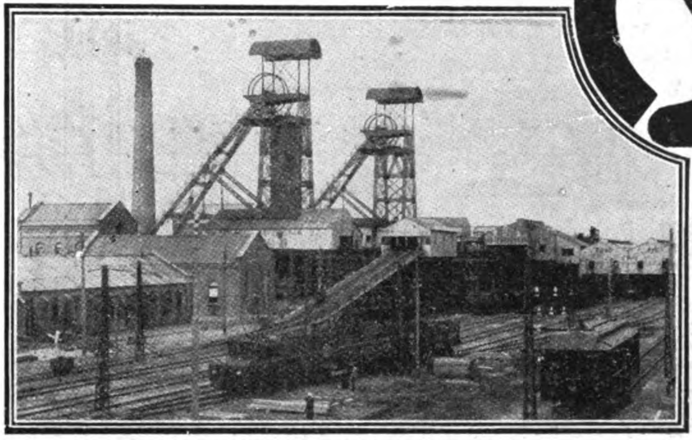

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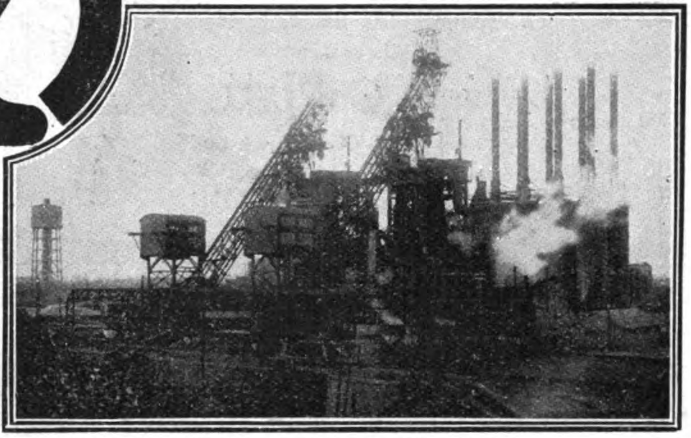

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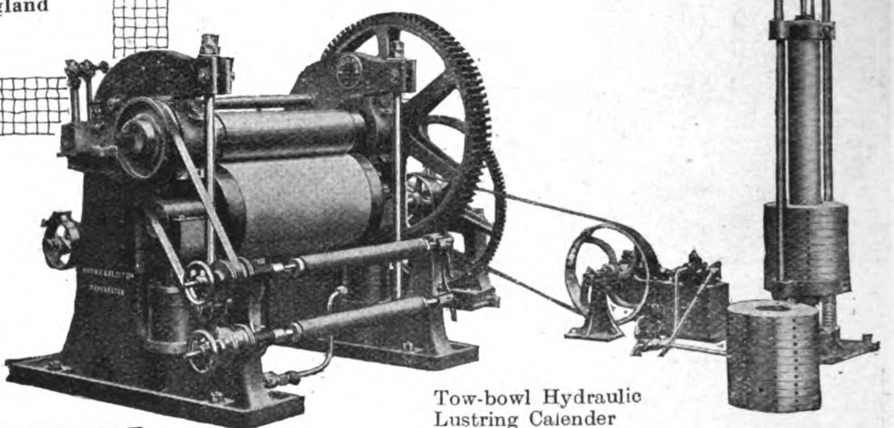

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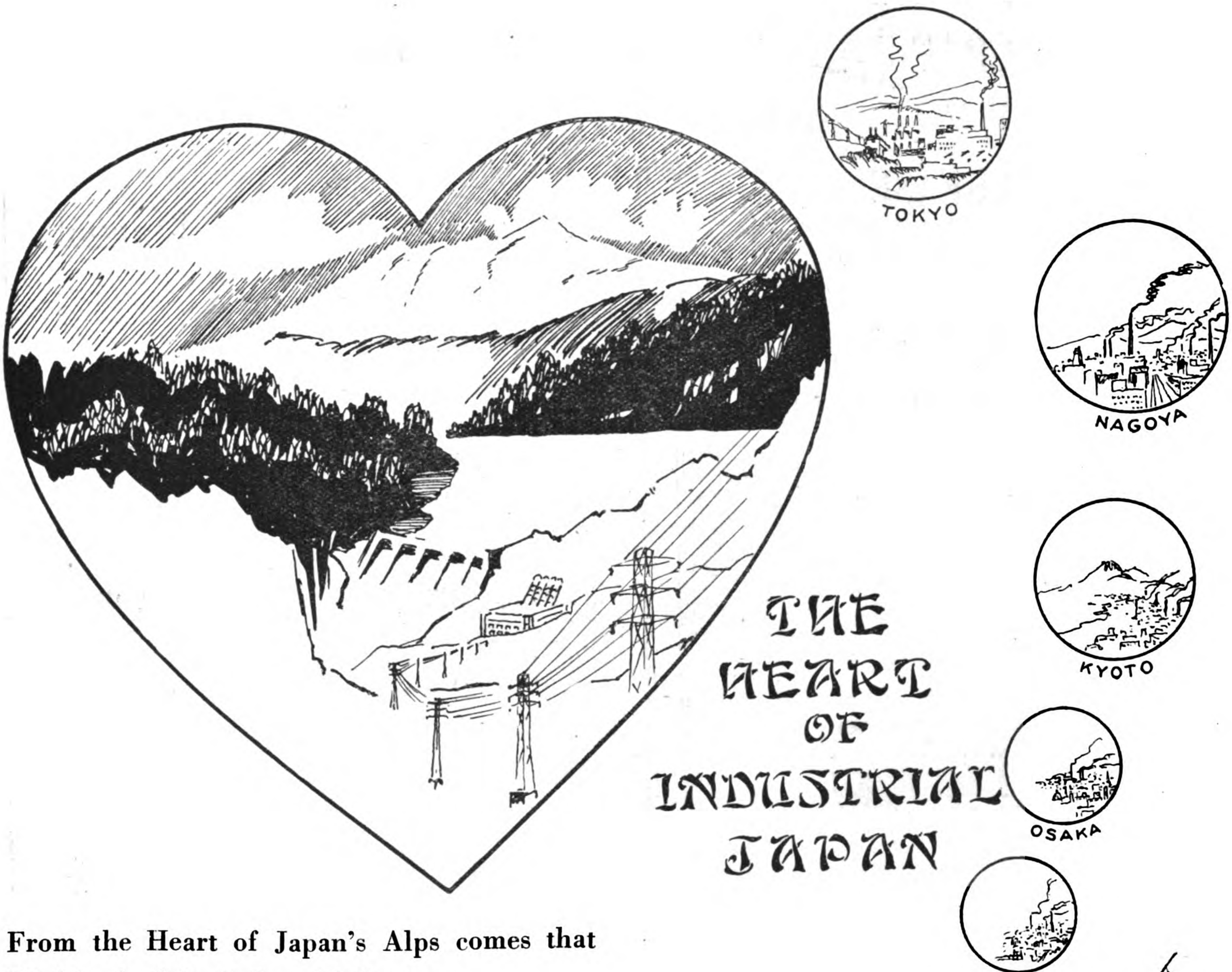


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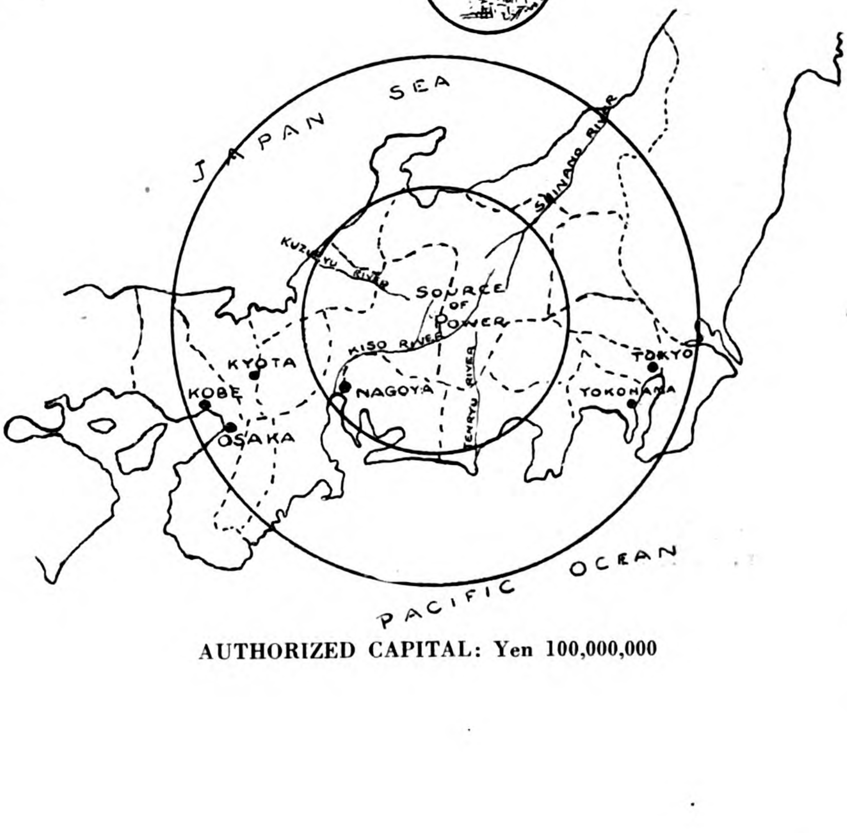


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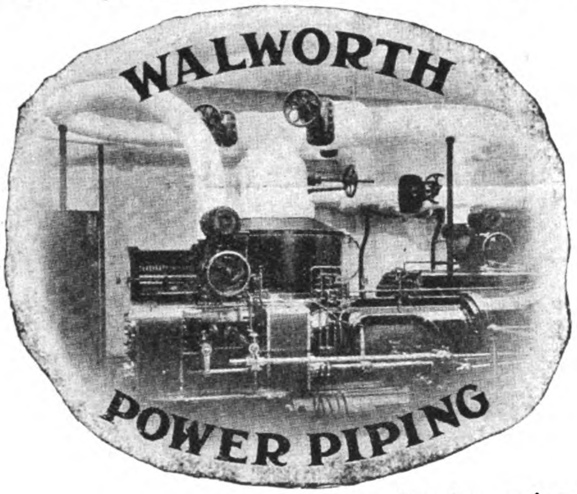


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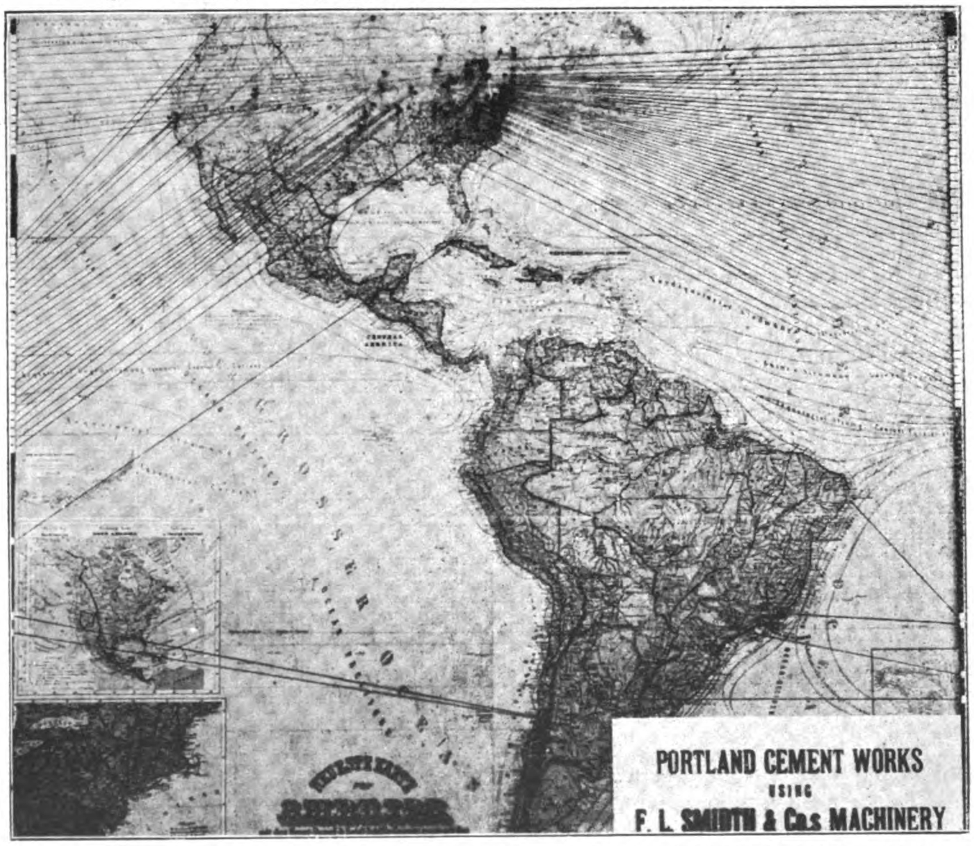


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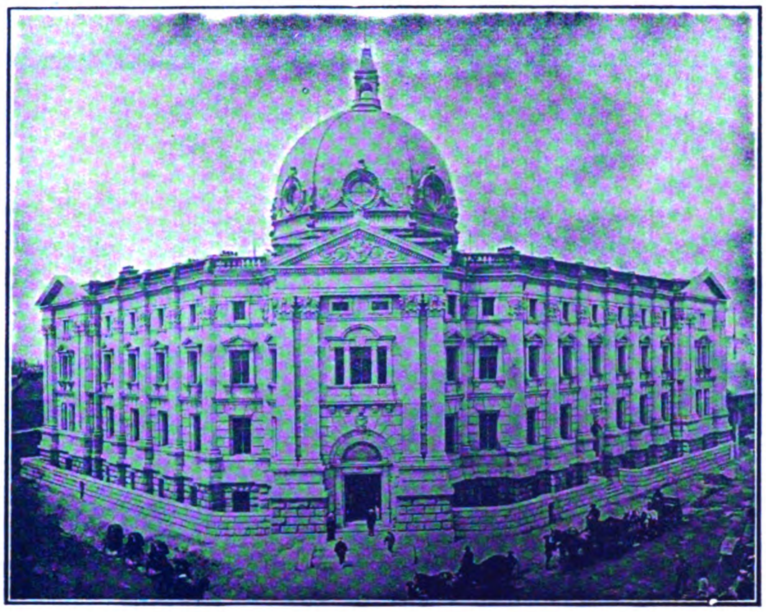


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